A Framework for Information Architecture for Business Networks

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* Submitted to the Bournemouth University Business School
in Partial Fulfilment of the Requirements for the Degree of
Doctor of Philosophy
at Bournemouth University

September 2005

Abstract

The concept of Information Architecture (IA) has been independently explored by researchers and practitioners in Information Engineering, Information Systems (IS) management, information visualisation and Web site design. However, little has been achieved towards its standardisation within and across these subject domains. To bridge the existing subject divide this study conducts a systematic analysis of publications on frameworks for Information Architecture developed in the field of IS planning and Information Engineering and elicits both common and desirable IA dimensions. It concludes that regardless of their originating subject field, existing IA frameworks are internally focused and have limited effectiveness for dynamic e-business alliances. To address this deficiency, related subject domains such as Systems Theory and Systems Modelling, Web design and virtual team working are explored and ideas are generated for further architectural components such as events, standards, aggregation level and trust that are not supported by existing IAs, but are of high importance for e-business. These are synthesized with the most prevalent IA dimensions identified earlier into a conceptual framework for IA for electronically mediated business networks, called FEBus (Framework for Information Architecture for Electronically mediated Business networks).

The structural viability and usability of the proposed analytical vehicle are evaluated over the period 2001-2003 using a triangulation of a Delphi study, an electronic survey, and evaluation interviews. The participants, representing three self-selecting samples of experienced UK academics and practitioners interested in IA, confirmed the need for an IA framework for e-business alliances and proposed and proved the scope, merits and limitations of the tool. Their views formed the basis for some amendments to the framework and for recommendations for future research.

This thesis presents an original contribution to IA knowledge through the comprehensive critical analysis of frameworks on IA and the development of a set of fundamental requirements for IA for e-business environments. Its importance is also seen in the synthesis of the research on IA conducted in different subject areas. The architectural tool built as an extension of the reviewed IA works constitutes another original aspect of this research. Finally, the novel multi-method evaluation approach employed in the study and the critical examination of its operability, present an advancement of existing knowledge on methodological diversity in IS research.

Acknowledgements

I would like to express my gratitude and appreciation to my supervisors, Prof. Brian Hollocks and Prof. Colin Armistead, for their guidance and support throughout this study. Their ability to drive my progress through sobering and encouraging comments is highly appreciated.

I also wish to thank all my colleagues and friends for their encouragement and moral support during the progression of this research, especially Dr. Jacqui Day for the invaluable advice and inspiration she presented to me during these years.

Thanks are to be extended to all those professionals who participated in the research and offered a very important reality check for the proposed framework.

Immense appreciation goes out to my husband and two daughters, without whose love, unconditional support and patience, this study would not have been possible.

Last, but by no means least, a big 'thank you' to my parents for their infinite understanding and encouragement for life-long learning.

Thank you!

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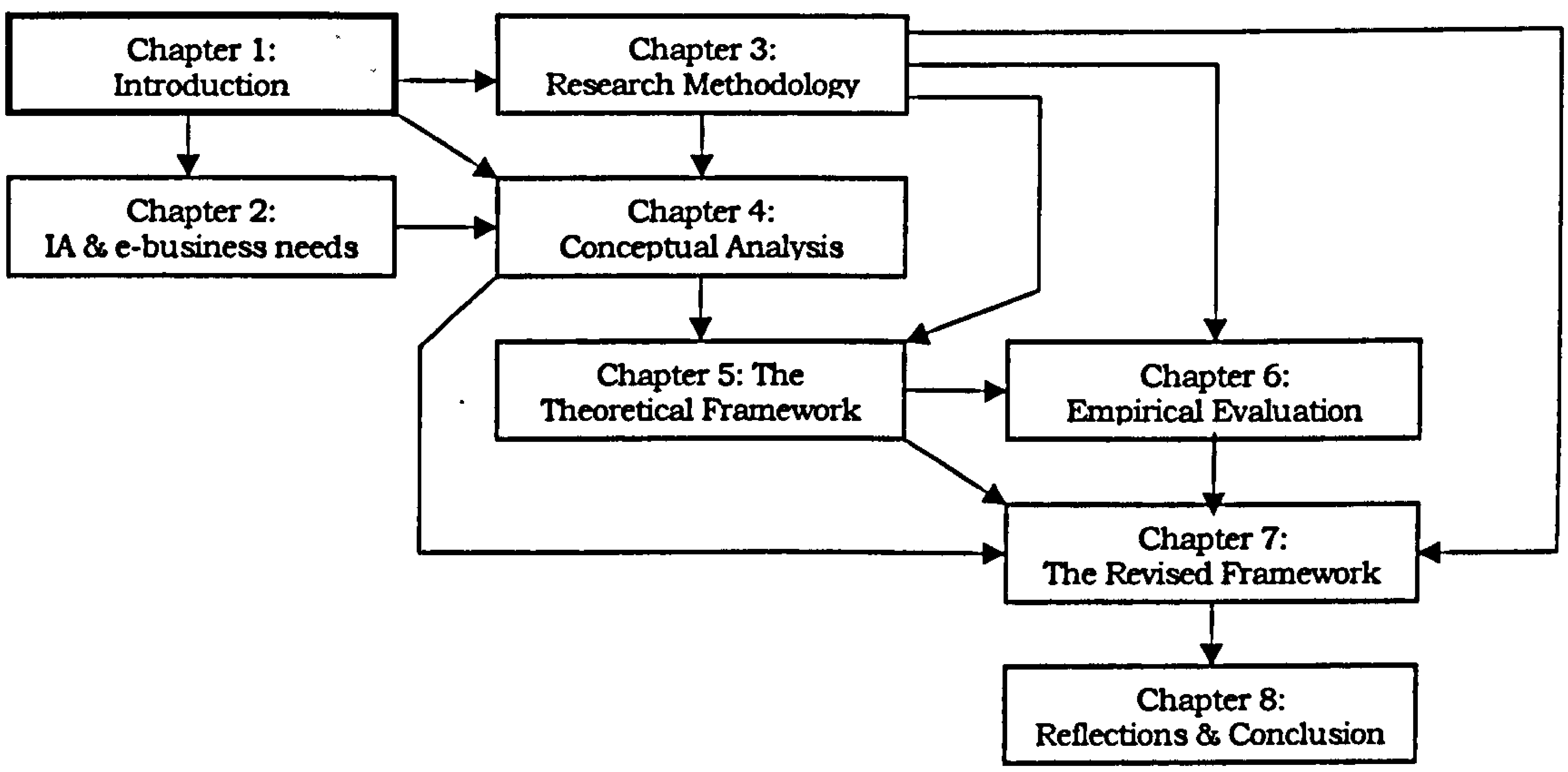
Abbreviations

BIT	-	Business Information Technology
EA	-	Enterprise Architecture
EBIS	-	IBM Europe, Middle East, and Africa Business Information System
FEBUS	-	**F**ramework for Information Architecture for **E**lectronically mediated **Bus**iness Networks
HTML	-	Hyper Text Mark-up Language
I(S)A	-	Information Architecture and/or Information Systems Architecture
IA	-	Information Architecture
IFW	-	Information FrameWork (Evernden, 1996)
IM	-	Information Management
IOS	-	Inter-Organisational System
IS	-	Information System
ISA	-	Information System Architecture
NIST	-	National Institute of Standards and Technologies
SDLC	-	System Development Life Cycle
SSADM	-	Structured Systems Analysis and Design Methodology
SSM	-	Soft Systems Methodology
UKAIS	-	United Kingdom Academy of Information Systems
VSM	-	Viable System Model

Chapter 1: Introduction



1.1. THE CASE FOR RESEARCH IN INFORMATION ARCHITECTURE FOR E-BUSINESS NETWORKS

> *"There is a tsunami of data that is crashing onto the beaches of the civilized[1] world. This is a tidal wave of unrelated, growing data formed in bits and bytes, coming in an unorganized, uncontrolled, incoherent cacophony of foam. It's filled with flotsam and jetsam. It's filled with the sticks and bones and shells of inanimate and animate life. None of it is easily related, none of it comes with any organizational methodology. "*
>
> (Wurman 1996)

The role of information and information technology (IT) as a driver for more efficient and effective business management and decision making has become critical over the past six decades. Arguably, today we are living in the Information Age, where information is at the heart of every business. Those organisations that have mastered the management of their information resources are beginning to exploit the new management concept of knowledge management, a key aspect of which is the development of information assets into knowledge. There are, however, many businesses that are still operating in the Data Age, as they rarely manage to transform data into information and knowledge (Davenport *et al* 2001). Even though an organisation might be well equipped with contemporary technologies and might be overloaded with data, it may still remain information-poor. Consequently, the phrase "*Every business is an information business*" (Evans & Wurster 1997) rings true only for those companies that have managed to deal successfully with technology obsession and are able to focus effectively on the generation and management of *information* rather than *data*. *Information* orientation embraces not only information practices and IT practices, but information behaviours and values (Marchand *et al.* 2000). Proficient information management is particularly important today when under the pressure of the new forces for competitive leverage, i.e. globalisation, deregulation and digitalisation (Downes & Mui 1998), businesses frequently undergo changes that often transpose their

[1] For certain terms both American and English spellings will be used, depending on whether this is a quote from a specific work.

organisational boundaries. It could be argued that information management (IM), as the ability to create, use, share and control information flows across the organisation and its environment, regardless of whether their sources are IT- or human-based, is another competitive force. It bonds and empowers all of the traditional and new competitive forces (Fig.1.1). Its performance as a master force is highly dependent on the use of analytical tools, such as architectures, frameworks and models.

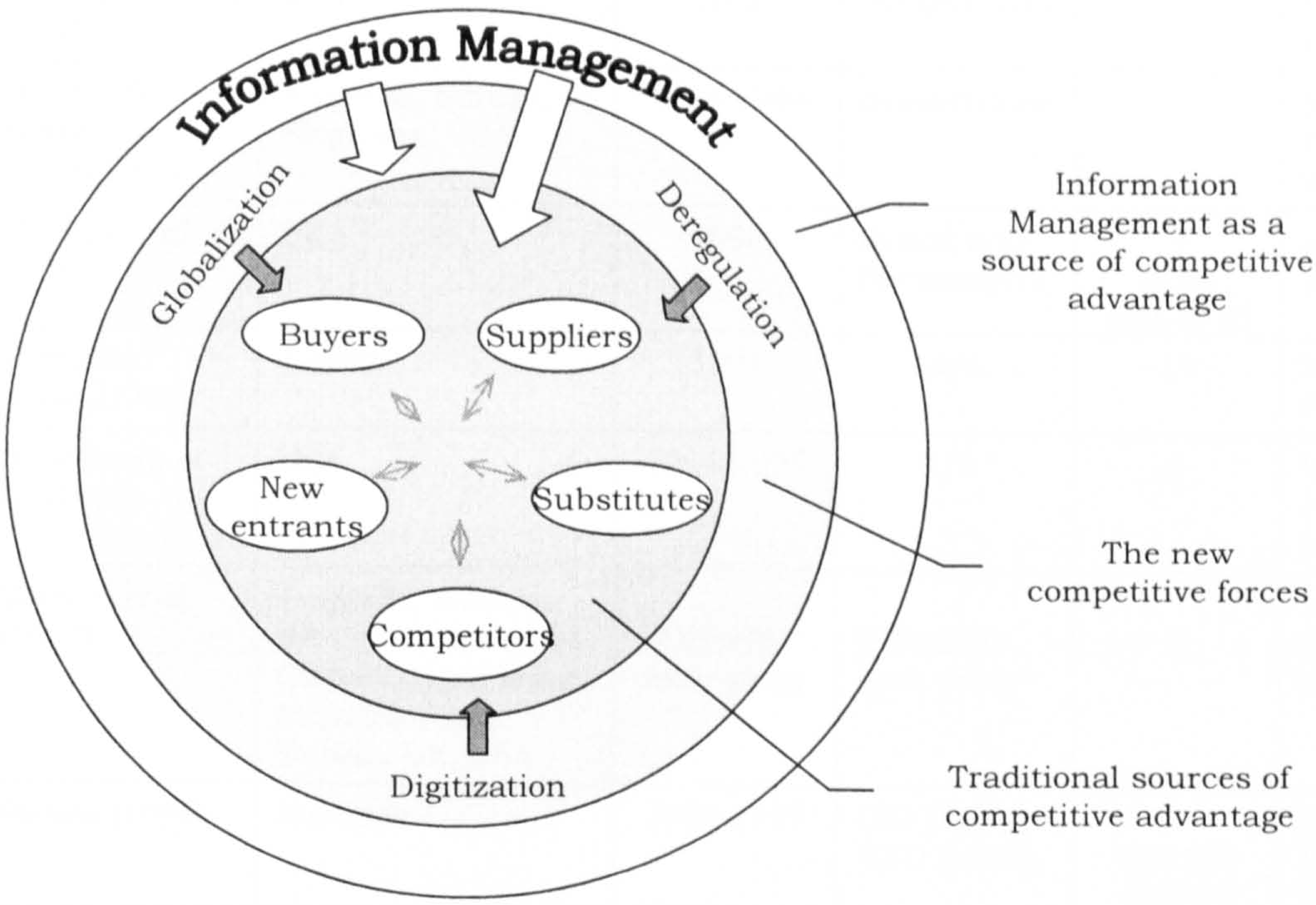


Fig. 1.1: Information management as a competitive force
(Based on Downes & Mui (1998))

1.1.1. INFORMATION ARCHITECTURE AND ITS ROLE AS AN INFORMATION MANAGEMENT TOOL

Over the last two decades several investigations have been done to establish the ten major management information issues for information officers, IS executives and chief executive offices (CEO) across the world (Galliers 1995; Galliers *et al.* 1994; Pavlia & Wang 1995; Pavlia *et al.* 2002; Pervan 1998; Watson & Branchau 1992). Understandably, the relative position in the rank list varied based on factors such as organisational characteristics and business environment (Caudle *et al* 1991; Niederman *et al* 1991; Watson & Brancheau 1992; Pavlia & Wang 1995; Pavlia *et al* 2002), informant's background and position within an organisation (Brancheau & Wetherbe 1987; Niederman *et al* 1991; Wang 1994; Pervan 1998) and the period when the research was carried out. Regardless of the impact of these determinants, the studies have confirmed that one of the five dominant managerial issues for Europe, the United States and Australia is that of Information Architecture (IA) (Table 1.1).

Table 1.1: The importance of developing and implementing an information architecture

Reference	Countries/ Continents	Year(s)	Sample constituent	IA Overall Ranking	Management concern areas
Niederman *et al* (1991)	USA	N/S	IS executives	1	Management, Planning
Watson & Brancheau (in Galliers 1992)	Australia, Europe, Singapore, USA	1986-1988	IS executives	5	Management, Planning, Internal
Galliers *et al* (1994)	UK	1992	IS and non-IS managers	4 IS (7) non-IS (2)	Information infrastructure
Palvia and Wang (1995)	Taiwan	1994	N/S	19	Management, Planning
Brancheau *et al.* (1996)	USA	1994-1995	N/S*	4	Management, Planning, Internal
Watson *et al.* (1997)	Australia, Estonia, the Gulf Cooperative Council, Hong Kong, India, Slovenia, Taiwan, UK, USA	Differ for each study	Differs for each study	3	Differ for each study
Pervan (1998)	Australia	1996-1997	CIO (1996) CEO (1997)	4 CIO (15) CEO (4)	Strategic Management
Lai (2001)	Hong-Kong	1998-1999 (not explicitly confirmed)	IS and non-IS managers	2	Operational, Tactical, Strategic

* N/S – Not specified

IA is a concept used by specialists from subject areas, such as Information Engineering, Information Systems Management, Web design and Information visualisation. Within the Information Systems discipline alone there are numerous definitions of what IA is, which are discussed in Section 2.1. They fully agree that an **IA is a blueprint for strategies, principles, guidelines, standards and models for information management (IM) and information systems (IS) development**, and this definition has been adopted through this study. The review of IA literature identified that often the term is used in conjunction with the term Information Systems Architecture (ISA), but there is no unanimous agreement on how these terms differ (See Chapter 2). To avoid any confusion arising as a result of this terminological diversity, in cases where the research refers to both IA and ISA, the format I(S)A will be used to represent both concepts.

The consistently high place IA takes in the Managerial Issues rank list (Table 1.1) could be related to its role and potential as a strategic and productivity tool for mastering business operations and competitive position. Being a generic logical structure with rules on relationships amongst its components, IA allows for structuring the information on a complex object such as an organisation and for standardising the descriptive presentations of its components (Zachman, 2001). Many authors recognise that some of the merits of the IA are inherent in the structured nature of any architecture (Allen & Boynton, 1991; Cook 1996, Evernden 1996; Periasamy & Feeny 1993a; Perkins 1997) and were initially linked to application development (Galliers et al. 1994). Structured or model-based approaches can be of value as they provide consistency through ensuring adherence to standards and regulations, a feature particularly useful for

- Interoperability and resource (incl. information) sharing and exchange ;
- Improved productivity through component development, management and reuse;
- Quality assurance in project management.

Further, using the principle of decomposition, IA allows technical and non-technical management to deal with the complexities and dynamics of planning, problem solving and exploring the implications of change (Benjamin & Blunt, 1992). In 1992, Benjamin and Blunt defined IA as

> *"the road map for the system development process and the anchor for justifying IT investment. Without an understandable information architecture, IT will be unable to bridge the gulf between the new technologies and the business strategic directions"*,

a view that is still valid in the current business environment.

Thus IA could be viewed as a framework that helps ensure that technical requirements are agreeable with existing infrastructure and functional requirements, i.e. for migration to new systems or expanding the reach beyond organisational boundaries to incorporate external sources.

IA models are often supported by graphical and pictorial presentations, which serve as common communication media with fewer complex concepts (Sowa & Zachman 1992b), thus enabling co-operation and communication amongst company stakeholders from different backgrounds.

IA is also seen as a managerial tool to foster capital IT investment planning, a key framework for increasing the organisation's technology "absorptive capacity" (Boynton *et al*, 1994). Similar views on IA as a planning tool have been asserted by the authors of IA frameworks such as Zachman (Zachman 1987; Sowa & Zachman 1992a) and Evernden (Evernden 1996, 2000, 2002).

From its early days, IA has been recognised as a tool for communicating, managing and controlling IS plans and for facilitating responses to changes in business, methodology and IT (Periasamy & Feeny 1993b). Further, Watson (2000) emphasises the role of IA as a facilitator to collaboration. He states that IA (the Enterprise IA, in particular) promotes more effective response to customer requirements through easier and faster building of information services, easier sharing with collaborators and outside vendors. Similar views are expressed by Rosenfeld and Morville (1998):

> *"Well-planned information architectures greatly benefit both consumers and producers. Accessing a site for the first time, consumers can quickly understand it effortlessly. They can quickly find the information they need, thereby reducing the time (and costs) wasted on both finding information and not finding information. Producers of web sites and intranets benefit because they know where and how to place new content without disrupting the existing content and site structure. Perhaps most importantly, producers can use an information architecture to greatly minimize the politics that come to the fore during the development of a web site."*

Building on the notion of information politics, it is appropriate to introduce the views of Perkins (1997), Zachman (2001) and Evernden (2002), who also affirm the role of IA as an organisational change management agent and a problem-solving tool. IA is seen as a comprehensive checklist of corporate issues that provides the link between strategic requirements and information systems that support them, and between the business model and application designs. They also recognise the importance of IA for strategic information management and rapid business decision making, by enabling the consistent and accurate extrapolation of strategic information from operational data. Morville (2001) observes that

> *"defining an information architecture strategy is a wonderful way to expose gaps in business strategy. The process forces people to ask difficult questions and make hard decisions they've previously managed to avoid."*

Clive Finkelstein, one of the originators of the ISA-related approach of Information Engineering, further asserts that

"The only way an organization can manage strategic information, implement interoperable systems, and establish true data sharing is by using an Enterprise Information Architecture." Finkelstein (1993)

Zachman (2001) reconciles the above by producing a comprehensive list of high-level business benefits that the IA adds (Table 1.2). The list has two parts, that Zachman refers to as 'dimensions', namely financial efficiency and business effectiveness, and could be used as a summary of the above-mentioned claims and assertions for IA.

Table 1.2: Two dimensions of architecture value (Zachman 2001)

Financial Efficiency		Business Effectiveness
Reuse		Tighter alignment with business strategies
Reduced time to delivery		Knowledge development
Efficient program management		Sophisticated asset management
Reduced support costs		Reduced decision risk
Lower acquisition costs		Tighter strategic partnerships
Technical adaptability		Business adaptability

Some of the cited claims on the benefits that IA could introduce are substantiated by empirical research, whilst others are anecdotally supported. Similarly, there are evidences and assertions of the disadvantages and problems related to the development and management of IA. The most renowned of these are that IA becomes obsolete fast (Davenport 1994, Davenport & Short 1990; Niederman *et al* 1991; Periasamy & Feeny 1993b) and that to some stakeholders IA is irrelevant (Periasamy & Feeny 1993b). Further criticism refers to the difficulty to recruit and develop human resources for IA development and management, i.e. people who are familiar with the business and are skilled in analysis, design and systematic thinking (Stevenson 1995b). IA and information processing today are inevitably associated with Information and Communication Technology (ICT) and technical jargon and details that could often be confusing and problematic to management (Galliers *et al.* 1994). Consequently, through lack of management support many IA projects lose their executive sponsorship and momentum and eventually are cancelled (Cook 1996). Davenport (1994) points out another primary reason for IA failure, this being that when undertaking IA planning, few companies consider how people will actually use information and what type of information they will use for decision making, computer-based or from conversations.

Zachman (1999) sustains the same view, arguing that one of the causes for the problems with IA work is that architecture is countercultural:

"Although we play verbal homage to standards, reuse, interchangeable parts, integration, design for change, administering change, alignment, assets, investments, and so on, the practical fact is that we are not doing any of them."

In the same work, Zachman recognises further reasons why, in spite of the logic of architectural concepts and the overwhelming set of benefits, the reality is that companies have not embraced the concept of IA. Enterprise architecture is not perceived to be an enterprise survival issue. The notion that "*the design of the system is the design of the enterprise; and if the system can't change, the enterprise can't change!*" (Zachman 1999) has not yet been absorbed. Furthermore, the state-of-art in designing and documenting models that could be used to describe the Network, Time, People and Motivation concepts is limited and companies do not have the knowledge and skills to implement IA, let alone the time to invest in the development of a complex set of applications, policies, regulations and models that build up the architecture.

Despite such criticism, IA is a significant managerial issue (Table 1.1) presenting many questions that warrant further research. Zachman argues that architectural revolution is imminent for every enterprise, but will need time to gain momentum as the IT industry is relatively young in comparison to other architecture-based disciplines, such as classical architecture and manufacturing, that are thousands of years old (Zachman cited in Lauchlan 1999).

1.1.2. THE NEED FOR FURTHER RESEARCH AND DEVELOPMENT IN INFORMATION ARCHITECTURES

Numerous frameworks for IA have been designed to enable the exploitation of information and information technology for the fulfilment of key business strategies (See Section 2.1.2 and Bibliography). However, with developments in information technology, businesses are beginning to seek the advantages from internet technology, lending to a new business transformation form, the Internetworked business (Tapscott, 1996). Over a decade ago Galliers (1993b) anticipated that changing business imperatives determine changes in information needs and business processes, which in turn demand flexible information architectures.

Preliminary investigation into existing IA tools established that these have been developed either with the view of a single organisation only (Finkelstein 1989; Perkins 1997; Sowa & Zachman 1992b; The Open Group 2002), or for a specific industry sector (Evernden 1996). In most of the cases the proposed 'information architectures' are IT-focused and rarely account for information values and behaviour, neither are flexible enough to provide

> *"awareness of the context in which information may be required and the manner in which it is likely to be interpreted to enable a required activity or decision to be made."* (Galliers 1993b, p.202)

This research study examines the state and status of frameworks for Information Architecture (Cf. Chapter 2.1 and Chapter 4.1) and investigates whether they meet the requirements for an IA for electronically mediated business networks (Cf. Chapter 2.3). For simplicity the latter are also referred to as e-business networks.

The need for analytical tools for the latter as a foundation for working across organisational boundaries has already been recognised by the proponents of inter-organisational information systems (Finnegan 1995; Meier & Sprague 1991). Within the last decade inter-organisational systems have evolved into (or relabelled as) electronic commerce (e-commerce) and electronic business (e-business) systems designed to support on-line practices of business networks. These are often referred to as Business-To-Business (B2B) e-commerce or B2B e-business systems. Application development to address these trends has been largely concerned with the provision of development methods, technological frameworks and web site design. Although the spectrum of research issues in this domain is very rich, still little attention has been paid to studies of information architecture for electronically integrated business alliances. The work carried under the banner of information architecture has been either constrained by organisational/sector boundaries (cf. above), or disguises web site architecture as information architecture (Rosenfeld & Morville 1998). Furthermore, much of what is published on the subject of IA is based on the industrial experience of authors, e.g. Zachman and Evernden, rather than being a result of conceptually grounded systematic research.

This thesis first conducts extensive secondary research into academic and practitioners' work on business transformation and IA from the areas of IS Management, Business Systems Planning and IS Design and Development. This outlines six major IA-related information management problems (Table 1.3) determining the need for this research.

Table 1.3: Problems determining the need for the research in IA frameworks.

Information management problems related to IA	**Source**
1. Businesses focus predominantly on data, rather than information.	Davenport *et al.* (2001)
2. Information management deals with information practices and IT practices, but does not sufficiently address information behaviour and values.	Marchand *et al.* (2000)
3. There is a demand for flexible information architectures that provide awareness of the context in which the information lifecycle takes place.	Galliers (1993b)
4. Existing IA frameworks are predominantly internally focused, serving centralised and regulated environments and could have limited support for emerging e-business alliances dealing with the new competitive forces.	Author's investigation (See Ch.2)
5. The most comprehensive IA frameworks are largely developed through observations and other empirical work and have limited theoretical foundations.	Author's investigation (See Ch.4.1)
6. IA work in related subject domains, such as Information Engineering, IS Management and Web Design, is conducted independently and with no attempt for building on and integrating relevant experiences.	Author's investigation (See Ch.4.2)

1.2. RESEARCH AIM AND OBJECTIVES

The aim of this study is **to develop further existing work done on information architecture frameworks to accommodate the needs of electronically mediated business networks**, also referred to as e-business networks.

This accommodates the following objectives:

(1) To investigate frameworks and models of information architecture and information systems architecture and establish their status within the IS knowledge domain;

(2) To conduct conceptual analysis on the frameworks and models identified as part of Objective 1 and then to establish fundamental IA components and desirable extensions to existing IA frameworks.

(3) To investigate requirements for IA for electronically mediated business networks and explore the extent to which they are met by the reviewed analytical tools.

(4) To propose a framework, based on the outcomes of Objective 2 and Objective 3, for e-business network information architecture that addresses the above problems, through utilisation and integration of best practice.

(5) To empirically evaluate the proposed theoretical framework and its status as an analytical tool.

(6) To refine, based on the findings of the empirical evaluation, the initially proposed IA framework.

The above objectives could be organised into two groups, called macro-objectives, these of Theory building and Theory evaluation. The first macro-objective includes objectives 1 to 4, of which objectives 1, 2 and 3 provide exploratory underpinnings for of the development of a new analytical tool (Objective 4). The last two objectives, 5 and 6, build up the second macro objective, the Theory evaluation and refinement one.

References to the research objectives at both macro and micro-level are going to be made where appropriate throughout this paper, and mainly in Chapter 3, and Chapter 8, as well as in Section 1.4 here.

1.3. DEFINITIONS OF WORKING CONCEPTS

Understanding of the ideas and contribution of this study is grounded in understanding of the key terms it operates with. To enable this, working definitions and explanations of the keywords are presented below.

Another clarification on the terminology employed in this study refers to the use of the terms 'business', 'company', 'organisation', 'firm' and 'enterprise' as synonyms. Further sets of terms that are used interchangeably in this work are specified in the definition of the key terms. Where possible, the choice of which term to use is determined by the preferences of the cited/referenced author(s). Similarly, the terms e-commerce and e-business are often used interchangeably in this paper, although strictly speaking, e-commerce refers to the buying and selling on the Internet, whilst e-business encompasses also non-profit making activities, such as providing free information to consumers and collaborating with business partners.

1.3.1. INFORMATION

> *"Information is that collection of data, which, presented in a particular manner and at an appropriate time, improves the knowledge of the person receiving it in such a way that he/she is better able to undertake a [required] activity or make a [required] decision."*
>
> (Galliers 1993b)

Davenport & Prusak (1997) expand on the role of the information, detailing the form of delivery:

> *"A message, usually in the form of a document or an audible or visible communication, meant to change the way a receiver perceives something and to influence judgement or behaviour; data that makes a difference."*

Information characteristics are these features of information that determine its use and quality. Gorry and Scott Morton (1971) outline comprehensive taxonomy of information characteristics, referring in particular to the information requirements for each of the three levels of management control, operational, managerial and strategic. Their work is further extended by Periasamy and Feeny (1997), whose framework for management information characteristics (Table 1.4) serves as one of the pillars for the proposed information architecture for business networks (See Chapter 5).

Another fundamental term related to information is the 'information lifecycle', i.e. the time sequence of processes that information goes through during its existence. The names of the stages in the lifecycle could differ based on the source, but in essence all labels reflect what is happening to the information from its birth to its death, e.g. create, acquire, process, store, disseminate and destroy.

Table. 1.4. Management information characteristics framework
(Adapted from Periasamy & Feeny (1997), p.204)

	Information Characteristics Continuum									
Characteristics of Information / **Source**	**Internal**	①	②	③	④	⑤	⑥	⑦	⑧	**External**
Scope	Narrow									Wide
Aggregation Level	Detailed									Summarized
Time Horizon	Historical									Future
Required Accuracy	High									Low
Usage Frequency	Frequent									Infrequent
Class	Formal									Informal
Presentation Media	Written									Oral
Form	Textual									Pictorial
Nature	Hard									Soft
Overall Emphasis	Syntactics									Semantics

Management Level		
Lower (Operational Planning / Control)	Middle (Tactical Planning / Control)	Senior (Strategic Planning)

Key to abbreviations:
DFD = Data Flow Diagram
Arch = Architecture

① - Structure Chart
② - Physical Data Model
③ - Logical Data Model
④ - High Level DFD
⑤ - Business Area Data Model
⑥ - Detailed Application Architecture
⑦ - Overall Application Architecture
⑧ - Business System Architecture

1.3.2. SYSTEM

Within the domain of Systems Theory and Systems Thinking a 'system' is defined as

> *"a collection of interrelated parts which are unified by design to obtain one or more objectives."*
>
> (Luchsinger and Dock 1976, in Wetherbe et al. 1988)

Notwithstanding the general agreement on the definition above, Checkland and Scholes (1999) state that there is no common account of the concept 'system' in the literature. Investigation into the works within this subject area evidences that all authors draw on the same clusters of ideas, namely that

(1) A system is a complex whole that may have emergent properties, i.e. properties that refer only to the whole and are meaningless in terms of the parts, which make up the whole.

(2) Each system exhibits layers of hierarchy and has processes of communication and control.

The system concept is used across multiple disciplines and systems of various kinds are defined, e.g. biological, ecological, technological, business or information systems.

This study focuses on two kinds of systems, namely information systems (defined below) and organisations as systems. The study of the latter, originating in the works of Optner (1965) and Simon (1960, 1977) (both cited in Checkland & Scholes 1999), justifies why this paper occasionally uses the term 'system' as a substitute for terms such as 'enterprise', 'organisation' or 'business network'.

1.3.3. INFORMATION SYSTEM

> *"An information system is an organised collection, processing, transmission, and dissemination of information in accordance with defined procedures, whether automated or manual."*
>
> (The Interoperability Clearing House 2004)

Cashmore and Lyall (1991) suggest that regardless of their type, information systems are made up of the following four elements:

- Collection of data: facts, figures or rumours;
- Storage of data: whether on a computer, folders in a filing cabinet or in one's head;
- Manipulation of data: arranging, collating, aggregating and interpreting it;
- Presentation of information: providing the potential users with information in the most suitable form, e.g. verbal, written, pictorial, graphical, et al.

Following the above definitions, this study supports the view that the term 'information system' should not be restricted to denote computer-based information systems only. However, it recognises that within the context of e-business, information and communication technologies (ICT) inevitably are to be considered as a core IS component that enables the storage, manipulation and presentation of information.

1.3.4. ARCHITECTURE

The definition provided by the ANSI/IEEE Std 1471-2000 proved to be the one that describes best the understanding of architecture in this study:

> *"the fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution".*

A certain degree of confusion could occur as, based on the context of the discussion, the term 'architecture' may have either of the following two meanings:

(1) A property of a system (as per the above definition).

(2) The product of developing architecture (or architecture plan) of a specific system.

In the current study the term is used predominantly in the first sense.

1.3.5. FRAMEWORK

Two definitions illustrate best the meaning of the term 'framework':

> *"A systematic taxonomy of concepts and their interrelationships."*
>
> (Zachman 1987; Sowa & Zachman 1992a)
>
> *"A logical structure for classifying and organizing complex information."*
>
> (The Interoperability Clearing House 2004)

In computing publications the term is used in the sense of a technological product that enables the linking of different systems, i.e. system and network management framework (e.g. IBM's Tivoli Enterprise & Computer Associates' Unicentre), which is not the case here.

Despite that linguists could argue for differences in the semantic content of the terms 'framework' and 'theoretical model', in places this paper uses them interchangeably to denote a structural design.

1.3.6. ARCHITECTURE FRAMEWORK

The Open Group (2002) provides a comprehensive definition of the term 'architecture framework', which is adopted here:

> *"An architecture framework is a tool which can be used for developing a broad range of different architectures. It should describe a method for designing an information*

system in terms of a set of building blocks, and for showing how the building blocks fit together. It should contain a set of tools and provide a common vocabulary. It should also include a list of recommended standards and compliant products that can be used to implement the building blocks. "

1.3.7. INFORMATION ARCHITECTURE

"Information architecture is the foundation for managing information in general as a corporate resource. It describes the theory, principles, guidelines, standards, conventions and dimensions that are necessary to design an effective management framework for information. Its purpose is to design information structures that help people to use information in effective, productive and innovative ways."

(Evernden 2002)

In the literature there are other terms, such as 'Information Systems Architecture', 'Enterprise Architecture' (EA), which definitions overlap partially with the definition of IA used here. A collection of more than 30 different I(S)A definitions was developed to facilitate the analysis of the scope of information architecture. It is considered that it is beyond the scope of this study to enter in further discussions on the difference and hierarchy of the terms 'information architecture' and 'information systems architecture'. A dispute on this topic could come down to the question of what was first, the hen or the egg? That means, does the architecture of information include the architecture of the system that manages this information or does the architecture of an information system include the information sub-architecture as one of its core components? Works supporting both views were identified and presented in Section 2.1.

This study takes the stand that in the context of electronic business the term 'Information Architecture' is equivalent to the term 'Information Systems Architecture'. It argues that any framework for on-line Information Architecture should present information on the data and the context of this data, including the storage, management and presentation of this data, i.e. all of the four elements of an information system (Cashmore & Lyall 1991). Further, it should discuss their inter-relationships and the relationships between these components and the environment, as well as the principles governing the lifecycle of the information system. As such, it could also be referred to as a framework for Information Systems Architecture.

This understanding of the commonality between IA and ISA is in agreement with Evernden's (2000) view that IA should come first, as

> *"Handling information through [computer-based] information systems is only one of the uses of information."* (Evernden 2000)

1.3.8. BUSINESS NETWORK

In this context a business network is defined as a system of actors, either organisations or individuals representing these organisations, that work together for the accomplishment of a common strategy. According to Snow *et al.* (1992) it is a highly flexible, vertical disintegrated set of self-managing interdependent business units at intra- or inter-organisational level that contract skills and resources with each other to form the value-chain for developing a particular product or fulfilling a service.

It has to be emphasised that 'network' in 'network organisation' should not be interpreted as 'computer network', but as a set of pathways (formal or informal) along which information and influence flow (Toffler 1990). However, with the growth of electronic communications the work of many business networks has become unthinkable without the underlying computer networks. At its start this study was defined as research on information architectures for electronically mediated business networks. However, as the research progressed, it has become apparent that such collaborative on-line business alliances are literally e-business networks. Therefore, the terms 'e-business alliances', 'e-business networks', 'e-business systems' and 'electronically mediated business networks' are used in this study interchangeably to denote business networks using inter-organisational computer-based information systems.

Further discussion on the characteristics of business networks is presented in Chapter 2: *Information Architectures and the e-Business World.*

1.3.9. ELECTRONIC INTEGRATION

Another term used throughout the study is that of 'electronic integration', used in the sense of a business strategy, design and implementation of system integration solutions at enterprise or business network level.

> *"Electronic integration refers to those strategies that apply information technology to transform business processes and relations, the business network or the business scope."* (Venkatraman 1991)

1.4. RESEARCH DESIGN

Having outlined the aim and objectives of this research and presented the working definitions underpinning the study, it is customary to progress with a brief insight into the design that was adopted to deliver the expected outcomes.

The decision on what research strategy will best provide for the successful accomplishment of the objectives was driven by two major principles:

(P1) The set of objectives of the study;

(P2) The philosophical basis of the research.

The research aim as outlined in Section 1.2, is delivered through two separate, yet inter-linked types of research objectives, these of theory building and theory evaluation, each of which constitutes of a number of smaller, tangible objectives. This, in the light of the first of the above principles (P1), required a decision on whether a different research strategy is needed for each of the macro objectives. Kerssens-van Drongelen (2001, p.504) argues that where the research pursues a variety of research question types, "*it seems sensible to apply a variety of research strategies as well*". On these grounds, this study has employed two research strategies, a theory-building one and an evaluation one, each accomplished through an appropriate set of research methods.

An investigation was conducted to identify methods for building models, frameworks and extending existing theories. It established that case studies and surveys are considered to be the most popular methods for theory building (Kerssens-van Drongelen, 2001), whilst focus groups, Delphi studies and multi-method approach have also been employed for these purposes (Galliers & Land 1988; Hamilton & Ives 1989; Vogel & Wetherbe 1984, Wynekoop & Russo 1997). Secondary research methods such as theoretical analysis were also considered as an alternative method for achieving this objective. These findings informed the design of the Theory building part of the research.

However, due to difficulties with securing the agreement organisations experienced in engineering and managing Information Architecture to be involved in the research as case study organisations, the theory building strategy underwent several redesigns (Table 3.1). The final research strategy for developing the theoretical framework (Section 3.1.1) was a multi-method one, including normative writings, subjective/argumentative analysis of extant literature and an interview with the author of one of the most comprehensive IA frameworks identified by this study.

Through a similar investigation into research studies with evaluation objectives it was established that experiments and the surveys were argued to be the most widely used research methods (Kerssens-van Drongelen, 2001), together with computer-based simulations, surveys, focus groups, Delphi studies and evaluation interviewing (Kraemer & Dutton 1991; Galliers 1992; Yin 1994; Kerssens-van Drogelen 2001). These were assessed for their alignment with the philosophical tenets of this research and suitability for this project. The lessons learnt from the experience with designing a theory building strategy were also taken into consideration when deciding on the feasibility of each alternative. As a result, the evaluation of the theoretical model was accomplished through a triangulation of three types of tests. In chronological order, these included a Delphi study, an electronic survey and evaluation interviewing. The findings of the three tests were correlated and synthesized with the outcomes of a theoretical evaluation using a checklist for IA frameworks (Evernden 2002) and a Metamodel test (Andersen & Opdahl 1995). The resulting set of recommendations formed the basis for alterations in the proposed framework.

The second of the principles (P2) for establishing a research strategy is based on the general agreement that the paradigm choice, and particularly the epistemological and methodological assumptions, sustain a set of research strategies to meet the research objectives (Gioia & Pitre 1990; Guba 1990; Denzin & Lincoln 2000).

To establish the underlying philosophy for this study, the author investigated the plethora of philosophical schools and ascertained that her beliefs with regards to IA conform to the principles of the postpositivist paradigm. Although she recognises the specificity of each business organisation, she believes that an architectural work of the kind discussed here is a generic construct that is applicable in most of the cases. This assertion confirms the ontological principle of postpositivism, arguing that the reality is independent of the individual case and is driven by time- and context-free generalisations (Lincoln & Guba 1985).

The postpositivist paradigm shares the same ontological and epistemological beliefs with the positivist paradigm, i.e. sustaining realist and objectivist view of reality, but has different methodological foundations (Lincoln & Guba, 1985). The latter are defined as being experimental/manipulative for positivist studies and interventionist for postpositivist ones. As a successor of positivism, postpositivism tries to address some of the methodological deficiencies of the former, mainly through consideration for individual views, a characteristic common for non-positivist methods. Postpositivists argue that there is no one correct method of science, but many methods and advance 'methodological pluralism'. Such a stand maintains that a single method will provide only a partial view of the reality (Mingers 1997). Miles and Huberman (1984, in Guba & Lincoln 1989) observe that "*it is getting harder to find any methodologists solidly encamped in one epistemology or the other*". Further, there is a debate among methodological pluralists about the extent to which they should adhere to the philosophical paradigm. Patton (1982) asserts that an evaluator can make "*mind shifts back and forth between paradigms*", even within a single investigation. Guba and Lincoln (1989) agree that the same methods and tools and techniques could be used across paradigms, but argue that, regardless of the method used,

> *those persons know (or should know) from which paradigm they operate, and that knowledge has significant consequences for the ways in which these tools are used.*

Methodological pluralism is being advocated by a number of IS and organisational theory authors (Gioia & Pitre 1990; Mingers 2001) and, as discussed above, is a fundamental feature of this work. True to the postpositivist spirit of this inquiry, the researcher had actively engaged "*in partial trade-offs, of rigour to gain relevance, precision to gain richness, theoretical elegance to gain local applicability, and measures of outcomes to promote inquiry into process, meaning and local context*" (Phillips 1987, as cited in Shaw (1999), p. 47). Keeping open minded and creative in selecting research methods was one of the principles that guided this study. Studies with similar objectives were identified and their methodological foundations examined. To ensure that the richness of the research style, breadth and innovation should not be inhibited by a conservative view on a closed set of paradigm-predetermined methods, the full range of appropriate methods was considered when determining the two research strategies here.

Further details on the philosophical foundations of the research and the research strategy are provided in Chapter 3, whilst the implementation of the design and the reflections on the research experience are presented in Chapter 6 and Chapter 8, respectively.

1.5. OUTLINE OF THE THESIS

This thesis is organised into eight chapters that present the research in its logical progression from setting up the research aim and justifying the need for such a study, through the development of the research design and its implementation, to the results analysis and reflections on the research product and experience. The structure of the research paper and the dependencies between the chapters, are illustrated on Fig.1.2 below.

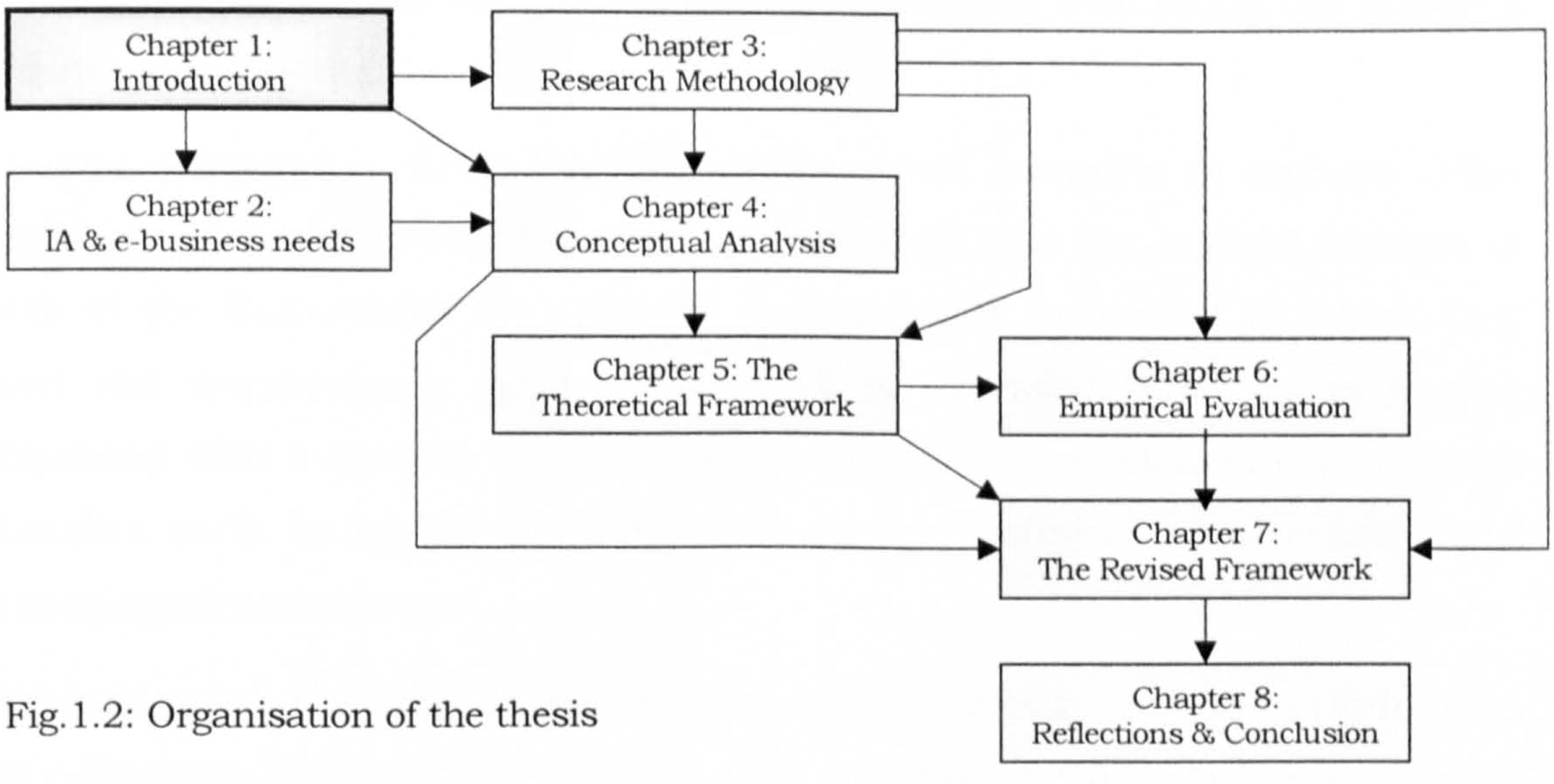


Fig.1.2: Organisation of the thesis

In this introductory chapter the research objectives and the working definitions employed in the research are presented. Brief information on the origins and the importance of the research is also provided, and the aim and objectives of the work are listed. The chapter discusses the factors determining the research strategy, i.e. the set of objectives and the researcher's philosophical stand, and explains how the specific research methods for each of the research strategies, i.e. theory building and theory evaluation, were identified.

Chapter 2 builds up the case for research, beginning with a discussion of the different understandings and classifications of IA and progressively introducing key I(S)A works. The rationale behind the choice of particular I(S)A works is provided and the value of these seminal studies is discussed. New assertions on the importance of I(S)A are put forward based on theories outside the boundaries of the IS field. The second part of the chapter ascertains that little has been done on the development of that this is a niche in IS research by studying business networks, inter-organisational IA and the forces for electronic integration. It produces a synopsis of requirements for a generic IA framework for e-mediated business alliances that is later used as a benchmark for the proposed architectural dimensions.

Chapter 3 discusses the methodological approach in the light of the research objectives and reviews the research instruments for data collection, analysis and visualisation of the proposed framework. In recognition of the impact that the researcher's philosophical assumptions could have on the research design, the chapter provides further insight into the post-positivist foundations of the study. The last section outlines the quality criteria for evaluating the research process and product.

Chapter 4 reviews in detail the I(S)A works of two formative IA authors, John Zachman and Roger Evernden. The commonalties and the original features of each of the frameworks are critically analysed and the extent to which they meet the requirements for e-business IA is assessed. The list is further enhanced with concepts suggested from studies in complementary research domains such as system thinking, web design, software requirements and managing virtual teams.

The focal point of this study is Chapter 5, where the proposed framework for IA for e-business systems is presented. The underlying rules, core components and characteristics are discussed and the originality of the work is justified by comparing the tool with the models and frameworks presented in Chapters 2 and 4.

Chapter 6 begins with a discussion of the implementation of the multi-method evaluation of the theoretical model built in Chapter 5. The results of each of the three evaluation exercises are presented, analysed and synthesised and recommendations for change are put forward.

The penultimate Chapter 7 revisits the proposed theoretical framework in the light of the recommendations of the empirical evaluations. It further subjects the work to two theoretical tests to confirm its nature as a meta-model of the main characteristics of an Information Architecture.

The final chapter, Chapter 8, reviews the research objectives and their artefacts and reflects upon the research process and the product of the theory building and evaluation processes. The limitations of the research are critically analysed and conclusions are drawn on the quality of the research, using the criteria established in Chapter 3. The implementation of the framework, including a method for application of the tool and any factors and issues related to the ways theory can inform practice are also discussed there. The chapter concludes by outlining the contribution to knowledge, implications for practice and research, and proposals for a number of possible themes for future research investigations.

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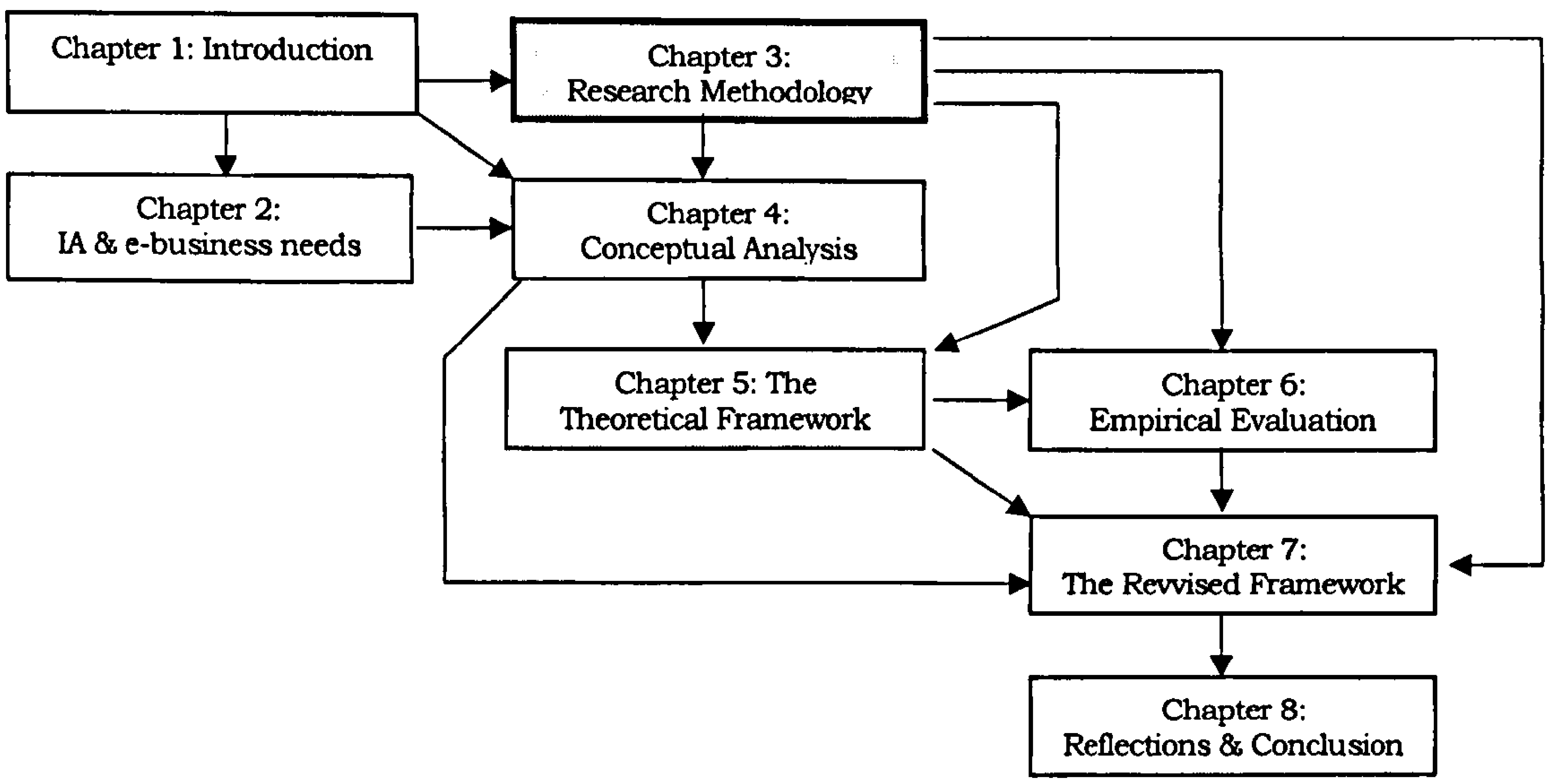
Chapter 3: Research Methodology



> .... *The gendered, multiculturally situated researcher approaches the world with a set of ideas, a framework (theory, ontology) that specifies a set of questions (epistemology) that he or she then examines in specific ways (methodology, analysis). ... Every researcher speaks from within a distinct interpretive community that configures, in its special way, the multicultural, gendered components of the research act.*
>
> Denzin and Lincoln (2000, p. 18)

This chapter presents the methodological foundations of this research and provides further insight into the philosophical principles underpinning the study. It is an account that the research process introduced by Denzin and Lincoln (2000) (Fig.3.1) has been followed through.

Hirschheim (1992) asserts that the 'correct'-ness of the method is contingent on the problem being studied. To accommodate this view, the chapter starts by revisiting the research objectives and the set of research strategies that deliver them (Section 3.1). Further, it specifies the set of research methods constituting each of theory building and evaluation strategies and deliberates on their strengths and weaknesses in the context of this study. A discussion of the research instruments and the options and trade-offs with the visualization of the framework is also included (Section 3.2).

The Research Process

Phase 1: The Researcher as a Multicultural Subject
Phase 2: Theoretical Paradigms and Perspectives
Phase 3: Research Strategies
Phase 4: Methods of Collection and Analysis
Phase 5: The Art of Interpretation and Presentation

Fig. 3.1: The Research Process (Denzin & Lincoln 2000)

In agreement with view that in any research there is a relationship of the studied subject with the researcher (Denzin and Lincolne 1985), this chapter includes a section discussing the fundamental principles of postpositivism. The latter begins with the outline of the dichotomy of research paradigms, the positivistic and the non-positivistic, and introduces the ontological, epistemological, axiological and methodological tenets that determine the framework for this study (Section 3.3).

The penultimate Section 3.4 focuses on quality frameworks and describes the set of tests that was chosen for its congruency with the philosophical paradigm of this research. Lastly, Section 3.5 summarises the research design as a process and product, revisits the philosophical and practical issues that have influenced the choice, and reiterates on the mechanisms used to ensure the methodological consistency and quality of the work.

3.1. RESEARCH STRATEGY – ALTERNATIVES AND CHOICE

The introductory chapter presented the formative factors of the choice of research strategy (Section 1.4), mainly the nature of the problem and the set of objectives of the study. The latter includes two macro-objectives, which infuse two distinct research strategies (Section 1.2), these of theory building (Section 3.1.1) and theory evaluation (Section 3.1.2).

Each strategy adopted a multi-method approach employing both qualitative and quantitative methods. Multiple scientific and interpretive methods were considered for achieving the objectives of this research. The secondary research on theoretical works and findings of other research experiences provided valuable insights and ideas on the strategy design and warned against some feasibility threats. Published interviews with business and IS specialists were also examined as a source of additional details on issues that should be considered. In search of robust and valid outcome, each of the methods identified as appropriate by previous studies (Galliers & Land 1988; Galliers 1992; Brancheau *et. al.* 1996) was examined using a set of criteria, suggested by Brewerton and Millward (2001) (Fig. 3.2). This evaluation instrument includes criteria such as ethical correctness, successful completion of pilot(

Fig. 3.2: Criteria for selecting a method (Brewerton & Millward 2001, p.68)

- Appropriate to your research objectives
- Able to elicit a form of data appropriate to testing your hypothesis/hypotheses or addressing your research question(s);
- Feasible given time, resource and organisational constraints and requirements;
- Adequately piloted;
- Ethically sound;
- Agreed and accepted by the organisation;
- Used appropriately, in the context of its original formulation and development;
- One you feel comfortable with, being confident and well rehearsed in its use before you use it.

studies, acceptance and agreement by the participants (individuals and/or organisations) and lastly, how it fits with researcher's individual preferences and constraints. Additionally, each of the populations of research methods fitting the above criteria is considered for its:

⇒ reliability, i.e. the consistency of the framework (Coombes 2001),

⇒ validity , i.e. whether the instrument confirms the truth of the matter and measures accurately what it is supposed to measure (Coombes 2001), and

⇒ feasibility/implementability/practicability/realism, i.e. how realistic it is that the researcher will be able to use and administer appropriately the suggested method.

The researcher's choice of methods for each of the two strategies is discussed in the respective sections below.

3.1.1. THEORY BUILDING STRATEGY

The aim of the theory building research strategy is to develop further the concept of information architecture to accommodate the specifics of e-business and business alliances. This involves four objectives (Objective (1) to (4) in Section 1.2). A secondary activity was to identify business networks and individuals and determine their suitability as evaluators of the proposed framework. To ensure reliability of the chosen set, a sampling frame was designed to define all the cases in the population from which the research sample will be drawn (Saunders *et. al.* 2000, Hussey and Hussey 1997). Initially it included individuals and companies that take part in business networks using inter-organisational information systems, are familiar with information architecture and have the desire to talk publicly about their projects. These were identified through secondary research and networking with academics and business professionals attending the conferences and workshops on IA and related topics. Implicitly, this is a very limited population, which affected the size of the research sample and resulted in two versions of the research designs to be attempted prior to the development of the third, current version. Brief descriptions of these are provided in Table 3.1, whilst more details on the withdrawn strategies could be found in Appendix A and Appendix B.

Kerssens-van Drongelen (2001) argues that such 'iterative theory building process' is a common research approach. It encompasses two major principles:

- *new theory is built during various cycles, allowing for a (conscious) change in the research question if empirical material already gathered requires this;* and
- *research strategies, data collection and analysis methods and tactics are selected based on the (changing) type of research questions and process phases. This often results in a combination of research strategies within one research process.* (Kerssens-van Drongelen 2001)

This research conforms to the above principles with the only variance, that the empirical data effected changes only in the research strategy, but not in the research question.

Table 3.1: Research strategies evolution

Version	Strategy Details	Status
Version 1 **A single case study within a business network (the NHS)** (Appendix A)	• Examination of NHS internal documentation provided by the NHS IM&T Strategy group. • A survey with IM/IT managers in NHS in the South West England affirming the state and status of electronic integration within the NHS; • A formal semi-structured interview with the Information Manager of one of the South-West NHS trusts (Bobeva, 1997) to pilot a forth coming series of semi-structured interviews with the participants in the research sample who had taken part in the survey and agreed to take part in further research. • Subjective/argumentative research through observation at an NHS conference dedicated to the new information management strategy in NHS; • Two informal semi-structured interviews with IS contractors in the NHS sector.	Withdrawn. Empirical research proved that the NHS is at a very early stage of its development as an e- business network, which raised concerns on the reliability and validity of findings based on a single case like this.
Version 2 **Multiple case studies** (Appendix B)	Based on a cross-section of market sectors outlining best practice in e-business integration. Companies approached included Tesco, Ladbrokes, SLB, Barclays. Research methods included: • Examination of internal documentation. • Informal interview (Barclays) to test whether organisations in the Financial Services sector will be willing to be used as a case study.	Withdrawn The invited participants declined participation in the study.
Version 3 **Critical review** (Section 3.1.1)	• Conceptual analysis of publications on IA works and associated concepts; • In-depth non-structured interview with the author of one of the I(S)A frameworks; • Subjective/argumentative research through observation (Business Intelligence conferences and exhibitions, UKAIS & BIT conferences) • Normative writings based on personal communication on the topic with academics and practitioners.	Accomplished.

3.1.1.1. The theory building process

The strategy implementation process resembles the theory building and testing process suggested by Jarvenpaa (1988) (Fig.3.3), with the exceptions that here the formulation of the research aim is based upon secondary research and observations, rather than emerging from a case study (Fig.3.4).

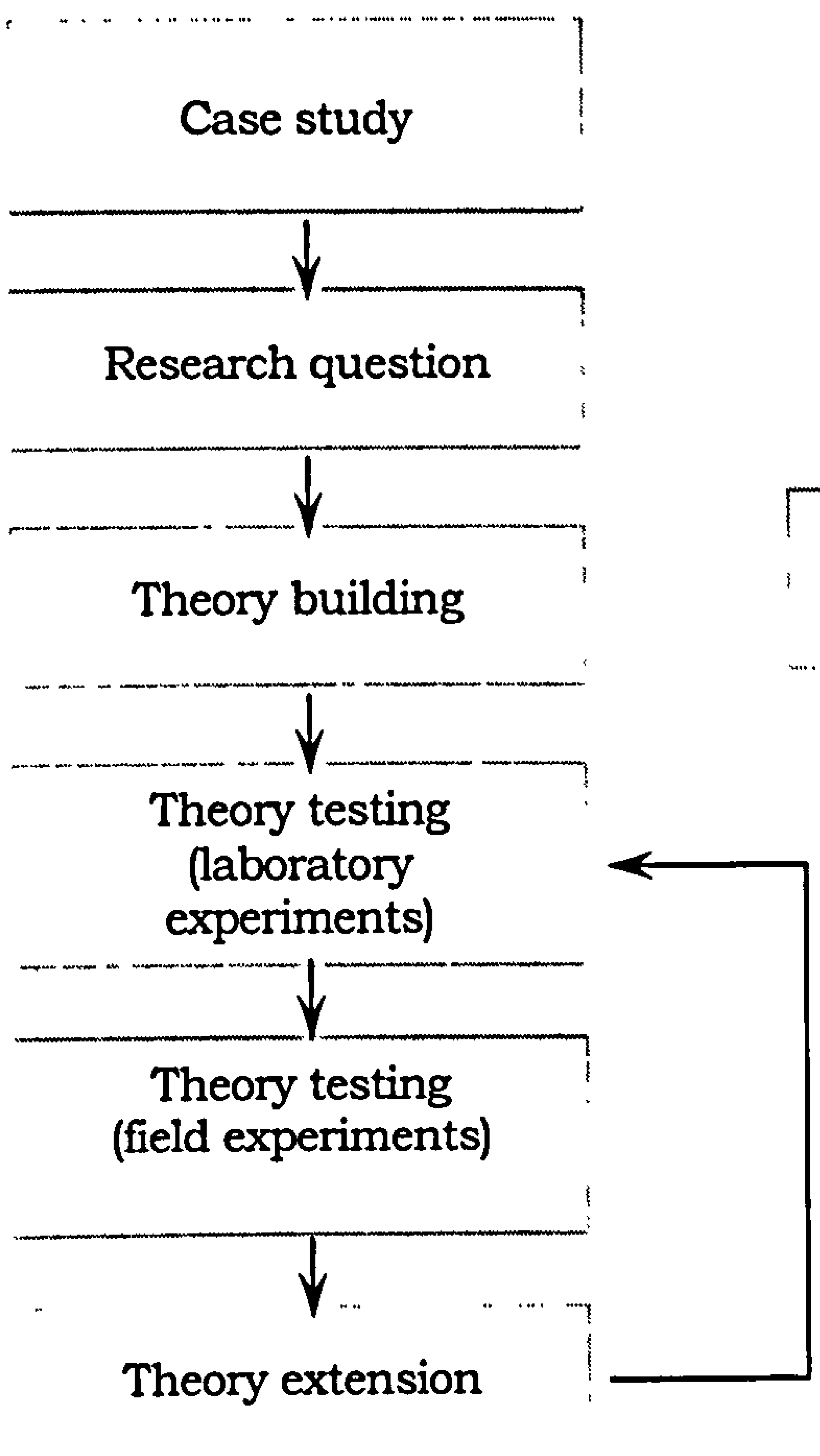


Fig.3.3: The use of alternative IS research approaches in theory building, testing and extension (Jarvenpaa, 1988, p.1504)

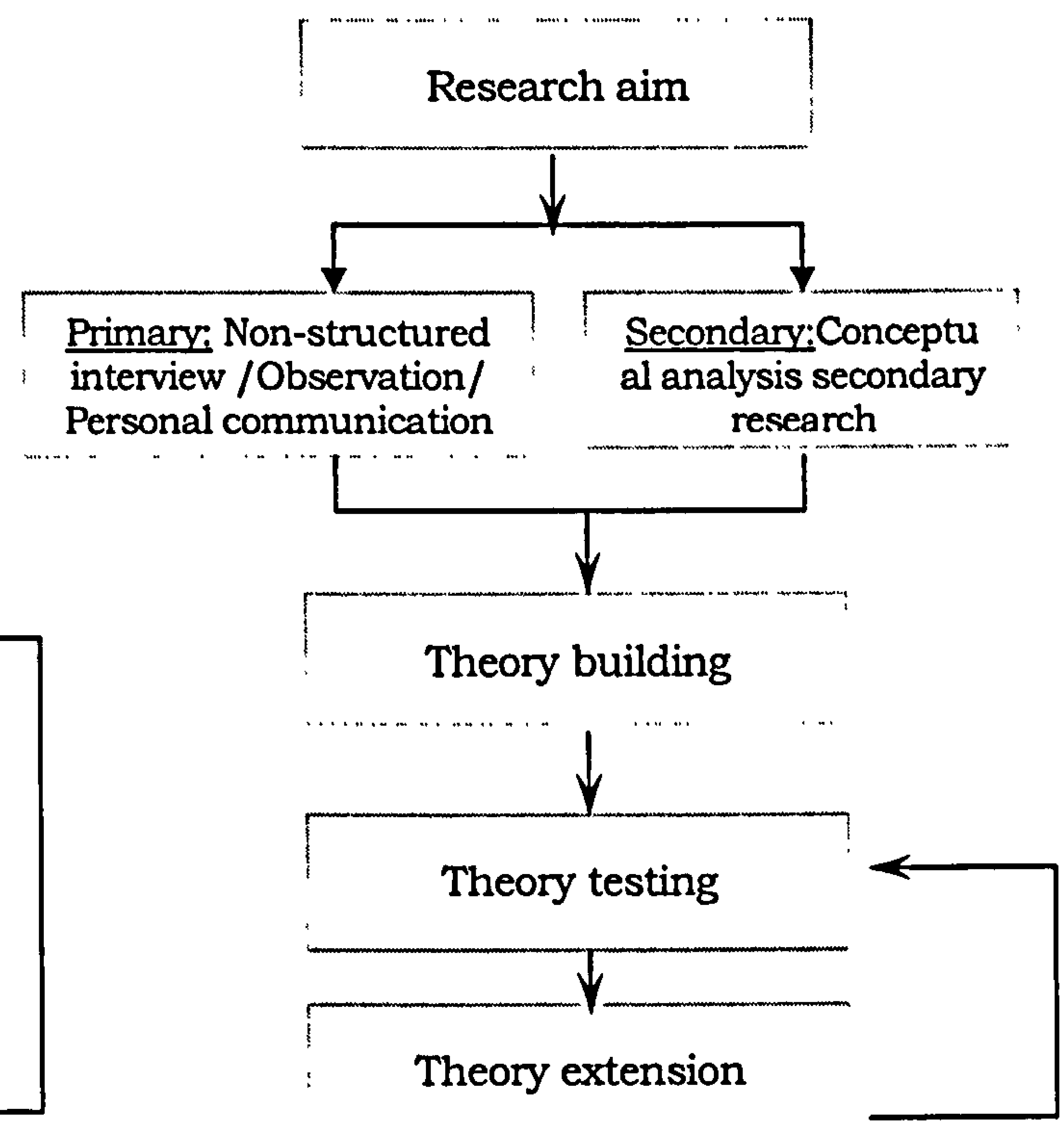


Fig.3.4: Theory building strategy (Version 3)

The fulfilment of the first three of the theory-building objectives was based upon conceptual analysis of I(S)A analytical tools (Section 2.1) and critical review of e-business information requirements (Section 2.2). This was extended through primary research including observations and a discussion of the core I(S)A frameworks and related issues with experts in their application and observation at professional conference events. Purposive sampling technique identified that an appropriate interview candidate is Roger Evernden, a professional who has been working on information architecture in the Financial

Services sector, promoted under the title Information FrameWork[1] (Evernden 1996). Evernden was invited for an in-depth non-structured interview and agreed to discussing his views on information architecture (Appendix C). Purposeful sampling was used for selecting the events for observation, as the researcher has already been a member of UKAIS[2] and has attended annual UKAIS and BIT[3] conferences. Further, a collaborative relationship with the conference organiser Business Intelligence had offered free access to UK-based IS-focused business conferences. This, unfortunately, excluded some highly-rated events, attendance of which was not financially feasible. Proceedings of some of these conferences were acquired later. The contacts made at the conferences built a research network where ideas on the topic were discussed.

On completion of the above research, the work on the fourth theory-building objective commenced. It was solely author's primary work based on synthesis the artefacts of the previous three objectives, i.e. the anthology I(S)A frameworks and the synopsis of e-business IA requirements.

3.1.1.2. Methods employed in building the framework

Kerssens-van Drongelen (2001) argues that case studies and surveys are the most popular methods used for theory building. The review of research for building models, frameworks and extending existing theories (Hamilton & Ives 1992; Vogel & Wetherbe 1984; Galliers & Land 1987; Wynekoop & Russo 1997) established that other primary research methods such as focus groups, Delphi studies, and multi-method approach are also appropriate for the purpose. The group of candidate methods also includes theoretical analysis, as a representative of the secondary research methods.

Using the method of elimination on the basis of the theoretical and practical criteria listed at the beginning of this chapter (Fig.3.2), and in agreement with other theory-building studies (Gable 1994), a multi-method approach was chosen. It was earlier stated that methodological pluralism characterises best postpositivist research. In this study it is achieved by triangulating theoretical

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[1] The rest of Evernden's models were not discussed as they were created after the interview (4th August 1998).

[2] UKAIS – United Kingdom Academy of Information Systems

[3] BIT – Business Information Technology

analysis with a survey in the South-West NHS, a set of semi-structured interviews and subjective argumentation. It has to be recognised that "triangulation", i.e. the use of several research methods in relation to the same object of study (Brannen 1995) for validating research findings, does not merely involve methods and data, but investigators and theories as well (Denzin 1970, p.310). As identified earlier, within the secondary research, triangulation of theories from different research areas was sought, but no triangulation of investigators was attempted.

The rest of this section deals with the methods employed for building the generic IA framework (Cf. Table 3.1) and the issues related to their implementation.

- **Critical review (Secondary research)**

The review of literature on past developments and the thorough and objective analysis of the results of the research are the foundation for any theory extension and evaluation. The objective is to identify the main contributions to knowledge in the field and to examine critically their strengths and weaknesses in the light of the research question. Galliers (1992) refers to this kind of research as descriptive or interpretive research. He acknowledges that this "*may not only lead to new insights but also is more likely to ensure that subsequent research builds on past endeavours*".

Section 2.1.1 had briefly outlined that in agreement with research literature (Hussey & Hussey 1997, Saunders et al 2000, Hollocks 2001) the existing body of knowledge on IA and IA-related topics was identified using generally recognised sources such as books, conference proceedings, doctoral theses, peer-refereed journals and practitioner's periodicals were consulted.

Electronic references also played an important role in the research review for information architectures and business networks. The strategy for searching electronic sources of information was primarily based on use of search engines, research databases and subject gateways. These included:

⇒ information portals to full text and abstract reference databases, such as NISS, Bournemouth University Electronic Information Services, BIDS, ABI/INFORM, INSPEC, Emerald, etc.

⇒ publisher's and association's websites, e.g. Elsevier, Auerbach Publications (www.auerbach-publications.com), MCB University Press (www.mcb.co.uk), Association for Information Systems (http://aisel.isworld.org).

⇒ subject directories, e.g. E-BizQ (www.ebizq.net), Biz/Ed (www.bized.bris.ac.uk) and IS World Net (www.isworld.org)

⇒ specialised search engines, i.e. the CiteSeer, the Scientific Literature Digital Library (NEC Research Institute index portal, http://citeseer.nj.nec.com/cs), the Techguide web site, PCWebopedia, The CCTA Government information service;

⇒ meta search engines, such as AskJeeves (www.askjeeves.com);

⇒ general search engines like Kartoo, AltaVista, Yahoo, Google, and Lycos, and

⇒ the mailbase system (www.mailbase.ac.uk).

Simple surfing was also used to the extent that URL links to other relevant information sources were followed.

As the list of the key words used to define the research comprises of words that are common across many disciplines, the search results contained many references only remotely relevant to the research. The use of different combinations of the keywords and familiarity with the search logic of each search engine only partially reduced the problem.

The secondary research resulted in the development of an extensive database of on-line journals, company documentation, individual research publications, research bibliographies and white papers on the Web, which was documented using the ProCite bibliographical application. Of greatest value for the study proved to be the reference databases that provided all required information, including in many cases, online full-text with least investment of search effort. This proved to be very effective exercise, as it allowed the researcher to sieve through the information and quickly come up with desired information, as well as to reuse the data when drafting reference lists for other publications. The search results were assessed using the criteria of scope, relevance, coverage, reliability and validity, accessibility and credibility of the source. Those sources that have influenced the work are included in the References and Bibliography lists.

The critical review provided valuable sources of ideas for the building of the framework. Critical to the work was the ability to deal with the definition conflicts. In several cases, in the absence of further publications or clarifications of the specific interpretation of the terminology, assumptions had to be made (See Section 2.1).

A summary of the analysis of the work done to date on information architectures and related concepts, models and theories encountered in the literature is presented in Chapters 2 and 4.

The primary sources of information included on-line communication with peer members of mail groups and interviews with informed professionals. This was a fast method of communication, but thoughts and ideas were delivered through plain text only and did not have the benefit of rich multimedia communication channels. This required special attention to be paid to clearly explaining views using unanimously agreed definitions.

- **Interviews**

According to Cannel and Kahn, as cited by Cohen and Manion (1989, p.307), the interview is

> *initiated by the interviewer for the specific purpose of obtaining research-relevant information and focused by him on content specified by research objectives of systematic description, predication or explanation*

The merits of this alternative lie with the opportunity for resolving quickly any communication problems arising form different backgrounds and for the creation of ideas and insights on how the framework could be improved. Some researchers deem the interview as an interpretivist approach (Galliers 1992, p.156), whilst others recognise that the interview fits with positivism as well (Silverman 2000). In the case of using interviews in positivist studies, the goal is to establish facts about behaviour and attitudes, whilst with interpretivist interactionist studies interviews are used mainly for describing authentic experiences. A close examination of the types of research data and interview relationship identified by Silverman (1998) confirm that within a positivist context the interviewer is an object, following research protocol, and the interviewee is a subject, revealing items relevant to the research protocol. Conversely, in non-positivist studies both the interviewee and the interviewer are subjects, the first one the active subject creating the interview context, whilst the second one is complying with, or resisting, definition of the situation.

Interviews could also be categorised based on the structure of the method, as structured, semi-structured and unstructured or focused interview (May 1993), as well as based on the number of participants, i.e. individual or group interviews. Each kind of interview is suited for different situations and purposes, and has strengths and weaknesses depending on the nature of the problem under investigation. Additionally

> *we can characterise interviews along a quantitative-qualitative dimension, varying from the formal standardised example (survey), to an unstructured situation of qualitative depth which allows the respondent to answer without feeling constrained by preformulated questions with a limited range of answers.*
>
> (May 1993, p.100).

In this study only individual interviews were conducted. These included one formal semi-structured interview and two informal semi-structured interviews were conducted as part of strategy version 1. Pre-specified questions were used, but where appropriate, the interviewee was asked supplementary questions to clarify specific points of interest. This, as May (1993, p.111) argued, enabled the researcher "*to have more latitude to probe beyond the answers and thus enter into a dialogues with the interviewee.*"

The third type of interview, the unstructured interview, is an open-ended interview and is more akin to an in-depth conversation than a straightforward question and answer session. As Lincoln & Guba (1985, p.269) state,

> *the unstructured interview is the mode of choice when the interviewer does not know what he or she doesn't know and must therefore rely on the respondent to tell him or her*.

The interview with Roger Evernden, the author of the IFW, was chosen to be unstructured to allow gaining an understanding of the salient issues as seen from the interviewee's perspective. The interview was taped, transcribed and the transcripts agreed with the participant.

Of the two types of interviews employed in this research, the researcher felt more confident when using semi-structured interviews, but felt that at times knowing how much more needed to be covered within the agreed time might have resulted in rushing through the questions and missing an opportunity to explore issues further or to exploit new insights into the IA problem situation. The experience with the unstructured interview was a very positive one, as the interviewer was well versed communicative person, truly interest in the research and able to allocate some additional time to allow the discussion to reachits natural end.

- **Normative writings and subjective/argumentative approach**

Normative writings are

> *concept development not based on empiricism or theoretical grounding, but on the author's speculations or opinion. Descriptions include on interpretation, but are presented as factual or objective accounts.*
>
> (Wynekoop & Russo 1997, p.51)

They are appropriate to use when designing frameworks or for theory building.

Galliers (1992, p.152) defines subjective, argumentative methods as

> *creative research based more on opinion/speculation than observation, thereby placing greater emphasis on the role/perspective of the researcher.*

It contributes to the development of cumulative knowledge and gives opportunity for creation of new ideas and insights. This method is particularly useful for theory building that can be subsequently tested by more formal means. Galliers (1992, p.157) points out that the scientific school would question whether this form of approach is genuinely research, as the nature of the research process here is very unstructured and subjective.

Despite being well prepared theoretically in managing literature review and critical evaluation of secondary material, the author found that the transition to normative writings required a disciplined inquiry with thorough document management and efficient cross-referencing. In retrospective, although the success of the implementation of this method was building slowly, there were no negative or disappointing experiences, apart form the few distresses where an important reference to back up the author's arguments could not be found immediately when needed.

The findings of the implementation of this strategy are presented in Chapter 4: and Chapter 5.

3.1.2. STRATEGIES AND METHODS FOR EVALUATING THE THEORETICAL FRAMEWORK

The aim of the evaluation strategy was to prove the reliability and validity of the outcome of the theory building stage. Three activities had to be undertaken to achieve this goal:

- Forming a panel of evaluators complying with the sampling frame;
- Designing evaluation instruments, both for data collection and data analysis, that nurture high internal integrity of the evaluation test;
- Examining and addressing any implementation issues that could effect quality of the collected data.

The following description of the evaluation strategy and its implementation deliberates on the appropriateness, validity and reliability of the selected subset of methods rather than of the product of the research. The implementation of the evaluation strategy and the quality features of the developed framework are going to be examined in Chapter 6.

The formation of an evaluation panel was partially addressed through the theory building strategy. The advertising sampling techniques identified participants whose contact details were given in conference proceedings, published on web sites, or mentioned in articles related to the topic of this research. Participative and convenience sampling narrowed down the research sample. Further participants were targeted through *typical case* sampling (Saunders *et. al.* 2000). These included the line managers in placement companies for the students from the B.Sc. Business Information Systems Management and B.Sc. Business Decision Management programmes of the Bournemouth University. It was envisaged that these practitioners, being informed and experienced in information management issues, would be able to relate to the evaluand. It is recognised that those of the participants who agreed in the research represent a self-selecting sample. This is considered as an advantage, rather than a threat to reliability, as the agreement indicates that these professionals have interest in the developments of information architecture and/or have got related experiences that they consider relevant to the research. The fact that they come from different organisations supports the claim that the views of the participants, even if skewed by their work environment and experience, have less chance to impact the results of the work.

For the design of the evaluation instruments, two evaluation models (Shaw 1999) were considered, the enlightenment one, that had a longer term action agenda and was better suited to policy evaluation and programme development, and the instrumental model. The latter was designed for assessing immediate applications using 'insider' or self-evaluation as an evaluation base, and was being used primarily for project evaluation, programme feasibility study and practitioner evaluation. The evaluation model chosen for this research was the instrumental one, where informed practitioners were asked to evaluate the IA framework and give their insiders' views on the completeness and applicability of the framework.

Shaw's work does not suggest whether the instrumental model is compatible with formative evaluation, i.e. the evaluation *within* the evaluand (Cronbach 1986, p.94), or with summative evaluation, i.e. the evaluation "*between the evaluand and its equivalencies/alternatives*" (Scriven 1986). Based on the definition of evaluation, provided by Lincoln and Guba (1986), the evaluation strategy for this research is formative, as it aims to provide "*descriptive and judgmental information, leading to refinement, improvement, alterations and/or modification In the evaluand*", i.e. the framework.

Following the mainstream view on evaluation (Cook 1985; Patton 1990; Scriven 1997), the evaluation strategy is grounded on a pragmatic postpositivist position based upon methodological pluralism and adopting methodological appropriateness as the primary criterion for judging methodological quality (Patton 1990, p.38-39).

Kerssens-van Drongelen (2001) suggests that most widely used strategies for evaluation are based on experiments and surveys. Research endeavours similar to this study and meta-research articles (Kraemer & Dutton 1991; Galliers 1992; Yin 1994; Kerssens-van Drogelen 2001) identified further evaluation options, including:

- Field experiments
- Computer-based simulation for visualising the framework
- Surveys
- Case studies
- Focus groups
- Delphi study
- Evaluation interviewing.

Similar to the selection of methods for theory building, the multi-method was chosen as the most effective evaluation alternative. The decision was driven by theoretical and practical considerations, including the aforementioned set of criteria (Fig.3.3) and Jarvenpaa's advice (1988) that

> *to truly test the predictive ability of the research results, the studies must also involve a multiplicity of research methodologies in order to avoid biases due to the methods used.*

It identified that, despite their high reliability, field experiments are unrealistic option for this study, due to the demand for unrestricted access over the business network data and other resources. Similarly, simulations, as the closest alternative to experimentation, require substantial investment in terms of time, computing skills and equipment, which determined the low feasibility of this option. Amongst the rest of the available evaluation methods, case studies (Appendix A) proved too difficult to implement due to insufficient experience with IA development and management (The NHS strategy option, Appendix A), or reluctance on behalf of the invited organisations, representing an e-business network case (Research strategy option 2, Appendix B). The remaining options of focus group, Delphi study, focus groups, survey and evaluation interviewing are all based upon the classic substitute to the above three evaluation methods, i.e. a panel of experts in the field, who have the knowledge, interest and experience in the object of the study. This, however, determines the small size of the research population and requires additional attention to the recruitment of the evaluation panel (Section 6.3). Further, when interpreting the results, it has to be recognised that these are based on participant's subjective views on IA, based on current and previous experiences with the building, using and management of I(S)A, rather than the views of the employing organisation. Using inter-company sample, however, is a common feature of studies using Delphi studies and surveys.

Based on the above argumentation, the evaluation of the proposed framework was based upon integration of the results of a Delphi study, an electronic survey and a series of semi-structured interviews, conducted with both academics and practitioners. The traditional form of the focus group method was discarded, due to the requirement of participants being at the same place at the same time, a condition that given the busy working schedule of the experts. The online option of the focus groups was also considered as not feasible due to the complexity of the discussed tool and the limitations of the e-mail communications.

To eliminate any further effect on the collected data in addition to method triangulation, triangulation of participant samples (Denzin 1970) was also employed. Participants were selected through a process of non-probability sampling, which allowed purposive selection, identifying those that would be most knowledgeable and informative about existing relationships.

The selected evaluation approach benefits from high internal validity, but is moderately reliable on external validity. However, given the constituent of the research samples for both the Delphi study and the interviews, it is expected that future studies will confirm the results and would prove the generalizability of the method. Details on the organisation, merits and drawbacks of Delphi studies and surveys are discussed below, as well as some specific issues for using interviews (Cf. Section 3.2.1) for evaluation.

- **Delphi study**

The Delphi study is a method for future predictions (Denzin 1970; Brancheau *et. al.* 1996) based on structured process for collecting and distilling knowledge (Fig.3.5) from a pre-selected group of experts (Linstone 1978; Turoff & Hiltz 1996). It emerged in the 1950s in a project with strategic importance and it could be argued that in comparison with the rest of the set of methods identified earlier, it is still in its development stage.

Delphi methods are most widely used in public sector and for social work, nursing and medical education, but have also been conducted in the area of technological forecasting (Gordon & Helmer 1964 in Ziglio (1996), Brancheau *et al.* 1996). They have had limited use in IS research (e.g. Brancheau *et al.* 1996, Galliers *et al.* 1994, Schmidt *et al.* 2001).

The Delphi method uses a series of questionnaires sent either by mail or via computerised systems and usually consists of two phases:

⇒ an 'exploration phase' (Round1), that aims to fully explore the subject and provide additional information, and

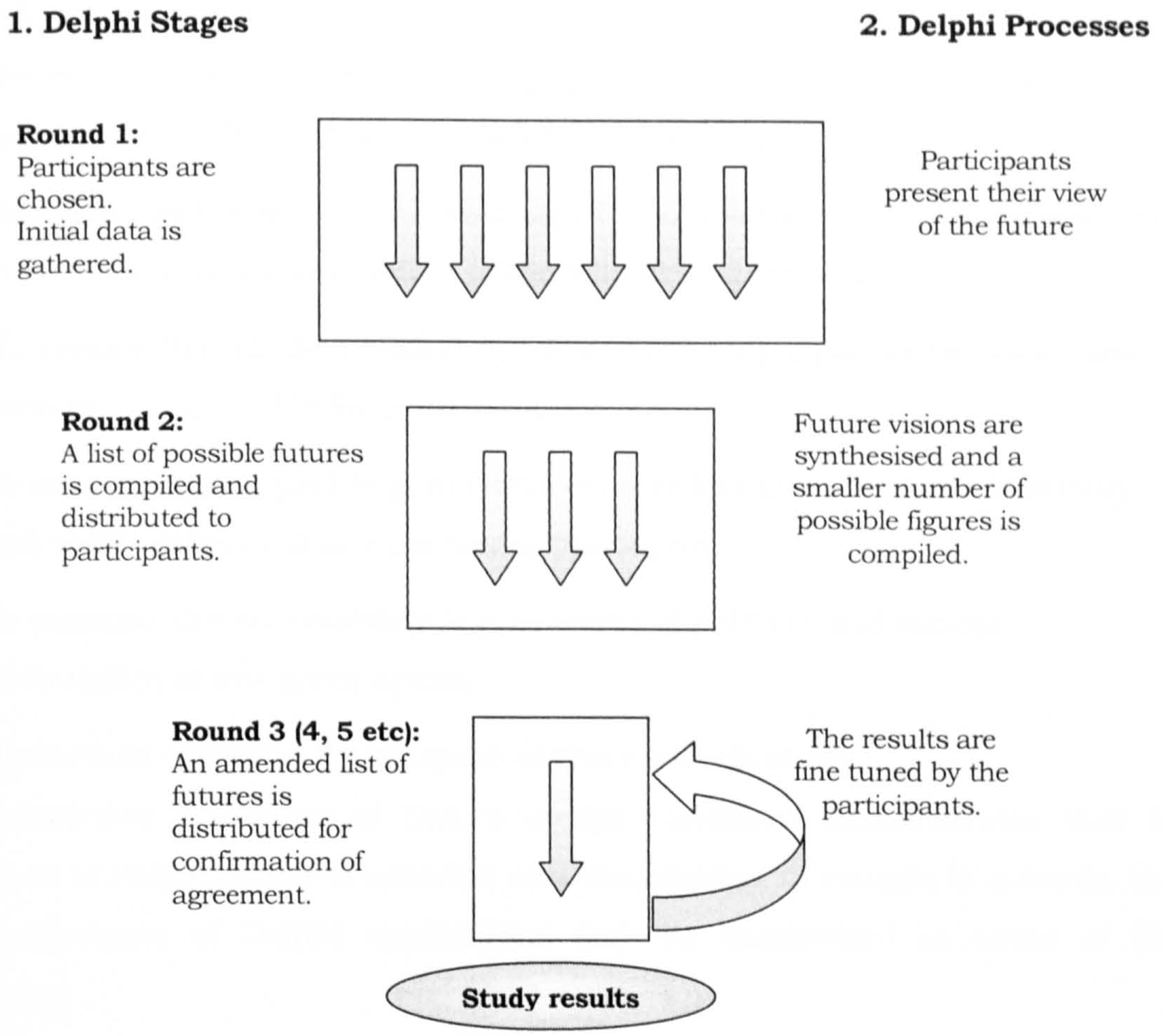

Fig.3.5: The Delphi study: process and stages
(Based on http://www.edn.gu.edu/au/survey/delphi.gif) [12 Sept 1998]

⇒ an 'evaluation' phase (Round2, 3 etc.), that offers the participants to re-evaluate their original answers in the light of controlled opinion feedback on the responses of the whole group, and to refine and delineate their views in a non-threatening environment in the search of the experts' views.

Linstone and Turoff (1975) and Linstone (1978) suggest that Delphi proves particularly useful in the following circumstances:

1. *The problem does not lend itself to precise analytical techniques but can benefit from subjective judgements on a collective basis;*

2. *The individuals who need to interact cannot be brought together in a face-to-face exchange because of time or cost constraints. Further, a conventional conference tend to be dominated by particularly strong personalities or to give rise of an undesirable effect.*

3. *The problem at hand has no monitored history nor adequate information on its present and future development.*

4. *Addressing the problem requires the exploration and assessment of numerous issues connected with various policy options where the need for pooled judgement can be facilitated by judgmental techniques.*

Furthermore, as the above authors suggest, the results of a Delphi exercise can serve any one or any combination of the following purposes:

- To ensure that all the possible options concerning a particular issue have been put on the table for consideration;
- To estimate the impact (e.g. in terms of technical and economic feasibility) and consequences of any particular option; and
- To examine the acceptability (e.g. in terms of political and ethical desirability) of any given option.

The latter best identifies the purpose of this research study.

A preliminary taxonomy of Delphi design variations demonstrates that in addition to subject domain criterion and the number of rounds in a study, the wide spectrum of Delphi applications may be categorised in terms of the following:

- Purpose of the study: building, exploration, testing, evaluation. The method has mainly been used for theory generation, rather than testing and evaluation (Holsapple & Joshi 2002) In IS research, in particular, the publications referring to Delphi study are limited in their discussion of Delphi methodological issues and reflections upon the use of the method itself. It is the purpose of this study to address this gap and provide details of the design and application of the Delphi for empirical evaluation of the proposed framework.

- Participants: This group constitutes a number of perspectives, mainly, constituency of the group, number of participants and expertise on the discussed topic. The first of these refers to whether the group is homogeneous or heterogeneous. The profile of the participants could be defined by age, nationality, knowledge, expertise, qualifications, occupation or position and thus could be used to further differentiate between two applications of the method. Of particular importance to potential users of Delphi is establishing the expertise of the participant (Gordon 1994) that affects the quality of the outcomes. It is, however, recognised that the definition of 'experts' varies according to the context and field of interest in which the Delphi method is applied (Ziglio,1996).

Turoff and Hiltz (1996) suggest that Delphis are commonly allied to groups of size 30 to 100. Ziglio (1996) observes that

> *the literature on the subject suggests that with a homogeneous group of experts good results can be obtained even with small panels of 10-15 individuals. In situations where various reference groups are involved, the size of the sample may be considerably larger.*

Linstone (1978) references a work done by Dalkey, Brown and Cochran (1969) that found that

> *a suitable minimum panel size is seven; accuracy deteriorates rapidly with smaller sizes and improves more slowly with large numbers.*

The constituency of the Delphi group is discussed in Section 6.3.

- Number of rounds: This is an interactive process, which can be repeated as many times as it is considered appropriate. Linstone (1978) argues that stability of the opinion throughout the rounds reflects consensus and suggests that marginal changes of less than 15 per cent suggests concurrence of views, which might be used as a criteria for termination of the study. Errfmeyer *et al* (1986) observed that the number of rounds could vary between two and ten but most commonly restricted to two or three rounds. Gottschalk (2000), however, in his comparison of methodological choices identifies Delphi studies with only one round. This is atypical of the method and the only acceptable explanation could only be that these 1-round studies are continuation studies, i.e. beginning the study from a previously defined list. Even though, it could be argued that a 1-round Delphi study is effectively a survey.

  The decision on the number of rounds for this Delphi study was based upon the examination of the concurrence of views, levels of stability and number of participants.
- Mode: face-to-face discussion or remote access. This classification is linked to the anonymity of the participants. Participation through postal or electronic communications allows ensuring full anonymity of the informants. The postal mode is the one chosen in this study.
- Anonymity: full or partial. This was a key element of the original Delphi process to ensure democratic participation and in this occurrence of the method full anonymity is ensured.

- Media: paper-and-pen based, through telephone/fax, or computerised. The convenience of electronic communication has steered the evolution of the Delphi toward computer-mediated studies. This could foster further developments, including support from multi-media, simulation and modelling tools and altogether boost new research opportunities for the method (Linstone & Turoff, 2002).

Further details on the implementation of the method are provided in Chapter 6.

The Delphi critics raise concerns regarding its value, credibility of the results and usefulness as a tool for inquiry. Ziglio (1996) argues that

> *There is no reason why the Delphi method should be less methodologically robust than techniques such as interviewing, case study analysis or behavioural simulations, which are widely accepted as tools for policy analysis and the generation of ideas and scenarios.*

Further Delphi method has been criticised for not using 'scientific' procedures in terms of sampling and testing of results through conventional experimental control (Sackman 1974). Ziglio's response to this (1996) is that

> *the theoretical assumption of the Delphi method is that informed group judgements, achieved through the methodological procedures associated with the Delphi method are more reliable than individual judgement.*

The mass of literature on the potential and application considerations for Delphi studies built the researcher's confidence in the suitability of this method for evaluating the proposed framework. Furthermore, triangulating the results of the Delphi with these of the e-survey further strengthens the quality of the evaluation results.

- **Surveys**

Surveys are based on a pre-developed set of hypothesis designed either to describe a predefined population and its views/attitudes (descriptive survey), or to analyse the correlation (or lack of correlation) of specific variables in the evaluand (analytical survey) (Hussey & Hussey 1997). The hypothesis could be tested using both qualitative (interview-based) and quantitative (questionnaire-based) approaches.

Surveys are a traditional positivist method that has been used to generate, refine or evaluate theories (Hussey & Hussey 1997, p.59). Studies of research methods (Kraemer & Dutton 1991; Wynekoop & Russo 1997) demonstrate that survey research is the most widely used, and most widely questioned method in the IS field.

For this study the interview-based survey was considered but deemed as not a feasible option due to the large number of interviews that needed to be conducted to induce a new theoretical framework. Furthermore, as the topic is very specific and the population is not concentrated in one area, it could be difficult to secure a large number of participants and conduct interviews with them at a convenient for them time.

Descriptive survey was deemed to be best suited for establishing whether a participant's view of the desirable for dimensions in an IA for e-business. This was administered through a questionnaire designed to test the set of set of current and needed IA components (Section 6.2.3). Open-ended questions were added free the participant from the limitations of a predefined set of answers (in this case IA dimensions). The research sample (Section 6.3) fits the sampling frame and includes IS/IT consultants, project managers, and other IS professionals, as well as academics involved with the subject area. Such a sample is very diverse, but so is the scope of the model. This aligns with the predominant practice in survey research.

The findings of a meta-research on the use of surveys (Kraemer & Dutton 1991, p.15) identified reliability and validity issues pervading the survey research. These include:

- sampling issues - most surveys were based on "purposive, nonprobability samples, often anchored in convenience and accessibility to the researchers."
- low response rates, below 50 percent, and
- designs that are inadequate for generalisation due to some ideal IS population.

The validity of the instrument is high, as it is developed by the researcher and the questions test the components and the perspectives of the developed framework. The feasibility of this method is medium. The questionnaire benefits from a user-friendly design, aimed to ease the apprehension, multiple-choice questions to save time and open-ended questions for additional comments. However, the volume of a questionnaire aiming to build a complex multi-dimensional framework could dishearten many of the respondents to invest the needed time and effort.

The applicability of the survey as an evaluation tool is as popular as its use as a theory building tool. The synopsis earlier was that the survey form, best to use for evaluation, is the analytical survey, executed via both qualitative and quantitative approaches.

In contrast with previous studies, the considerations and the experience gained through using the method in the theory building stage, e.g. low return rate, some misunderstandings of terms and the complexity of the framework, marked this choice as a less desirable for evaluation. The concern is also that participants might be exposed to a terminology, different to the one that they are using in their day-to-day business activities, which could affect negatively the return rate.

A delivery form of the survey that was potentially advantageous is the electronic survey, i.e. a questionnaire-based survey delivered via e-mail or posted on a web site. This option was very appealing due to it low cost, fast delivery and capabilities to support delivery reporting facilities. Although it is believed that although on-line communications also have a both positive effect on the implementation this method, they could also impact negatively on the constituent of the research sample, user acceptability and return rate. Although no research was done to identify any works comparing the success of electronic and traditional surveys, it is believed that the advantages of electronic form of survey outweigh its drawbacks and that if complemented by other evaluation methods, electronic survey could be one of the methods that meet all the method evaluation criteria specified earlier. As identified later, it was employed in the evaluation of the components of the framework.

- **Evaluation interviewing**

In its original outline the evaluation interviewing is a type of interview (Cf. Section 3.1.1.1) intended to be used only for generating ideas and building theories, whilst the testing would have been accomplished using more formal means (Vogel & Wetherbe 1984). Shaw (1999, p.147) argues that

> *interviewing approaches that have been developed with methodological antennae attuned for evaluative applications repay efforts at translation.*

Furthermore, in Bloor's words (1997, p.49) *"validation exercises are not tests, but opportunities for reflexive elaboration."*

The reliability of the individual interview is low, due to the subjective nature of the process. In search of a cumulative result, the same criteria for the selection of "appropriate experts" was applied, as in the case of Delphi studies.

In agreement with the philosophical stance and to ensure that the whole of the framework is being scrutinised and no additional perspective and components are missed out, semi-structured interviews are employed.

3.2. RESEARCH INSTRUMENTS

The set of research instruments described in this section includes tools for data collection, data analysis and data visualization that have been considered and employed in this research. Some of the issues considered when developing and using these tools are discussed below. Reflections on the efficacy are discussed in Chapter 6.

3.2.1. TOOLS FOR DATA COLLECTION

The set of data collection instruments in this study includes questionnaires and interview templates. In planning and implementing these the ethical principles for conducting research with human participants developed by the British Psychological Society (2000) were adopted and followed.

3.2.1.1. Paper-based and electronic questionnaires

Questionnaire design issues are widely discussed and well documented in both general research texts (Robson 2002; Sanders et al 2000; Sekaran 2003) and in references focusing explicitly on survey design (Fowler 1995; Oppenheim 2000; Fink 2003). These were frequently consulted when designing the Delphi questionnaires and the questionnaire used in the electronic survey.

Improving the low reliability of the survey method through successful questionnaire design was the main design goal in the primary research. Working definitions of the core terms were provided with the intention to bridge the diverse understandings of the core terms. However, the researcher is aware that even with such measures in place, there is the threat of misconception. Moreover, the inclusion of such a dictionary turns the questionnaire into a substantial piece of paperwork, the sheer volume of which could discourage the respondent from any attempt to fill in the questionnaire.

Designing the electronic survey proved to present a greater challenge to the researcher, as design issues related to the technical details are not sufficiently documented in the literature (Dommeyer & Moriarty 2000). For the administering of the electronic survey three alternatives were considered:

Alternative 1, the questionnaire to be embedded into the body of the e-mail message, was discarded as depends on the e-mail browser being used and on the size of the window for the message. When settings different from the ones used when designing the questionnaire, the text might appear scrambled on the recipient's screen. As the initial appeal of the design is of extreme importance for being able to seize addressee's attention and positively influence their decision on taking part in the survey, this option was not considered as appropriate.

Alternative 2, an attachment in Rich Text Format (RTF), requires that the addressee edits the file, saves it under a different name and then sends the new version to the researcher either by e-mail, post or fax. It was considered that many people would either have problems with getting this process right, or knowing that this could take some time, they would ignore the questionnaire. The considerations of respondents' expertise and time, and the usability of the returned samples, determined the elimination of this option.

Alternative 3, an HTML form was the option chosen mostly for its effectiveness in terms of design and simplicity of use. This included the ability to use images and hyperlinks within the text, as well as form buttons to indicate choice. Furthermore, the convenience for the participant to send the reply by simply pressing the 'Send' button the form was considered as an attractive feature, too. In addition, to enable the readability of the respondents' e-mails, a form-handling application was used.

The downside of using a ready developed form-handler is that the researcher is not aware of who completed the form if the respondent did not provide their contact details. This eliminates the option of sending a second invitation to those of the target sample, who have not completed the questionnaire and prevents any follow-up communication. On the positive side, a form handler guarantees anonymity for those of the respondents that would prefer to stay unknown.

The form was hosted on the Bournemouth University Business School web site http://business.bmth.ac.uk/mbobeva/Survey_on_Information_Architecture.htm (Section 6.2.2). Due to time limitations such a dedicated web site providing more information on the research, such as detailed explanations of the aims, methods and information on the progress of the stud, was not developed.

3.2.1.2. Interviews

In an endeavour to reduce the limitations of the interview-based methods, the interviews were planned to be conducted in a face-to-face manner with cross-questioning, where possible, which enabled the researcher to resolve any ambiguities that had arisen and to benefit from the advantages of this form, e.g. visual aids to explain better the complex nature of the model and additional information on attitude gained from interviewee's body language. Telephone interview or video conferencing were also considered as possible solutions, but with a lesser priority, due to the constraints imposed by limiting the format of the information exchanged with the evaluator. The videoconferencing option presents even further difficulties related to the availability of a videoconferencing hardware, the cost of the link, experience with the tool, et al.

The interviews were recorded and transcribed after the event to ensure that all comments on the merits or the drawbacks of the tool are available to the researcher at the time of the analysis. This helped to ensure the credibility of the interview process, but as Shaw (1999, p.185) states "*if the purpose of the evaluation goes beyond seeking an understanding of participants' perspectives, then credibility is an inappropriate surrogate for validity.*" The validity of the findings in cases like this will rest with the comprehensiveness and ethics of the analysis.

3.2.2. DATA ANALYSIS TECHNIQUES

The selected research design is grounded on two types of data: discrete quantifiable data collected from the Delphi study and the electronic survey, and qualitative data, reflecting the comments of the participants in all of the three evaluation tests.

For analysing the outcomes of the Delphi study and the electronic survey statistical analytical techniques were applied. Amongst these are tests on central tendencies, dispersion and correlation between variables and between the responses of the Delphi study sample and those of the e-survey participants.

In agreement with Miles & Huberman (1994) the analysis of qualitative data here was based on generating categories and organising the data around them. They are used to sort the data and help identifying patterns of agreement or disagreement with a particular aspect of the tested object. The main categories in this study were predefined by the dimensions of the proposed framework. The analysis of empirical examples quoted by the participants to explain the need, scope and variance of a specific component, suggested some changes to the conceptual framework, as a few new categories emerged from the data. Such an approach defines the analytical strategy in this study as deductively based (Yin 1994) and employing two analytical procedures, i.e. the principal pattern matching is supported by the explanation building, should the interview data permits.

Research was also conducted on the appropriate technical support for data analysis. Generally, computer-aided methods for data analysis are considered to be a very useful and efficient tool for adding validity and trustworthiness to the research (Kelle & Laurie 1995). Their potential to enhance the creativity of the researcher is also recognised (Richards & Richards 1991, 1994 in Kelle (1995)). Conversely, there is the threat that the researcher is alienated from the data by a machine (Kelle 1995). With this in mind, prior to determining the use of any computer-based data analysis tools for analysing the results of the study, first-hand knowledge was acquired of Microsoft Excel and SPSS as tools for quantitative data analysis, and NVivo and WinMax, as qualitative data analysis tools. Concurrently, issues related to the use of these and similar computer-based applications were researched. Based on the primary experience with piloting the use of qualitative data analysis tools, results of the research on the features of the tools and the nature of the interviews, i.e. evaluation-focused, semi-structured, based on a predefined detailed template, initially it was perceived that only tools for quantitative data analysis should be employed and SPSS was considered as better suited for the needs of this study. The relatively small number of interviews further lead the author believe that the analysis could be performed without the need of employing a Qualitative Data Analysis (QDA) tool. However, a factor that was not taken into account was number of variables as a factor of the complexity of the theoretical framework. The attempt to analyse the transcripts of the first interview using aids as highlighters and Post-It notes, confirmed that the management of this laborious task would be best achieved with the help of a QDA tool.

The detailed description and application of the data analysis tools and techniques is described in Section 6.4.

3.2.3. TOOLS FOR VISUALISATION OF THE FRAMEWORK

> *Imagine having in front of you a beautiful Caravaggio painting: you can look at it and admire its marvellous details and the way colours, shades and lights melt on the canvas. But think now if you could not see the actual masterpiece but had to be content by reading about it and especially by reading about how many colours Caravaggio used, the size of each detail and the intensity on a colour scale of each shade....*
>
> Baraldi and Bocconcelli (2001)

Data visualisation methods allow to communicate complex ideas more efficiently and effectively and to reduce the impact of subjective interpretation. Amongst the most widely used visualisation aids are diagrams, conceptual models (Card *et al.* 1999), multi-media hyperlinked documents/pages and hypercubes (Giovinazzo 2000). The decision of which of these, if any, to use was determined by the following considerations:

- Conceptual data models stem from the view of relational database tables as sets of multidimensional data where the number of attributes corresponds to the number of dimensions. However, as recognised by Card *et al.* 1999:

  in such a view, it is often unclear which dimensions are independent and which are dependent. In most cases, only a limited number of the dimensions are of interest in a certain context.

- Venn diagrams appeal in their ability to intersect geometric shapes, but are cumbersome to use to represent all the possible relationships among more than three sets (Soerri, in Card *et al.* 1999).

- Hypercubes (Fig.3.6), i.e. data cubes of data cubes are primarily used to represent multi-dimensional objects in object-oriented datawarehouse design.

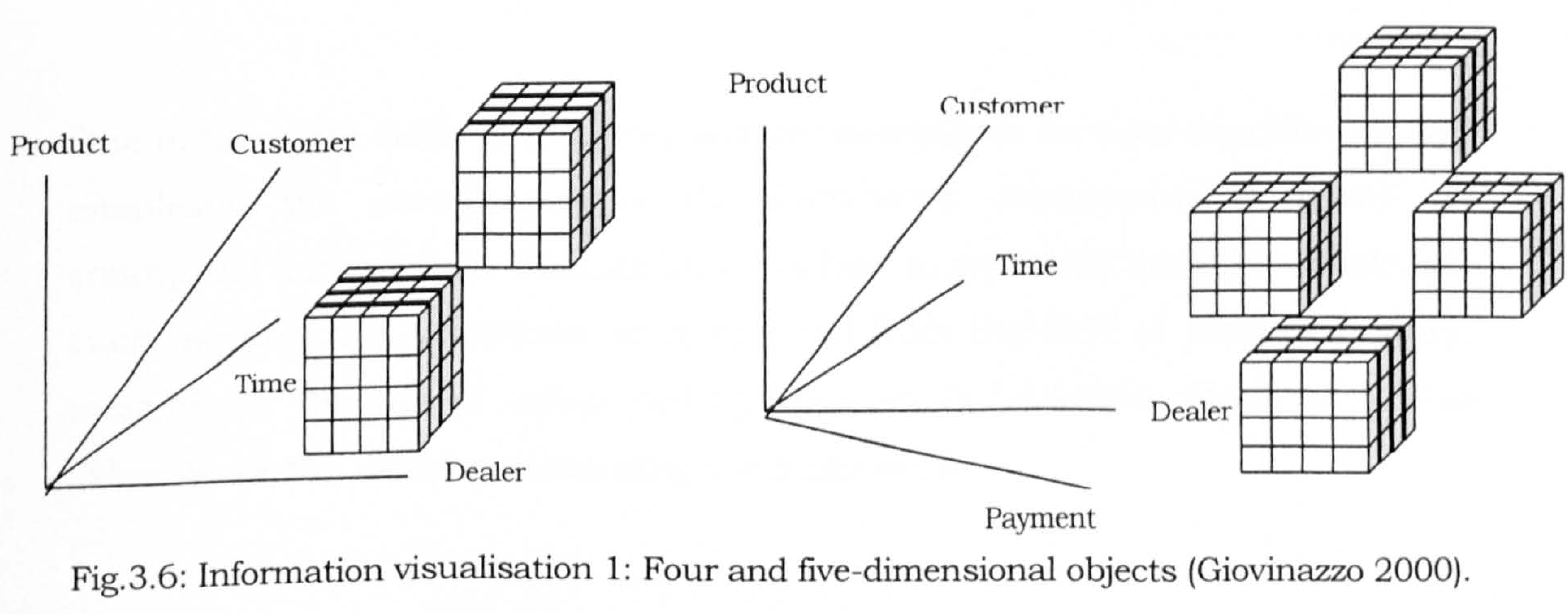

Fig.3.6: Information visualisation 1: Four and five-dimensional objects (Giovinazzo 2000).

Giovinazzo (2000) recognises that

> *Although hypercubes could be used [to present four- and five-dimensional objects in three dimensions], future presentations will be limited to three dimensions, data cubes.*

- Multi-media software applications such as the one used for the Kartoo search engine (http://www.kartoo.com) (Fig.3.7), are very appropriate for their ability to represent information objects and the relationships between them in an easy to understand way through hyper-links and colour-coding. However, these require advanced programming skills and considerable time for developing a prototype or simulation of the framework.

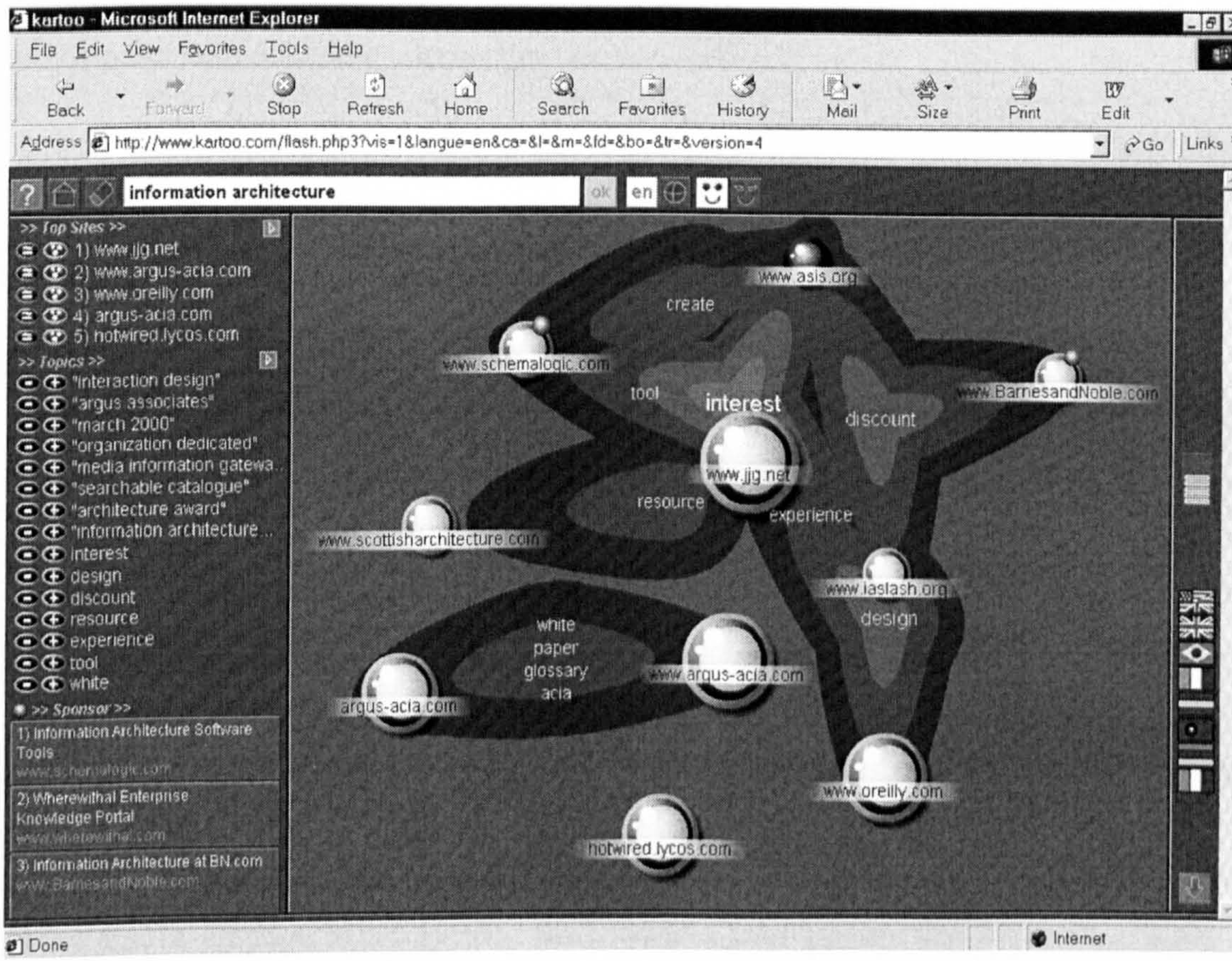

Fig.3.7: Information visualisation 2: The Kartoo search engine (www.kartoo.com)

Due to time and skills limitations, and considerations for user-friendliness and simplicity, the presentation of the framework components is based on conceptual data models. Further ideas on how to represent complex constructs such as molecule structures, were inspired from the field of stereochemistry. Insights on the use of colour coding (Herman & Levkowitz 1992) were also valuable for the work on visualising the framework.

3.3. PHILOSOPHICAL PARADIGMS AND THE RESEARCH TENETS

Denzin and Lincoln (2000) have argued that research is a human endeavour to perform disciplined inquiry and as such, it is founded on the beliefs and assumptions of the researcher. The researcher's assumptions, whether implicit or explicit, influence the approach, design and implementation of the research study. To enhance understanding of the paradigm underpinning this study and to strengthen reader's ability to comprehend the rationale of the chosen research design, this section continues the review of the fundamentals of the postpositivist paradigm[4] started in Section 1.4.

3.3.1. DEFINING THE TERM 'PARADIGM'

Research into key philosophical concepts identified that the term paradigm has been interpreted differently by different researchers. Kuhn (1970) defines it as

> *"universally recognised scientific achievements that for a time provide model problems and solutions to a community of practitioners."*

Another definition, enabling a broader understanding of the term, determines a paradigm as a "*commonality of perspectives which binds the work of a group of theorists together*" (Burrell & Morgan 1979). In this paper, in concordance with organisational theorists (Gioia & Pitre 1990; Goles & Hirschheim 2000) the latter definition is used. A paradigm here is defined as a way of thinking that reflects fundamental beliefs, value judgements, perspectives, norms, standards, assumptions, etc., about the world and guides us in our endeavours. The research paradigm (as opposed to other paradigms, e.g. judgmental and religious) is such a belief system that reflects and guides the researcher's view on the nature of reality (ontology), the nature of the knowledge about this reality (epistemology), the role of the researcher's values (axiology), and the ways this reality should be studied (methodology) (Guba 1990, p.18). The particular paradigm adopted for certain research is partly determined by the nature of the research problem and the research objectives (Gioia & Pitre 1990), but is also shaped by the researcher's philosophical assumptions.

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[4] In this study the terms 'postpositivist paradigm' and 'postpositivism' are used interchangeably.

3.3.2. THE POSTPOSITIVIST RESEARCH PARADIGM

> *How many such 'basic sets of beliefs are there? ....*
> *Perhaps there two – qualitative and quantitative, or positivist and postpositivist, or realist and idealist? Maybe there are three – realist, hermeneutic and critical theory? But possibly there are four – positivist, postpositivist, constructivist and critical theory?*
>
> Shaw (1999)

The fundamentals of the postpositivism are best discussed in relation to the rest of the research paradigms. However, whilst there is a consensus amongst social and IS researchers as to what the basic pillars of a research paradigm are, there is no unanimous understanding on what the term stands for, what paradigms there are, nor how these should be classified. Research in philosophical schools has identified that not all paradigm taxonomies recognise postpositivism (Table 3.2). For example, some researchers use postpositivism as

Author	Typology
Burrell and Morgan (1979)	functionalist, interpretivist, radical structuralist, and radical humanist
Walsham (1995)	positivist vs. interpretivist
Guba (1990) and Creswell (1998)	quantitative vs. qualitative
Remenyi et al. (1998)	positivism vs. phenomenology

Table 3.2: Paradigm typologies that do not incorporate postpositivism.

a collective term for paradigms that radically reject positivist tenets (Hirschheim, 1992), others argue that it stands for a discrete paradigm that similarly to other non-positivist paradigms such as constructivist and critical theory paradigms, tries to address the deficiencies of positivist rigid views through consideration of individuals views.

As already discussed in Section 1.4 postpositivism shares with positivism the same ontological and epistemological ones (Table 3.3) (Lincoln & Guba 1985; Guba 1990), but differs on the methodological stance. The postpositivist stand is interventionist and addresses "*the imbalance created by excessive emphasis on context-stripping controls*" (Guba 1990, p.22) and argues for carrying out the inquiry in more natural settings, using more qualitative approaches (Galliers & Land 1988). For this research, this meant the exclusion of methods tightly coupled with the traditional positivistic approach, such as laboratory experiments and mathematical modelling (Jarvenpaa 1988). Further, this study was based on the premise that, when organisations are subject to the research inquiry, it is not feasible to create the sanitised environment needed when conducting experiments. This is particularly true for business networks, where the dynamic nature of the formation could escalate further the imbalances between precision and richness, and rigour and relevance, as recognised by Guba (1990, p.21-22).

Further distinctive feature of postpositivism is its support for 'methodological pluralism'. This is in agreement with the author's beliefs and had inspired a review of the full spectrum of research methods, including methods that could even be associated with other paradigms, to establish the most appropriate and feasible ones for this study. A compelling justification of such multi-method cross-paradigm approach is Gioia's & Pitre's argument that if paradigms are viewed as *"fundamentally incommensurable and noncomparable"*, the researcher should stay focused on one perspective and disregard any disparate views (Gioia & Pitre 1990).

Level \ **Paradigm**	**Positivist**	**Postpositivist**	**Critical theory**	**Constructivist**
Ontology	Realist	Realist	Realist	Relativist
Epistemology	Dualist, objectivist	Dualist, objectivist	Interactive, subjectivist	Interactive, subjectivist
Methodology	Experimental / manipulative	Interventionist	Participative	Hermeneutic, dialectic

Table 3.3: Comparison between research paradigms (Guba 1990).

A number of IS and organisational theory authors (Lee 1991; Mingers 1997; Jones, M. 1999; Lewis & Grimes 1999) have also argued that a multiparadigm perspective is possible, and probably desirable, as it fosters greater insight and creativity. However,

> *any metaparadigm perspective is nonetheless rooted in a specific paradigm, depending on the ground assumptions of the observer.*
>
> (Gioia & Pitre 1990).

As Lewis and Grimes (1999) point out in their examination of multiparadigm reviews, research and theory building,

> *multiparadigm approaches aid exploration of particularly complex and paradoxical phenomena by helping theorists employ disparate theoretical perspectives.*

Mingers (2001) further argues for the desirability of multi-method research for information systems. He suggests that the term 'methodological pluralism' could be conceptualised in three different ways:

- Loose pluralism – that asserts that
  the IS discipline as a whole should support and encourage a variety of research paradigms and methods within it, but should not specify how and when they be used.
- Complementarism – that views different paradigms as
  internally consistent and based on different assumptions about their context of use, such that each paradigm would be seen as more or less appropriate for a particular research situation..
- Strong pluralism – that takes the stand that
  all research situations are seen as inherently complex and multidimensional, and would thus benefit from a range of methods. (Mingers 2001)

This research adheres to this strong pluralistic methodological view and considers different types of activities within different stages of the research process to provide a better understanding of the multidimensionality of the IA framework. It attempts to sustain single-paradigm ontological and epistemological perspectives, whilst employing a cross-paradigm methodological perspective (Cf. Section 3.1.2). This is a difficult task, especially as in search of inspiration for how to accommodate softer issues in a generic architectural framework, the research is referring to (Soft) Systems models and theories. This could create the impression that the researcher switches epistemologies and takes a subjectivist stand. To ensure that the realist and objectivist views of postpositivism are upheld throughout the study, the author draws the following axioms:

(1) A generic framework for Information Architecture will serve any organisation regardless of its characteristics, business, assets and behaviour.

(2) To accommodate any individualities, the framework should have component(s) that accommodate softer information. The content of these components could be very subjective and reflect individual specifics, even to the extent that it could result in several versions of IA existing. However, this would not require changes in the structure providing for this content, i.e. the framework. It is the uniform structure that conforms to Axiom (1) and would allow for resolving any discrepancies in the individual perceptions in search of a shared view.

The value of having these statements in place is reflected upon in Chapter 8.

3.3.3. ONTOLOGICAL, EPISTEMOLOGICAL, AXIOLOGICAL AND METHODOLOGICAL TENETS OF THE RESEARCH

The ontological, epistemological, axiological and methodological assumptions that determine the methodological framework used here are explained below.

The ontological assumptions address the question on the nature of reality, or the nature of the 'knowable'. The author's ontological beliefs are *realist* in nature, sustaining that 'reality is not a subjective construction of the mind'. Although it exists independently of the individual and is driven by laws that are time and context-free generalisations, it is recognised that reality can never be fully comprehended. In the context of this research, this means that a generic Information Architecture for e-business alliances will be sought to provide extension of existing work, but when drawing out its applications, it should provide for flexibility to reflect the specifics of the individual context.

At epistemological level, there are two typologies, each of which presents a dichotomy of views:

- Dualist/objectivist vs. interactive/subjectivist: The *dualist/objectivist* stand is that the researcher remains detached from the research situation and is in position to neutrally observe a report on the reality, i.e. without the results of his/her work being biased by individual's values. The *interactive/subjectivist* view argues that research findings emerge from the interaction between researcher and research situation. It further sustains that the values and beliefs of the researcher are shaping the findings of the research.
- Insider vs. outsider, where the insider's view is considered to be "*the best judge of adequacy of research*" (Fitzgerald & Howcroft 1998). The merits of the outsiders view, on the other hand, lie in its objectivity.

The epistemological stand utilised here is that, to construct a plausible extension of the existing frameworks for information architecture, the researcher will have to take an outsider's stand. This is to ensure that the work is context-free, whilst still taking into consideration the criticism of studies similar in design. Although objectivity is the desired ideal, in developing and evaluating the theoretical framework, the researcher interacts with the participants and inevitably applies her cognitive filter. Nonetheless, she recognises this threat and has strived to sustain a neutral stand and to acknowledge any personal predispositions so that readers are aware of these if using this study in their own research endeavour.

The axiological tenets concern the bias that researcher's values, i.e. attitudes, likes, dislikes, and beliefs, introduce to the findings. They define the value profile of a research study as independent, i.e. value-free, or affected by the value system of the actors, i.e. value-laden (Creswell 1998). This study aspires to be recognised as value-free research, i.e. to be rigorous and exhibit internal validity, built into the research design through tight experimental control and quantitative techniques (Fitzgeral & Howcroft 1998a). Value-laden research has better relevance to practice, as it is externally valid.

The internal and external validity and reliability of the developed conceptual and theoretical IA framework are being verified through empirical work. Based on the postpositivist assumptions that the nature of the information architecture in organisations is value-free, a deductive approach is determined to be appropriate for theory testing. Both organisational (nomothetic) and individual-centred (social-actor/ideographic) perspectives are explored in the search of general IA components and relationships between them. This part of the study takes place in settings that are more natural for the subjects, rather than in a laboratory. Guba (1990) recognises that *"locality and specificity are incommensurable with generalizability"*. To address this imbalance, the architectural framework resulting from this study was reviewed to reflect on the evaluation results. As one of the objectives of the research is to evaluate the proposed theoretical tool, the research could be characterised as diagnostic and confirmatory. This implies that although efforts were made to control its internal validity and to provide a realistic estimate of its external validity, the judgement of its generalizability would not be conclusive. In a different organisational context with a set of evaluators with different value systems, the results could prove different.

Competing dichotomies at a different level of abstraction have been identified for the **methodological assumptions**, also. The works done at methodological level by Fitzgerald and Howcroft (1998a), Creswell (1998), Saunders et al (2000) and Hussey and Hussey (1997) were reviewed, and an integrated taxonomy of abstractions for the methodological assumptions is suggested (Table 3.4). The proposed levels of abstraction include Purpose, Logic, Data, Environment, Time horizon, Granularity, Context, Relationships, Flexibility, Outcome and Reliability. The different levels of abstraction are tightly integrated with the research objectives and each of them presents a decision point in the design of the research process. It is sustaining this characterisation of the methodological structure that helps the researcher to define thoroughly the methodological profile of the study, addressing one abstraction at a time.

However, in cases like this where there is more than one strategy employed, the analysis of the paradigm tenets needs to accommodate any methodological differences. Here the existence of two research strategies required two separate Methodology sections highlighting the specifics of each of the research designs (See Table 3.4).

Probert (1997, p.44) argues that in cases that contain " *'intertwinings' between technical and social aspects*", it is appropriate to use multiple methods and diverse sources of data, theories and appraisal. As the framework for information architecture for e-business systems is a true example of such a case, where possible, triangulation of methods is sought in both the theory building and theory evaluation studies. Qualitative approaches complement quantitative ones in an endeavour to extend the precision and the richness of the tool. Computer assisted methods of analysis of the qualitative and quantitative results were also employed.

Based on Guba (1990, p.20) and Denzin and Lincoln (2000, p.9) it could be argued that the philosophical pillars and the objective of the research, namely, the building and evaluation of a framework for information architecture as a tool for planning, auditing and controlling the information assets within a business network, position this study firmly in the postpositivist school of thought. The fit of this research to the postpositivist paradigm has been further confirmed by a review of work on research philosophy both within the IS research domain (Butler 1998; Cash 1989; Fitzgerald & Howcroft 1998a; Gable 1994; Galliers 1992; Kraemer & Dutton 1991, *et. al.*), and outside it, within organisation theory research (Cassell & Symon 1994, Hussey & Hussey 1997; King, N. 1994; Staw 1990, *et. al.*) and social sciences research (Denzin & Lincoln 1998; Morse 1994; Patton 1982, 1987, 1990; Silverman 1998, 2000; Stake 1995 *et. al.*).

Paradigm level	Key questions and their options		The assumptions in this study
Ontology	What is the nature of reality? (Realist vs. relativist)		Critical realist - Reality is objective and singular, but can never be fully appreciated. The driving forces are natural laws that could be only incompletely understood.
Epistemology	What is the relationship of the researcher to that researched? (Objectivist vs. subjectivist; Interactive/subjectivist vs. dualist/objectivist ; Outsider vs. Insider)		Modified objectivist - Objectivity is the ideal, but it could only be approximated.
Axiology	What is the role of values? (Value-free and unbiased (internal validity) or Value-laden and biased (high external validity)		The researcher acknowledges her individual set of values and tries to remain as unbiased as possible.
Rhetorics	What is the language of research? (Formal presentation, based on a set definitions; Impersonal voice)		Formal presentation, based on a set definitions; Impersonal voice.
Methodology **Selected methods:** (a) for theory building • Critical review • Interviews • Subjective argumentation	What is the process of research ?	**Level of abstraction**	**Theory Building**
		Purpose	Predictive
		Logic	Inductive for building the framework;
		Data	Combined: Quantitative and qualitative;
		Environment	Natural settings, but still controlled environment
		Granularity	Nomothetic
		Context	Context-free
		Relationships	Mutual simultaneous shaping of factors
		Time horizon	Cross-sectional
		Flexibility	Static design –categories isolated before studies
		Outcome	Basic research
		Reliability	Accurate and reliable through verification
(b) for theory evaluation • Delphi study • E-survey • Interviews		**Level of abstraction**	**Theory Evaluation**
		Purpose	Exploratory
		Logic	Deductive for the evaluation of the framework
		Data	Combined: Quantitative and qualitative;
		Environment	Natural settings
		Granularity	Nomothetic
		Context	Context-free
		Relationships	Mutual simultaneous shaping of factors
		Time horizon	Cross-sectional
		Flexibility	Dynamic redesign
		Outcome	Basic research
		Reliability	Accurate and reliable through verification

Table 3. 4: The key paradigm tenets and their values in this research
Based on Fitzgerald and Howcroft (1998a), Creswell (1998), Hussey & Hussey (1997) and Saunders et al (2000)

3.4. QUALITY CRITERIA

Positivist researchers adhere to the basic set of quality criteria that is based on the four tests of construct validity, internal and external validity and reliability (Yin 1989, 1994; Lee 1999).

As far as non-positivist studies are concerned, there are diverse views on what quality criteria should be employed, as the positivist tests have different philosophical foundations (Cf. Section 3.1)

Lincoln & Guba (1985, pp.289) and Stake (1988) put forward a set of non-positivist analogues to the positivist tests, collectively referred to as trustworthiness analogies. These are the criteria of confirmability, credibility, transferability, and dependability that correspond to the positivist tests of construct validity, internal validity, external validity and reliability, respectively.

Shaw (1999) designed another set of criteria for naturalist non-positivist studies, based on the criteria of truth, applicability, consistency and neutrality. Although Shaw's set of quality criteria is not applicable to postpositivist studies as this one, the summary of (Table 3.5) is a useful illustration of how the above three sets of quality criteria relate to each other.

Table 3.5: Naturalistic analogue to conventional validity criteria (Shaw 1999, p.67)

Values	Conventional criteria	Problem countered thereby	Achieved by	Trustworthiness analogues
Truth	Internal validity	Confounding	Control, randomization	Credibility
Applicability	External validity; generalization	Atypicality	Probability sampling	Transferability
Consistency	Reliability; replicability	Instability	Replication	Dependability
Neutrality	Objectivity	Bias	Insulation of researcher	Confirmability

Credibility – prolonged engagement, persistent observation, triangulation of different kinds, and informant checks

Transferability - achieve plausibility through the evidence of narrative about the context

Dependability could be deduced by external audit of the process

External audit of the product will facilitate the deduction of confirmability.

The correspondence of these positivist and trustworthiness frameworks for research quality assessment is discussed below with the view of their suitability for post-positivist studies. A summary of these definitions is presented in Table 3.6.

This combined set of quality criteria is applied in the final chapter of the work when reflecting on the quality of the study.

Positivist Assessment (Quality Criteria)	Non-positivist Assessment (Trustworthiness Criteria)
Construct validity (objectivity): Establishing correct operational measures for the concepts being studied (Yin 1994). The construct has to be meaningful in thepretical sense annd the instrument measuring it has to be adequate.	**Confirmability:** guaranteeing the quality of the research data. It is established by an audit trail that should include the raw data gathered, data reduction and analysis products, data reconstruction and synthesis products, process notes, materials relating to intentions and dispositions, and instrument development information. **(data trail)**
Internal validity: establishing a causal relationship whereby certain conditions are shown to lead to other conditions. (Yin 1994). Each examined condition is translated into a research variable. This criteria is appropriate for for explanatory and causal studies only, but not for descriptive and exploratory studies.	**Credibility:** producing research results that reflect the viewpoints of those, whose views are sought, i.e. the research participants. Confidence in the findings is improved as multiple and different sources of evidence suggest similar results. **(informants)**
External validity: confirming the domain to which a study's findings can be generalised (Yin 1994, p.33). This could be refer to types of persons, settings and times (Cook & Campbell 1979).	**Transferability:** Establishing the similarity between ideographic (local, time and context bound) paramenters of the sending and receiving contexts. Proving the transferability is responsibility of the person seeking the application of statements to other contexts, rather than the original researcher. The author must provide sufficient descriptive data to make this possible.**(literature)**
Reliability: demonstrating that the study has generated accurate and precise results that can be repeated with the same results (Yin 1994, p.33). Other authors refer to this measure as accuracy, dependability, consistency and stability. (Bacharach 1989; Mitchell 1996)	**Dependability:** providing the opportunity for readers to audit (and to judge the quality of) the process of research, and the product of that process - the research data. Non-positivists recognise that domains of study are always and ever changing and that precise replication of any study 's results is highly improbable. **(process trail)**

Table 3.6: Assessing the quality of research - positivist and non-positivist tests.

Confirmability is the non-positivist analogue for **objectivity**. Although the epistemological beliefs of post-positivists sustain the philosophy that objectivity could only be approximated, it is argued that operational measures should be independent of the specific subjective context. To confirm that data collection methods have been reliable and valid, an audit trail of the process of the research is provided (cf. Chapter 6).

Internal validity could be defined as the extent to which variations in the dependent variable can be attributed to a controlled variation in an independent variable (Cook & Campbell 1979, p. 37). As the objective of this study is not to establish the existence (or non-existence) of relationships between research variables, but to prove or disprove the need of certain components of information architecture, the measure of internal validity here is applicable only to the design of the research instruments. The documentation of the research instruments and the systematic development and application of the research design is provided as an evidence for the internal validity of the research.

External validity refers to the ability to replicate results of one study into another study using different sample of the same population. On the grounds of their ontological beliefs, rather than discussing the extent to which the result of this study are generalisable, interpretivists assess **transferability** of the outcome, i.e. the applicability of the results in another context, which is considered as better suited for a post-positivistic research. Lincoln and Guba (1985, p.316) state that

> *Whether they [the working hypotheses] hold in some other context, or even in the same context at some other time, is an empirical issue, the resolution depends upon the degree of similarity between sending and receiving (or earlier or later) contexts. Thus, the naturalists cannot specify the external validity of an inquiry; he or she can only provide the thick description necessary to enable someone interested in making a decision to reach a conclusion about whether transfer can be considered as a possibility.*

The last of the positivist measures on quality of the research process and outcome is **reliability**, i.e. the extent to which study results are accurate, consistent and replicable. Non-positivist analogue of this measure is **dependability**, i.e. the dependence of the study results on the study organisation. No studies in a business environment could be a complete replica of a previous study due to the ever-changing business environment that impacts the behaviour of business components, and the reliance on the human element as a transmitter of views. However, it is believed that, if sound sampling methods are applied, the results of the research should be considered as reliable. Lincoln and Guba (1985) outline several routes to dependability, the most common of which is triangulation. This includes triangulation of both methods and samples. To enhance the confidence in the findings IS professionals from both industry and academia expressed their views on the hypotheses reflecting the framework.

This research being a postpositivist one, while sharing some philosophical aspects with positivism, also recognises that organisations are systems with their specific behaviour and could not be studied with pure scientific methods. Due to this cross-paradigm nature of the study, the tests employed to evaluate the quality of this work will be an integrating the positivist and non-positivist frameworks discussed above. The researcher is aware of and adheres to Kelle's and Laurie's (1995) warning on the danger of simply borrowing validity concepts from quantitative methodology.

Furthermore, when designing specific aspects of the research study, e.g. theory evaluation questionnaire design, sampling, et al., publications exploring quality issues related to the respective aspect, will be consulted (Bacharach 1989; Mitchell 1996; Fink 1998). Measures to address threats to reliability related to the human components in the research, i.e. participant and observer errors and biases (Robson 2002), are also going to be built into the designs.

The application of this quality framework in the case of this research is discussed in Section 6.4.

3.5. RESEARCH DESIGN AND IMPLEMENTATION: SUMMARY

The chapter reviewed the methodological and philosophical tenets of this research, deliberating on alternatives and justifying the choices made here. A summary of the methods employed for the accomplishment of each of the research objectives is provided in Table 3.7

The rationale for defining this work as postpositivist is also included and best illustrated though the specifics of the paradigm levels of the study (Table 3.4).

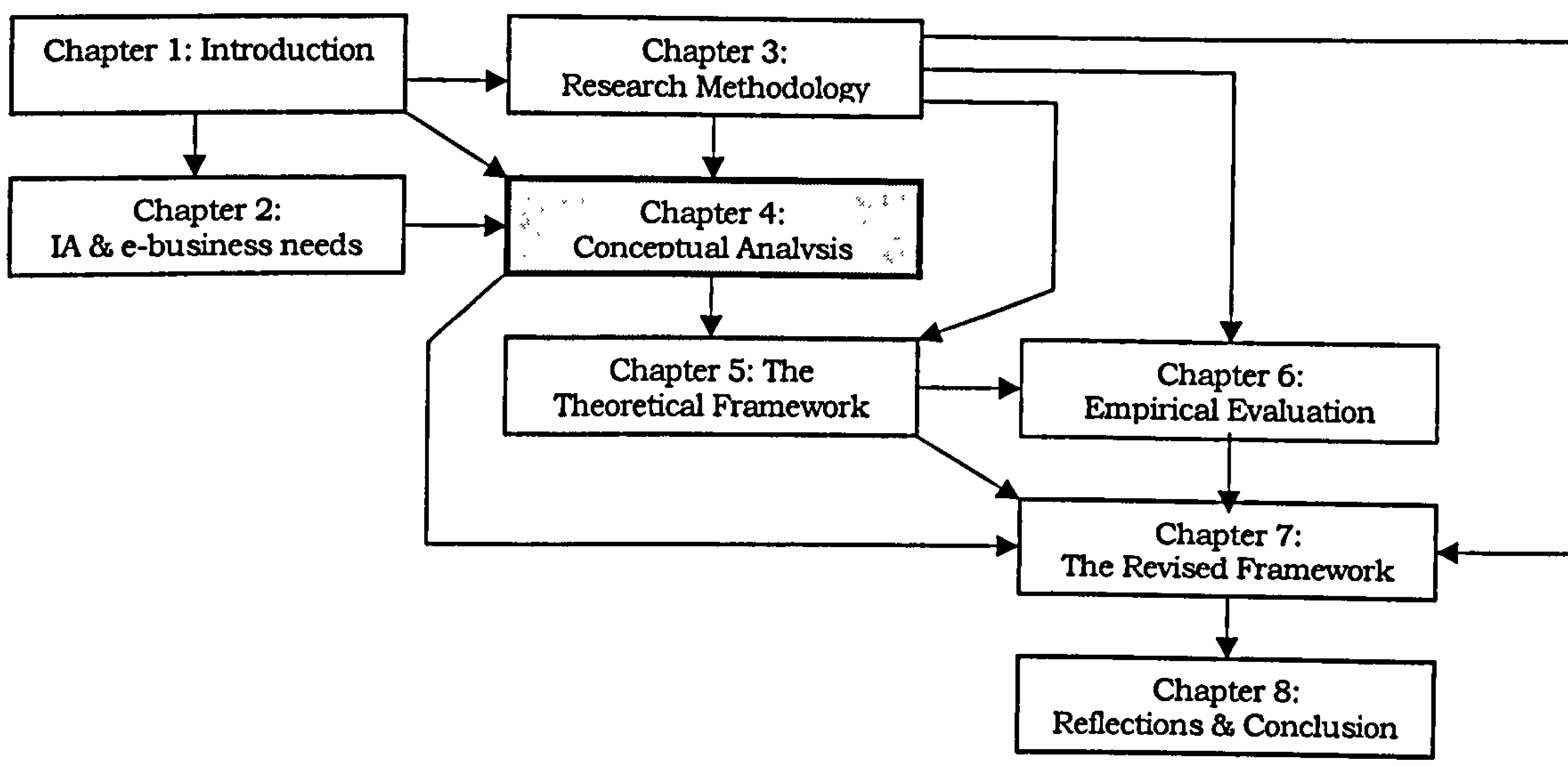
Further, two sets of criteria were introduced, this for selecting appropriate and feasible research methods (Fig.3.2), and for evaluating the quality of the research (Table 3.6). These are of high value as a measure for improving the feasibility and reliability of the work.

The details on the implementation of the research strategy are discussed in Chapter 6 and the analysis of the quality of the research and reflections on the research experience are presented in Chapter 8.

Objectives	Type of research	Research Methods				
		Critical review	Interviews	Subjective argumentation	Delphi study	e-Survey
• **Theory Building**						
(1) To investigate frameworks and models of information architecture and information systems architecture and establish their status within the IS knowledge domain;	Secondary & Primary	✓	✓In-depth non-structured interview with R.Evernden, the author of the IFW & the Evernden Eight;	✓Subjective/argumentative research through observation (Business Intelligence conferences and exhibitions, UKAIS & BIT conferences)		
(2) To conduct conceptual analysis on the frameworks and models identified as part of Objective 1 and establish fundamental IA components and desirable extensions.	Secondary & Primary	✓		✓(same as above)		
(3) To investigate requirements for e-mediated business networks and explore the extent to which they are met by the reviewed I(S)As.	Secondary & Primary	✓		✓(same as above)		
(4) Based on the outcomes of Objectives (2) and (3) to propose a framework for IA for e-business networks that integrates best practice in academic and practitioners' work on IA and accommodates the needs of business networks sharing information via electronic media.	Secondary & Primary			✓Normative writings based on personal communication on the topic with academics and practitioners, incl. e-mails.		
• **Theory Evaluation**						
(5) Through empirical research to evaluate the theoretical framework and its status as an analytical tool.	Primary		✓		✓	✓
(6) Based on the findings of the empirical evaluation to refine the quality of the proposed IA framework.	Primary	✓		✓		

Table 3. 7: Research objectives and methods employed for their accomplishment.

Chapter 4: Literature Review Part II: Conceptual Analysis of Information Architectures and Other Relevant Works



Over the years numerous models and frameworks for managing information and for Information architecture have emerged. This chapter builds upon the initial discussion on IA presented in Chapter 2 and focuses on the two most comprehensive works that have had the highest impact on the information architectural developments, i.e. the frameworks developed by John Zachman and Roger Evernden. The review (Section 4.1) covers the taxonomy and the evolution of each model/framework and deliberates on its importance and deficiencies, as related to this research. Section 4.2 then introduces other state-of-the-art research, namely web architectures, Systems Thinking and virtual teams, and provides a rationale for how each theory pertains to this study. A discussion of how the newly introduced subject knowledge expands the views on what an information architecture for e-mediated business networks and their. The chapter concludes with a synthesis of those features that have been identified as required for IA for e-business alliances and maps them onto the features provided by existing IA frameworks. The outcome of this analysis is used to justify the need for the development of the framework for IA e-business systems, presented in the following chapter.

4.1. INFORMATION ARCHITECTURE: CORE DEVELOPMENTS

4.1.1. THE ZACHMAN FRAMEWORK

The Zachman framework presents an integrative tool that enables staff at different levels of the organisational hierarchy to work together for the design and change of the enterprise and the computer systems that support them. The framework originally was called a framework for Information Systems Architecture (Zachman 1987; Sowa & Zachman 1992a) and its primary objective was to be used for designing stand-alone computer-based information systems, defining and controlling the interfaces and the integration of all the components of the system (Zachman 1987). In the preliminary paper in 1987 only three columns of the framework were introduced, namely Data, Function and Network, and a further three possible aspects were suggested. These are described in greater detail in Sowa & Zachman (1992a). In his later works, Zachman and his fellow researchers from Zachman International and the Information Engineering Systems Corporation started to refer to the IS Architecture (ISA) framework as Framework for Enterprise Architecture (EA).

> *"Although from the outset, it was clear that it [the ISA framework] should have been referred to as a 'Framework for Enterprise Architecture', that enlarged perspective could only now begin to be generally understood, as a result of the relatively recent and increased world-wide focus on enterprise engineering".* Zachman (1996)

The repositioning of the conceptual model has offered broader perspectives for its application. Today the framework is promoted as a tool for classifying and organising the descriptive presentations of an enterprise and it is seen as being important to both the management of the enterprise and to the development of the enterprise's systems (Zachman 1996a, 1999).

Cook (1996) recognises Zachman's architectural framework as a breakthrough in the departmentalisation of the enterprise, advocating the shift from vertical or proprietary department-centric approach to a horizontal approach that cuts across the organisation and introduces a set of standards to help reduce the problems introduced by decentralisation in enterprise information systems.

Since its initial launch the Zachman's Framework has been a pillar for many research studies and an implementation challenge for practitioners. It is being served by Zachman Institute for Framework Advancement (www.zifa.com) and case studies on applying the framework are being presented at EA workshops and conferences, such as the annual European conference on Enterprise Architecture or the Data Management and Information Quality Conference (www.irmuk.co.uk [8th March 2004]).

4.1.1.1. Overview of the framework

The ISA framework is taxonomy of 30 cells organised in six columns, labelled for addressing convenience from A through F, and five rows, numbered from one to five. The columns describe the aspects of data, process, network, people, time and motivation, whilst the rows represent the perspectives of the different roles involved with the development and use of the framework (Table 4.1). The latter are referred to as the vertical dimension of the ISA. Sowa and Zachman (1992b) define these as levels of description, and compare them to the levels of description produced by an architect when designing and constructing a building:

	A	B	C	D	E	F
	Data □ entity □ relationship	**Function** □ function □ argument	**Network** □ node □ link	**People** □ agent □ work	**Time** □ time □ cycle	**Motivation** □ ends □ means
Scope Planner	**List of things important to the business** □ entity = class of business thing	**List of processes the business performs** □ function = class of business process	**List of locations in which the business operates** □ node = major business location	**List of organisations/ agents important to the business** □ agent = major organisation unit	**List of events significant to the business** □ time = major business event	**List of business goals/strategy** □ ends/means = major business goal / critical business function
Enterprise model Owner	**e.g. entity/relationship diagram** □ entity = business entity □ relationship = business constraint	**e.g. process flow diagram** □ function = business process □ argument = business resource	**e.g. logistics network** □ node = business location □ link = business linkage	**e.g. organisation chart** □ agent = organisation unit □work = work product	**e.g. master schedule** □ time = business event □ cycle = business cycle	**e.g. business plan** □ ends = business objective □ means = business strategy
System model Designer	**e.g. data model** □ entity = data entity □ relationship = data relationship	**e.g. data flow diagram** □ function = application function □ argument = user view	**e.g. distributed system architecture** □ node = information system function □ link = line characteristics	**e.g. human interface architecture** □ agent = role □ work = deliverable	**e.g. processing structure** □ time = system event □ cycle = processing cycle	**e.g. knowledge architecture** □ ends = criterion □ means = action
Technology model Builder	**e.g. data design** □ entity = segment/row □ relationship = pointer/key	**e.g. structure chart** □ function = computer function □ argument = screen/ device format	**e.g. system architecture** □ node = hardware / system software □ link = link specifications	**e.g. human/technology interface** □ agent = role □ work = deliverable	**e.g. control structure** □ time = execute □ cycle = component cycle	**e.g. knowledge design** □ ends = condition □ means = action
Components Sub-contractor	**e.g. data definition description** □ entity = field □ entity = address	**e.g. program** □ function = language statement □ argument = control block	**e.g. network architecture** □ node = address □ link = protocol	**e.g. security architecture** □ agent = identity □ work = transaction	**e.g. timing definition** □ time = interrupt □ cycle = machine cycle	**e.g. knowledge definition** □ ends = subcondition □ means = step
Functioning system	**e.g. data**	**e.g. function**	**e.g. network**	**e.g. organisation**	**e.g. schedule**	**e.g. strategy**

able 4.1: The Zachman framework for Information Systems Architecture (Sowa & Zachman 1992)

- Row 1, *Objectives and Scope,* defines the purpose, size, shape and spatial relationships within the final structure, as they are seen from the perspective of the Planner or the sponsor of the system.
- Row 2, *the Enterprise model,* represents the system from the perspective of the Owner of the system and shows the core entities and business processes and their interactions.
- Row 3, *the System model,* outlines the perspective of the Designer of the computer-based information system or the system analyst who has to design the data elements and the system functions that will represent the business entities and business processes.
- Row 4, *the Technology model,* considers the Builder's perspective and introduces details related to the underlying technological base of the information system, namely programming languages, database management systems, I/O devices and the associated with them transformation of the System model.
- Row 5, *the Components or Detailed representations,* as viewed by the sub-contractor, includes detailed specifications that are given to the programmers, e.g. detailing the Data Definition Language, data access requirements, client-server communication protocols, etc. Zachman argues that the people involved in these tasks do not need to be concerned with the overall picture that their job fits in, as this is already incorporated within the specifications they follow. This could be a justification why these rows are referred to as the out-of-context perspective.

Some researchers (Hokel 1999; Vail III 2002) perceive that the taxonomy of the framework is based on six rows, rather than five, with the last one being the Functioning system or the Product perspective. Although Zachman does include such a row in the pictorial representation of the framework, he does not discuss it as a distinct perspective. Further, Zachman (1987) acknowledges that the first three representations are fundamental and the remaining detailed, but out-of-context representations are "somewhat less interesting "architecturally", since they do not depict the final product in total and are more oriented to the actual implementation activities. This could accepted as an explanation for the diverse views on the number of perspectives in the framework.

It is interesting to observe that the framework perspectives could be mapped onto the traditional System Development Lifecycle (SDLC), as covered in structured system development methods such as the Structured System Development Method (SSADM) (Fig.4.1). Thus the Planner's perspective is needed at the stage of Feasibility study, where initial System analysis is carried out. The Owner's view is required for defining and evaluating Business System Options (BSO) and conducting a conceptual analysis of the selected BSO. The System model, developed by the Designer of the system, corresponds to the required system logical system model developed at the Design stage of the SDLC. The Technology model developed by the Builder covers both the Logical Design and the Technical System Option stages in SSADM. And finally, the Components for the sub-contractors refer to the Physical design of the system, i.e. programming the individual modules or installing the specific computer network module.

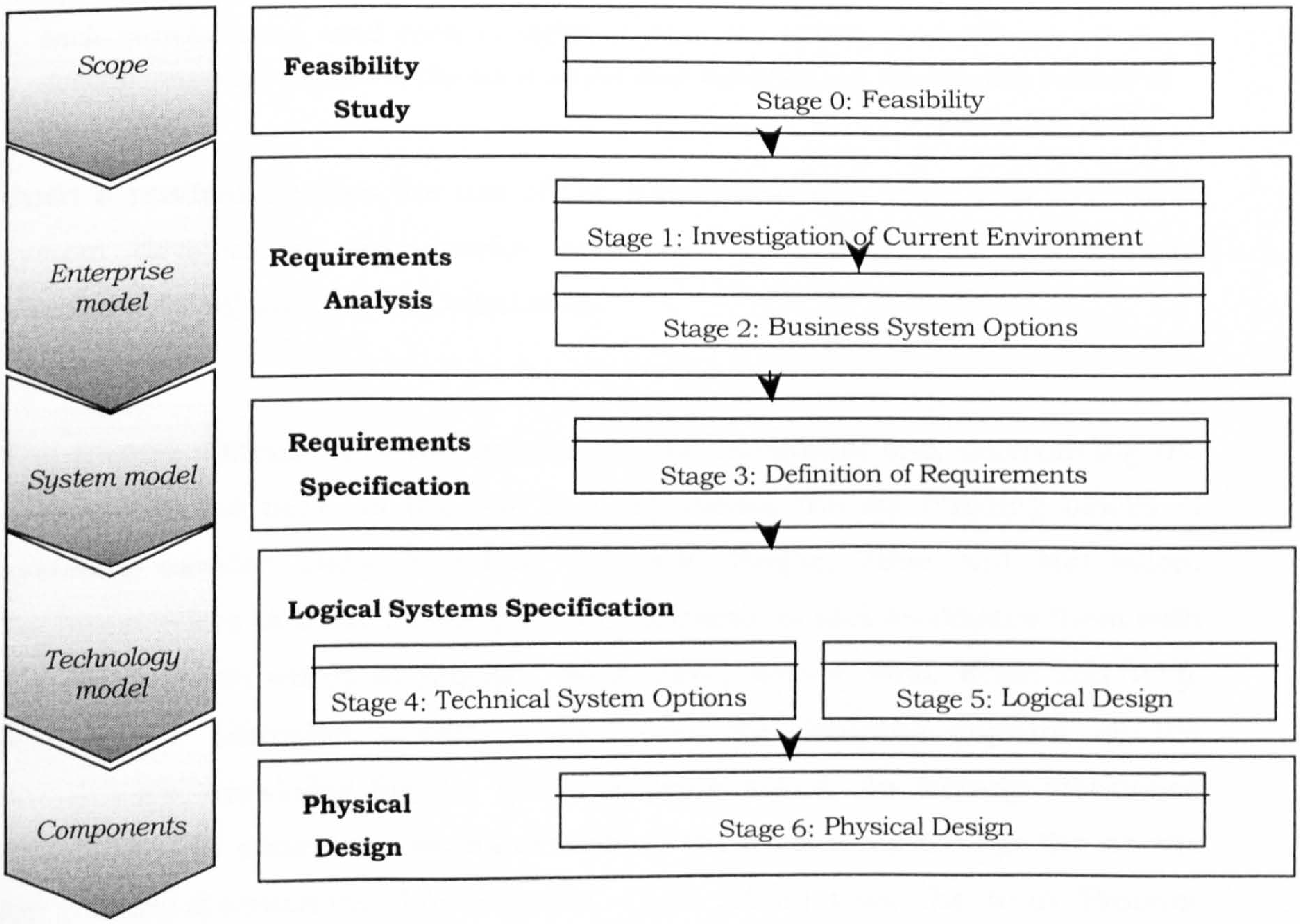


Fig.4.1: The Zachman framework and the traditional SDLC, an SSADM perspective.

This close correspondence could be attributed to the fact that the framework was developed at a time when structured system development methods were in their apogee. Although Zachman does not prescribe any specific method of using the framework, the congruity of the framework with the SDLC exemplifies how the framework could be applied in the case of system development methods. It is also helpful for drawing comparisons with other IA frameworks, having similar dimensions, e.g. Olle et al (1988) cited in Stevenson (1995a), Evernden (1996), et al.

The analogy with the SDLC was introduced with the intention to warn users of the framework that such an obvious correspondence might wrongly lead to the conclusion that the five perspectives are merely a set of hierarchical representations, each of which introduces further details to the previous one. Conversely, they should be regarded as different architectural views of the same product with the level of detail being an independent variable that may vary within each of the architectural representation.

> *" In short, each of the different descriptions has been prepared for a different reason, each stands alone, and each is different from the others, even though all the descriptions may pertain to the same object and therefore are inextricably related to each other."* (Zachman 1987)

Such a position enables the use of the framework with other less structured system development frameworks such as Dynamic System Development Method (DSDM) and Object Orientation.

The second dimension of the framework, the horizontal one, determining the columns of the table, is the one that represents the six building blocks of systems, namely: Data, Function, Network, People, Time and Motivation. Zachman refers to these as the product abstractions and associates them with the six question words in English: *What, How, Where, Who, When* and *Why*, respectively. Lauchlan (1999) clarifies that the columns capture all the enterprise's knowledge for the question being asked. As already mentioned (Section 2.1.2) some later works describing the framework change the names for certain abstractions. For example, Cook (1996) uses the term 'Process' instead of 'Function', and Zachman in some of his later works refers to the Motivation column as 'Business Rules' (Zachman 1996a) and mentions new representations of the People column, i.e. work flow models and presentation architecture, which seem more appropriate for other column, namely the

Function one (Zachman 1999). Regardless of this diversity in naming the abstractions, all of the above mentioned works adhere to the following understandings of the sub-architectures:

- *Data* addresses the classes, entities and their characteristics and the relationships between them, either from business or system developer's point of view.
- *Function* addresses the business processes (or classes of processes), classes of processes, application or computer functions that take place in the enterprise and the resources or formats needed to accomplish these.
- *Network* is defined by the nodes and the links between them. These, based on the specific perspective, could be seen as major business locations, the logistics of these locations, distributed systems functions, system architecture (the hardware and system software) or even network architecture.
- *People* are the agents that complete the work. These could be major organisation units, roles in terms of human interface, human/technology interface or security identities.
- *Time* stands for the business events that the system responds to, or the system event and cycles designed for the processing and control of the system.
- *Motivation* describes the means and the ends, i.e. business objectives, criteria, rules and conditions and the corresponding actions.

The intersection of the abstractions (the columns) and the perspectives (the rows) determines the cell content and could utilise a recommended special notation and documentation (Table 4.1). For example, cell A1 in the Scope row of the Data column addresses the question *What?* and provides a list of things important to the business, classifying these as entities. Similarly, the intersection of the Enterprise model row with the Function column, cell B2, answers to the *How?* question and recommends building a Business Process Model with key components business processes and business resources as inputs and outputs. The intersection of the same row with the Network column, cell C2, provides the answers to *Where?* in terms of business location the action takes place and what are the linkages between these locations. The latter intersection builds up the Business Logistics model.

4.1.1.2. Rules of the framework

Sowa and Zachman (1992b) discuss seven rules that govern the framework.

Rule 1: The columns have no order.

All columns are equally important and could be explored in any order.

Rule 2: Each column has a simple basic model.

This model is generic metamodel that is consistently applied in all the cells in the column. For example, the Data column employs Entity-Relationship Diagrams and assigns different meanings to the core components of this model, the entity and the relationship. In doing so, this ensures its applicability in different system settings and usability as a communication tool and generator of various scenarios by both technical and non-technical personnel. This is further benefited by the fact the framework is neutral with regards to processes and tools used for producing the descriptions.

However, it is acknowledged that some of the columns, i.e. Scope, are underdeveloped and are in need of established conceptual graphs to present a readable graphic notation for logic that is designed for translations to and from natural languages (Sowa & Zachman 1992b).

Rule 3: The basic model of each column must be unique.

The uniqueness is a result of applying the common tool to a different perspective.

Rule 4: Each row represents a distinct, unique perspective.

This was already addressed earlier when describing the perspectives.

Zachman does not state whether the rows should be addressed in sequential manner based on the logical progression of the row numbers. This deficiency has been addressed in later studies based on or having similar objectives as The Zachman framework (Evernden 1996; Vail III 2002).

Rule 5: Each cell is unique.

This could be derived from Rules 3 and 4. The cell as an intersection of rows presenting unique perspectives with columns, having unique basic models, is unique, too. This has its downsides as it complicates the application of the framework, as it introduces a host of design formalisms.

Rule 6: The composite or integration of all cell models in one row constitutes a complete model from that row's perspective.

This has been the principle that governs one of the approaches for applying the framework, described below.

Rule 7: The logic is recursive.

Sowa and Zachman (1992b) state that the framework is recursive in several different ways: as a metamodel that could describe itself, or as a description of entities and events that comprise of nested sub-components.

4.1.1.3. Approaches for using the framework

One of the approaches for employing the framework is to review sequentially the perspectives focusing on one of these six aspects only and holding the others constant. This enables organisations to aggregate a 'total enterprise knowledge' for each question/artefact (Lauchlan 1999). An alternative approach is to focus on one perspective only and define in detail each of the abstractions for this perspective. Lauchlan (1999) explains that

> *"It is the points of view which give meaning to the answer, so it is the perspective which dictates what kind of information can be gathered in that row. The perspective enables the information in the row to become usable knowledge that contributed to enterprise development."*

The latter approach seems to be the easiest to illustrate with examples (Zachman 1987; Cook 1996).

Lately the notion that the framework could be considered as both a process and a product emerges. As a product it stands for the artefacts, such as principles, guidelines, standards, designs, etc., in a particular enterprise, and inevitably changes over time, driven by changes in technologies and business strategies. As a process it has aims to institutionalise the process of disciplined analysis and decision making (Zachman 2001) and keep the artefacts up-to-date.

However, although evolution of the framework in time was recognised, no dimension was added to accommodate these changes. The Time abstraction defines the changes in the information, but does not provide for tracking these changes, i.e. it does not inform on differences in the evolutionary versions.

4.1.1.4. Deficiencies of the framework

Zachman's ISA framework is a valuable tool for addressing the challenge of enterprise (intra-organisational) integration. However, throughout the course of this study several deficiencies of the work were revealed in the context of the business network application:

- Ambiguity in the labelling of the dimensions and their components - As identified earlier (Section 2.1.2) there are is no agreement on how to name certain abstractions, Process or Function, Motivation or Business Rules, Control, Time or Behaviour. In different occasions, different labels are used. Furthermore, Zachman states that IA is one of the components of EA. If EA is a synonym term of ISA, the term *Enterprise Information Architecture* could be deemed as an oxymoron, i.e. Information System Information Architecture, or the Information Architecture of an Information System. Detailed unambiguous plausible definitions of the terms are needed to avoid any misinterpretations.
- No differentiation between functions and processes. – The most confusing are the top level perspectives of Planner and Owner, where the function is defined as either a class of business processes or a business process. One agrees that any 'business function' such as Marketing, Research & Development, Manufacturing, et al., is a set of business processes, but there is also the process organisation of these functions, often represented with the Value chain (Porter 1985), that is responsible for the delivery of the final product/service to the customer. Similarly, at the Owners level, a function stands for a business process, which contradicts with the business process as a part of a particular business function. At the lower levels, the use of the term 'function ' is less obscure, as it indicates with a computer function (Builder's level) or language statement (Sub-contractor's level). Given this, it could be argued that the attempt to introduce a uniform, column-specific meta model has created more confusion in places where meta model concepts are the same as business concept.
- Under- or non- presentation of the user perspective. The framework does not account for the increased involvement of the user as both a participant in the IA development process beneficiary of the IA. This is particularly true in cases of small or medium enterprises or in end-user development, where one person will play different roles.

- Ambiguity of the meaning of the 'Owner' and potential discrepancy between the objective of this perspective, i.e. to build a conceptual model of the enterprise and the meaning of the word 'Owner'. In cases of medium and large organisations the owner of the information could be the Chief Executive, or the Information Manager of the enterprise, or the Head of the XYZ department, or a project leader for the system development. The situation becomes even further complicated, if a user as a participant is brought into the picture.
- Intra-organisational focus – Despite its universal nature, it could be argued that The Zachman framework treats the enterprise as a single organisation with its divisions and departments. As mentioned earlier, the term 'enterprise' could also stand for a chain of organisations (The Open Group 2002), or a business network, which reflects the current trend of organisations entering in temporal or more stable relationships with other organisations for the accomplishment of common objectives[1]. Zachman argues that EA extends beyond organisational boundaries to external sources and targets, but does not provide any further detail on this matter.
- Unsubstantiated claims of shifting the focus from stand-alone systems to integrated enterprise-wide systems – When the framework was initially introduced, it focused on the development of stand-alone systems, rather than an integrated set of information systems. With the change of the name to Enterprise Architecture, the perception is that the framework overarches all the information systems in the enterprise, but no examples are reported on how this integration could be achieved, particularly in the case of legacy systems. This allegedly is a problem mostly for those familiar with the original use of the framework as a tool to facilitate system development. Being influenced by the initial system development context they inevitably seek to see how, when repositioned later as an enterprise-wide tool for information management, the framework could be used to manage the integration of legacy systems into an enterprise-wide system.

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1 The term 'extended enterprise' is not used here as it frequently stands for encompassing partners, suppliers and customers, as well as internal business units.

- Related to the previous point is the issue of (non-)recognition of scalability of the architectural framework, i.e. recognising that the Information Architecture of each business unit within the enterprise hierarchy presents a part of a cascade of Information Architectures that should be aligned both vertically, with the architecture of the parent unit(s) at the upper hierarchical level, and horizontally, with the architectures of the other units within the same hierarchical level.
- Insufficient recognition of the role of human component – Although Zachman (2001) argues that *"Enterprise Architecture is not about how computers talk to each other"* and could be used for both computer-based and non-computer-based systems, the framework is primarily suited for computer-based systems, as the lower perspectives levels indicate. More over, in discussing the People abstraction the upper perspectives limit the breakdown to identifying the agents and the products delivered by them, but fail to recognise the role of the particular agent and any relationship particulars, including trust.
- Change of the abstractions over time is not addressed sufficiently. - Although the evolution of the artefacts produces by the framework was acknowledged, the work on the framework as a process was not taken to a further level.

The last two issues evidence of another generic problem with the framework, namely, the insufficient level of detail on each abstraction and perspective. Evernden (1996) recognises that the set of questions defining the columns in Zachman's framework, apply within each column, as well as across columns, thus providing a further breakdown or classification of the information.

Another fundamental problem with the Zachman work is the plethora of names used to denote his work. The secondary research identified that the terms Enterprise Architecture, Enterprise Information Architecture and Information Systems Architecture have been used interchangeably to represent the Zachman framework, which construe significant definition conflicts. Furthermore, it makes it difficult for anyone considering the use of the framework without consultancy support to differentiate the concepts and to construe application potential. The following sections present details of the problem and author's speculations on the reasons behind these inconsistencies.

IS Architecture or Enterprise Architecture?

In his paper of 1987 Zachman (1987) introduced a framework for IS architecture, that was further developed in 1992 (Sowa & Zachman 1992a; 1992b). Several years later, without any further structural amendments being done, the extended work was renamed to a framework for enterprise architecture (Zachman 1996a, b; 1999; 2001). In some cases Zachman even calls it 'Framework for Enterprise Integration and Information Systems Architecture'. One explanation for this given by Zachman himself in his later publications (Zachman 2001) is that:

> *"the system is the enterprise: Manual systems employ pencils, paper, file cabinets. Automated systems employ stored programming devices and electronic media"*

A far more perceptive explanation is contained in Cook's statement:

> *"Industry has an incredible potential towards buzzwords that are really just slight changes to something that has been done before...Perhaps giving new names for old techniques gives hope to the beleaguered business community, exhausted from trying the previous fad."* Cook (1996)

Another independently derived justification for the re-labelling of Zachman's original framework from a Framework for IS Architecture to Enterprise Architecture could be found in the assertions of The Open Group (2002):

> *"The term "enterprise" in the context of "enterprise architecture" can be used to denote both an entire enterprise, encompassing all of its information systems, and a specific domain within the enterprise. In both cases, the architecture crosses multiple systems, and multiple functional groups with the enterprise."*

It is recognised that this is a high-level view of the enterprise as an integrated information system and that conceptually it could contradict previous work, that is not accounting for the system thinking viewpoint adopted here. One such example is the work on Enterprise Architecture conducted by The Open Group (2002), named TOGAF[2]. This architecture is very similar to Zachman's Framework. It recognises that the Enterprise Architecture includes several sub-architectures, i.e. Business, Data, Application and Technology Architectures. It also introduces the Information Systems Architecture that combines the Data Architecture and the Application Architecture. Two discrepancies with the

2 TOGAF – The Open Group Information Architecture Framework

system view of Zachman's work are identified in the TOGAF framework, namely:

(1) The TOGAF framework is based on the understanding that ISA is a sub-architecture of EA, which contradicts the notion supported by Zachman and that the framework for EA is identical with the framework for ISA. One would assume that the TOGAF definition of ISA is limited to Computer-based ISA, which would have been correct if not (2).

(2) The ISA in the TOGAF includes only the Data Architecture and the Application Architecture, but does not include Technology Architecture, whilst Zachman's framework supports the Network sub-architecture.

As outlined above, such differences in the assumptions could be attributed to the different ontological approach in defining the different sub-architectures. Whilst The Open Group approach is practical, experience-based bottom up approach of integrating different facets of Enterprise architecture, the approach taken here is theoretical, top-down one that builds upon previous critically assessed empirical and theoretical studies.

To address this semantic paradox and clarify how the terminology is used within the context of this study a proposition is put forward to use the terms *Enterprise Architecture* and *Information System Architecture* interchangeably.

Zachman (2001) has provided some justification for this already (Cf. Section 4.1.1.4). Further support for this proposition is based upon the following viewpoints:

(a) Any organisation is an information system (Checkland 1999; Millett 1998; Senge 1990)

(b) The context of this study is analogous to the context of the study on architecture frameworks conducted by The Open Group (The Open Group 2002) and hence, here the same definition of the term 'enterprise' could be adopted:

An 'enterprise' is

"any collection of organizations that has a common set of goals and/or a single bottom line. In that sense, an enterprise could be a government agency, a whole corporation, a division of a corporation, a single department, or a chain of geographically distant organizations linked together by common ownership."

(The Open Group 2002)

If the term 'organisation' in (a) is substituted with 'enterprise', the resulting statement is that 'any enterprise is an information system'. When substituting the word Enterprise in the term Enterprise Architecture with Information System, it is proved that in organisational context the terms Enterprise Architecture and Information System Architecture could be used interchangeably.

Similar arguments, albeit much more complicated, could be used in the case where 'enterprise' stands for either an "undertaking or a new project", or for "a business concern" (Merriam-Webster 2003), rather than for a company.

Given the diversity of views on what I(S)A stands for this proposition is not going to be tested empirically. This is to be recommended as an objective for future IA studies. The semantic proof will be considered as sufficient for arguing the case that the framework for Enterprise Architecture as a framework for Information Systems Architecture at internal for the organisation level, could be employed as a foundation for a framework for Information Systems Architecture for inter-organisational systems, such as the proposed here architectural framework for e-business networks.

Enterprise Architecture or Enterprise Information Architecture?

Arguably the most confusing point is the lack of agreement on the use of the terms Enterprise architecture (EA) and Enterprise Information architecture (EIA). Many authors, when discussing Zachman's work use these interchangeably. Zachman (2001) defines EA as

"the holistic expression of the enterprise's key strategies, i.e. Business, Information, Application and Technology and their impact on business functions and processes".

In the same paper he further defines the Enterprise Information Architecture as a set of models driven by the Enterprise Business Architecture, that describes the enterprise's information value chain, models key information flows, describes the key artefacts of business events and enables rapid decision making and information sharing. Despite this clarification, some authors when referring to Zachman's work use both the terms Enterprise Architecture and Enterprise Information Architecture (See Cook (1996)).

For the purposes of this research, the framework that Zachman labels as both ISA and EA and Cook (1996) in places calls EIA, is being referred to as Zachman's framework. Furthermore, to eliminate any second-order misinterpretations, the sub-architecture that is related to the question How? Is called "Function", as in the original publication, but not "Process", as it has been called in Cook's work..

In summary, despite its deficiencies and numerous reference names, the Zachman framework has proved to be a tool for management of enterprise integration. With the support of the Zachman Institute for Framework Advancement (www.zifa.com) through numerous conferences, forums and workshops organised world-wide, this tool has gained recognition amongst business and IS professionals. However, this critical analysis ascertains that despite of its strengths and wide recognition, the Zachman framework could not be applied as a tool for integrating business partners in an e-business network. Some of its deficiencies have been addressed in follow-up studies, such as Evernden's works on IA (1996, 2002, 2003a), for others solutions could be identified in conceptual models, developed in IA-related subject areas (Sections 4.2).

The following sections present a summary of other IA developments and theories that address some of the above criticism on the Zachman framework.

4.1.2. EVERNDEN'S INFORMATION FRAMEWORKS

This section reviews three information frameworks introduced by Roger Evernden, namely The Information FrameWork (IFW) (Evernden 1996), The Information Model (Workspace International 1997) and The Evernden Eight (Evernden 2002) and analyses their deficiencies with the view to establish to what extent they could be used as IA for e-business alliances.

4.1.2.1. The Information FrameWork (Evernden 1996)

The Information FrameWork (Evernden 1996) was developed by IBM's Banking Solution Centre in Dublin in conjunction with more than 50 financial institutions from all over the world. It provides a comprehensive structure to manage information created from diverse processes, applications and systems, and accommodates a variety of approaches to information management. Evernden (1996) acknowledges that initially the framework was built upon Zachman's ISA (Zachman 1987) and that the IFW project incorporated a lot of experience from other "industry" architectures and models developed by IBM, such as the Financial Application Architecture and the Financial Services Data Model. He further argues that although the framework outlined in the paper was derived from the experience in the Financial Services industry, it could be applied to manage complex information structures in any industry.

4.1.2.1.1. Overview of the Framework

The IFW is made up of the five components (Table 4.2), three of which, row, column and cell, were used in Zachman's framework:

- The ***view*** is the first of the two new components. The framework incorporates three views, namely Organisational, Business and Technical, each of which is defined further through a number of columns (the following component). The views represent the perspectives of the different groups that are going to use the framework and allow for easier definition of industry-wide models. Furthermore, as each of the views has a different pace of change, there is a choice of strategies on propagating the changes in the remaining views, i.e. containment or simultaneous change.

- The ***columns*** present broad categories or abstractions of the subject. There are ten columns, grouped into the three views mentioned above. Evernden (1996) states that

"In the IFW the columns represent various ways to represent different types of information"

and justifies the listed set of columns through the analysis of methodologies for business and information systems modelling.

- The ***rows*** represent the levels of constraint that the information goes through. There are three broader levels, ordered by their stability factor, namely Decomposition, Composition and Implementation, corresponding to the Analysis, Design and Implementation (Physical design) stages of the SDLC. Each of the levels could be further subdivided to introduce further representations of the subject to satisfy different purposes and objectives. These representations could be textual, graphical or pictorial (refer to Table 4.2 for examples). The ***cells*** are the repositories for the content of a particular abstraction defined at a certain level of constraint, i.e. they are the intersection between a column and a row.

- The ***dimension*** is the second component that is not present in Zachman's work. The taxonomy of six dimensions includes Types of information (the rows), Levels of constraints (the columns), Content (the cells), Transformation over time, Ownership and Methodology chains, also called routemaps (Fig.4.2).

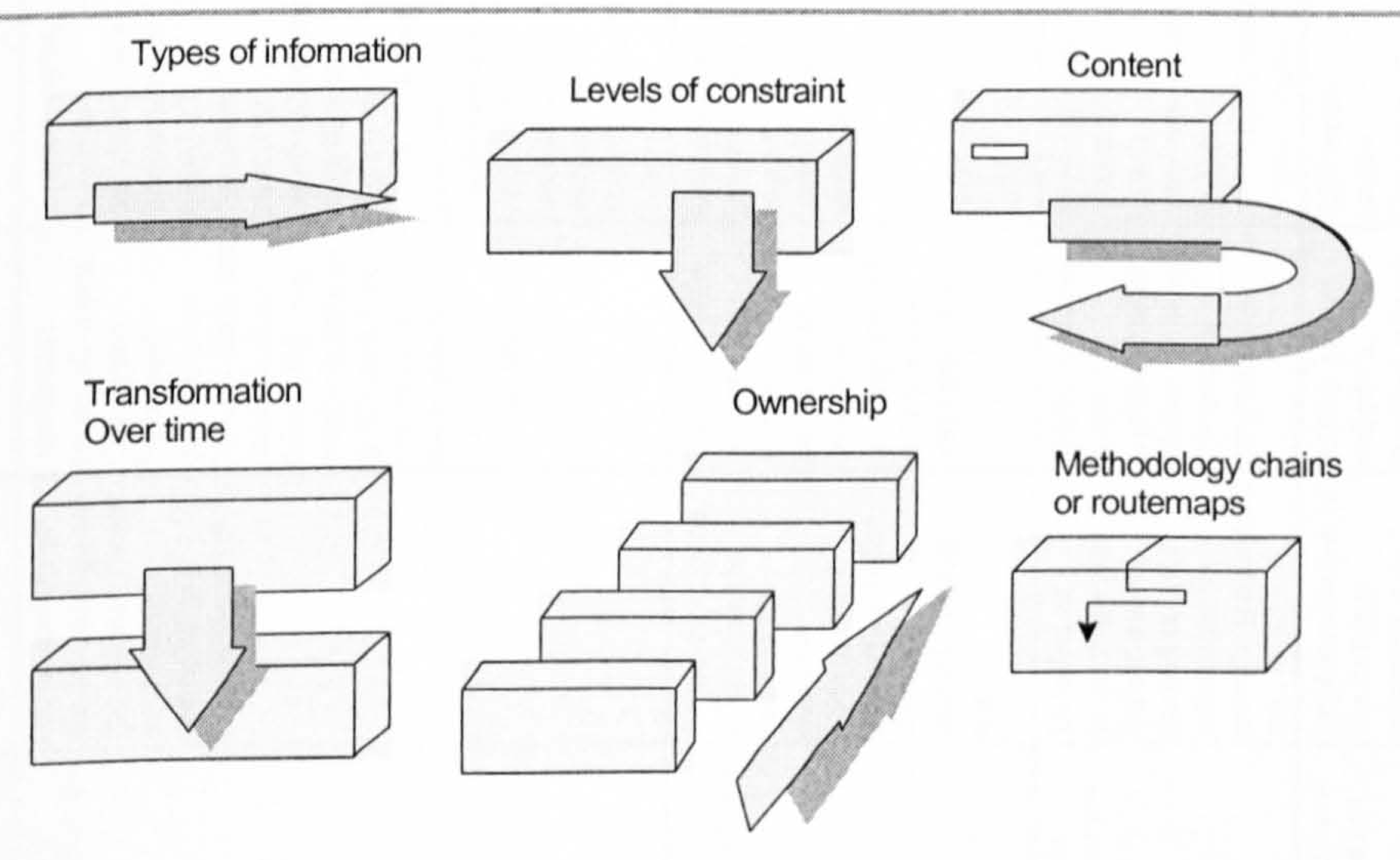


Fig. 4.2 : Dimensions of the Information FrameWork (Evernden 1996)

Types of information

Levels of constraint			Organisation view			Business view				Technical view		
Broad levels of constraint	Detailed levels of constraints and their explanation		Strategy column	Structure column	Skills column	Data column	Function column	Workflow column	Solution column	Interface column	Network column	Platform column
Deconstruction level	Domain concept: row	Concepts important for understanding the column, e.g.:	target, constraint, Key indicators (KI), critical success factors (CSF)	Socio-infrastructure, role and culture	Experience, ability, characteristics, training	Involved party, arrangement, condition, classification, product	Direction, market and resource management, business operations	Activity verbs, activity, trigger, workflow, critical business process	Product structure, report structure, management information	Logic, component, structure, language, interface	Device, topology, communication medium, protocol	Storage, resource manager, operating system (OS)
	Domain classification row	Classification of the knowledge of the column based on domain concepts, e.g. classification of:	constraint types, KI types, CSF types, "strategy" information listed within the classification hierarchy, e.g. major business goals and CSF, constraints (weaknesses, threats, regulations)	location types, role types, administrative infrastructure types, "structure" information, listed within the classification hierarchy e.g. major business locations, organisations, organisation units and agents important to the business	types of experience, training, ability, "skills" information, listed, e.g. techniques or methods used by the business, training qualifications recognised within the organisation, abilities required by staff	data concept schemes and values, data concept descriptors, and data concept relationships, "Data" information, listed within the classification hierarchy, e.g. classes of things important to the business	Function types, types of state, data access types; "Function" information listed within the classification hierarchy, e.g. functions managed within the business, classes of business processes	Verb types, trigger types, activity types; "Workflow" information listed within the classification hierarchy, e.g. events significant to the business, triggers that initiate business activities, verbs used to name business activities	Product structure types, report types, management information system types; "Solution" information, listed within the classification hierarchy, e.g. business conditions that differentiate products, parameters used to drive reports	Types of logic, component types, language types, programming interface types; "Application" information , e.g. languages used to code programs within the institution, components used to construct or generate applications, interfaces used to connect program components	Device types, protocol types, types of topology or network structure; "Network" information, e.g. protocols used in the institution's networks, devices connected to the network, communication medium used for distributed systems, communication software	Types of storage, resource manager types, OS types; "System" information, listed within the classification hierarchy, e.g. OS used in the institution, resource managers available to support applications and networks, database management systems
Composition Level	Generic template row	Cross-enterprise, generic model relating the column components (classified in the domain classifications) e.g.:	Business plan, 5-year plan, mission statements, business strategy model, information strategic plan	Organisation structure chart, report distribution structure	Human resource development plan, IS development methodology	Entity-relationship diagram, object data model, business entity model, subtype-supertype hierarchy, object class diagram	Function context diagram, data access diagrams, state transition table	Critical business processes, business procedures manual, process context diagram, scenario diagram	Product/condition dependency matrix, product/activity support matrix	Application structure architecture, application programming interfaces	Network architecture, distributed system architecture, communication interfaces	System architecture, hardware configuration map, resource manager interfaces, database management system interfaces
	Design context row	Detailed or project-specific logical model (based on and extending the generic templates), e.g.:	Objective/measurement method matrix, objective/schedule matrix, project plan	Organisation unit structure chart, role/deliverable matrix, role/organisation unit matrix	Skill set/project matrix, skill set/role matrix, methodology manual	Application data model, database logical design	Data access diagram, CRUD matrix, functional dependency diagram, data flow diagram	Workflow model, process flow diagram, control flow diagram, message flow diagram	Product/condition value matrix, activity/parameter matrix	Program structure chart, application program interface design	Local area network diagram, distribution network diagram	Resource manager interface design, database interface design
Implementation	Operational bound row	Implementation of the column concepts, e.g.:	Actual project schedule, product rollout, customer satisfaction	ABC bank, Loans Department, General Manager, Louis Lane	Core competencies, bank teller experience, published methodology	Customer information database, account transaction data definition	Customer enquiry module, arrangement data access module, customer relationship module	Program logic to print statement, evaluate customer workflow	Condition value table for personal loan, parameters to drive management information search	Application programming interfaces, dynamic linking, compiler or interpreter logic	Communication protocols, connecting cable, node links, network programming interfaces	System response codes, system programming interfaces, system software, hardware

Table 4.2: Summary of the structural components in the Information FrameWork (Evernden 1996) (adapted from Evernden 1996)

The structure diagram of the framework (Table 4.2) accommodates the first three dimensions, that define the components of an information architecture, but as a two-dimensional model could not present the remaining three dimensions. The last three dimensions encompass the further development of Zachman's frameworks, determining the IFW as a multi-dimensional framework that also reflects

(1) how the framework changes over a period of time (the fourth dimension), i.e. the transition or the transformation from one version to another,

(2) the levels of ownership of the information, e.g. global, industry, cross-enterprise, enterprise, local, or individual level (the fifth dimension) ;

(3) the use of the individual cells, in terms of generalisation, specification and logical sequence, as employed in an individual project and/or methodology (the sixth dimension).

Evernden (1996) argues that these new dimensions are intended to facilitate the use of the framework in the most effective manner.

4.1.2.1.2. Comparison of the IFW with Zachman's framework

Evernden (1996, p.40) compared the IFW with Zachman's framework for ISA on the basis of focus and nature, main processes supported, structure and architecture and rules governing the frameworks. Here the order of the criteria is redrawn to reflect of the magnitude of the differences.

Two tables have been developed to present the distinctions in structure and architecture. Table 4.3 presents how the IFW accommodates Zachman's abstractions and perspectives and Table 4.4 highlights how the IFW maps onto the Zachman framework. It is noticeable that whilst all cells within Zachman's framework are accounted for, it is only the Data column where the two frameworks considerably overlap. Zachman's Function abstraction has been dispersed mostly between the IFW Function and Workflow column, which eliminates the confusion created by using the terms 'function' and 'process' interchangeably by recognising that

> *"The function column covers the more static aspects of what is going to be done, whereas the workflow column covers the behavioural aspects of when it will be done and how it will be done... A function is relatively static, is found vertically throughout the structure of the organisation, is not time dependent, and is often related to the organisation structure and strategies; a workflow is dynamic, is found horizontally*

across the structure of the organisation, has a start, a middle and an end, and is related to people and their roles within the organisation." Evernden (1996)

Further structural distinctions in the frameworks include the inclusion of two new columns in the IFW, i.e. Skills and Solutions that are not explicitly covered in Zachman's framework. The Skills column informs the users of the level of competency, experience and training in the organisation and is often considered in conjunction with the Solution column, when determining the applicability of a solution at certain level. The Solutions column includes products, services and support solutions that the business provides to its customers or would like to reuse internally in the strive for reduced delivery time, standardisation and mass customisation.

Types of information

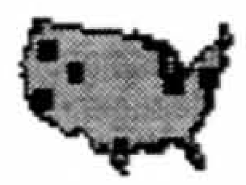
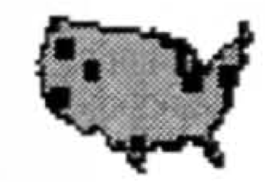
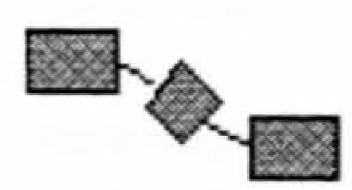
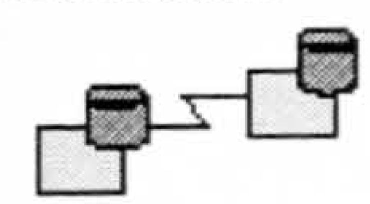
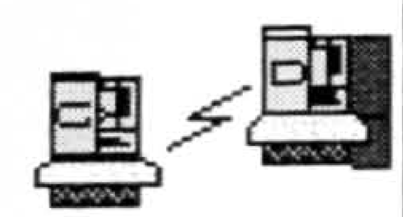
Levels of constraint		Organisation view			Business view				Technical view		
Broad levels of constraint	Detailed levels of constraints	Strategy column	Structure column	Skills column	Data column	Function column	Workflow column	Solution column	Interface column	Network column	Platform column
	Domain concept: row	**(Not explicitly defined)**	**(Not explicitly defined)**	**(Not explicitly defined)**	**(Not explicitly defined)**	**(Not explicitly defined)**	**(Not explicitly defined)**	**(Not explicitly defined)**	**(Not explicitly defined)**	**(Not explicitly defined)**	**(Not explicitly defined)**
Deconstruction level	Domain classification row	**List of business goals/strategy** □ ends/means = major business goal / critical business function	**List of locations in which the business operates**  □ node = major business location **List of organisations/ agents important to the business** □ agent = major organisation unit	**(Not explicitly defined)**	**List of things important to the business** □ entity = class of business thing	**List of processes the business performs** □ function = class of business process	**List of events significant to the business** □ time = major business event	**(Not explicitly defined)**	**List of locations in which the business operates** 	**(Not explicitly defined)**	**(Not explicitly defined)**
Composition Level **(continues)**	Generic template row	**e.g. business plan** □ ends = business objective □ means = business strategy	**e.g. organisation chart** □ agent = organisation unit □work = work product	**(Not explicitly defined)**	**e.g. entity/relationship diagram**  □ entity = business entity □ relationship = business constraint	**(Not explicitly defined)**	**e.g. master schedule** □ time = business event □ cycle = business cycle	**(Not explicitly defined)**	**(Not explicitly defined)**	**e.g. network architecture** □ node = address □ link = protocol **e.g. distributed system architecture**  □ node = information system function □ link = line characteristics	**e.g. system architecture**  □ node = hardware / system software □ link = link specifications

Table 4.3a: The Zachman ISA framework (Sowa & Zachman 1992) as represented within the Information FrameWork (Evernden 1996) (adapted from Evernden 1996)

Continues..

Types of information

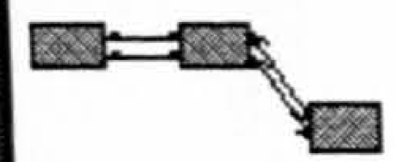
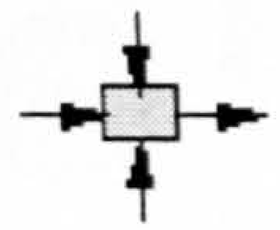
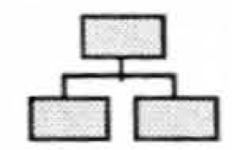
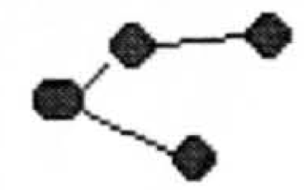
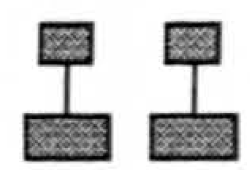
Levels of constraint		Organisation view			Business view				Technical view		
Broad levels of constraint	Detailed levels of constraints	Strategy column	Structure column	Skills column	Data column	Function column	Workflow column	Solution column	Interface column	Network column	Platform column
Composition Level **(continued)**	Design context row	**e.g. knowledge architecture** □ ends = criterion □ means = action	**e.g. human interface architecture** □ agent = role □ work = deliverable	**(Not explicitly defined)**	**e.g. data model**  □ entity = data entity □ relationship = data relationship	**e.g. data flow diagram**  □ function = application function □ argument = user view	**e.g. process flow diagram** □ function = business process □ argument = business resources **e.g. human/technology interface** □ agent = role □ work = deliverable **e.g. security architecture** □ agent = identity □ work = transaction **e.g. control structure** □ time = execute □ cycle = component cycle **e.g. knowledge design** □ ends = condition □ means = action	**(Not explicitly defined)**	**e.g. structure chart**  □ function = computer function □ argument = screen/ device format	**e.g. logistics network**  □ node = business location □ link = business linkage	**(Not explicitly defined)**
Implementation	Operational bound row	**(Not explicitly defined)**	**(Not explicitly defined)**	**(Not explicitly defined)**	**e.g. data design**  □ entity = segment/row □ relationship = pointer/key **e.g. data definition description** □ entity = field □ entity = address	**(Not explicitly defined)**	**e.g. program** □ function = language statement □ argument = control block **e.g. processing structure** □ time = system event □ cycle = processing cycle **e.g. knowledge definition** □ ends = sub-condition □ means = step	**(Not explicitly defined)**	**(Not explicitly defined)**	**(Not explicitly defined)**	**e.g. timing definition**  □ time = interrupt □ cycle = machine cycle

Table 4.3b:The Zachman ISA framework (Sowa & Zachman 1992) as represented within the Information FrameWork (Evernden 1996) (adapted from Evernden 1996)

Continued)

	Data □ entity □ relationship	**Function** □ function □ argument	**Network** □ node □ link	**People** □ agent □ work	**Time** □ time □ cycle	**Motivation** □ ends □ means
Scope Planner	**List of things important to the business** □ entity = class of business thing D	**List of processes the business performs** □ function = class of business p F	**List of locations in which the business operates** □ node = major bu lo I A	**List of organisations/ agents important to the business** □ agent = major organisation unit A	**List of events significant to the business** □ time = major business event W	**List of business goals/strategy** □ ends/means = major business goal / criti business S
Enterprise model Owner	**e.g. entity/relationship diagram** □ entity = business entity □ relationship = business constraint D	**e.g. process flow diagram** □ function = business process □ argument = business resource W	**e.g. logistics network** □ node = business location □ link = business linkage N	**e.g. organisation chart** □ agent = organisation unit □work = work product A	**e.g. master schedule** □ time = business event □ cycle = business cycle W	**e.g. business plan** □ ends = business objective □ means = business strategy S
System model Designer	~~**e.g. data model**~~ □ entity = data entity □ relationship = data relations D	~~**e.g. data flow**~~ **diagram** □ function = application function □ argument = user view F	~~**e.g. distributed**~~ **system architecture** □ node = information system function □ link = line characte N	~~**e.g. human**~~ **interface architecture** □ agent = role □ work = deliverable A	~~**e.g. processing**~~ **structure** □ time = system event □ cycle = processing cycle W	~~**e.g. knowledge**~~ **architecture** □ ends = criterion □ means = action A
Technology model Builder	**e.g. data design** □ entity = segment/row □ relationship = pointer/key D	**e.g. structure chart** □ function = computer function □ argument = screen/ d format I	**e.g. system architecture** □ node = hardware / system software □ link = link specifica P	**e.g. human/technology interface** □ agent = role □ work = deliverabl W	**e.g. control structure** □ time = execute □ cycle = compon e W	**e.g. knowledge design** □ ends = condition □ means = action W
Components Sub-contractor	**e.g. data definition description** □ entity = field □ entity = address D	**e.g. program** □ function = language statement □ argument = control bl W	**e.g. network architecture** □ node = address □ link = protocol N	**e.g. security architecture** □ agent = identity □ work = transaction W	**e.g. timing definition** □ time = interrupt □ cycle = machine cycle P	**e.g. knowledge definition** □ ends = subcondition □ means = step W
Functioning system	**e.g. data**	**e.g. function**	**e.g. network**	**e.g. organisation**	**e.g. schedule**	**e.g. strategy**
Key to colour coding:	Deconstruction level	Composition level	Composition level	Implementation level	S - Strategy column A - Structure column D - Data column F - Function column	W- Workflow column I - Interface column N - Network column P - Platform column

Table 4.4: The Information FrameWork coverage of the Zachman framework

The row components of the two frameworks form another basis for comparison. As Evernden (1996) states, *"redefinition of the Zachman levels by IFW is subtle rather than radical"*. Similarities exist for the first two rows where Zachman's Planner's perspective to a great extent overlaps with the IFW Deconstruction level (with the exception of the Network and Platform columns), and Zachman's Owner's perspective is included in the IFW Generic Template row from the Composition level. At the IFW Operational bound in the Implementation level it is only the Business view and partially the Platform information that are barely covered in Zachman's framework. Furthermore, the IFW Domain concepts row used for classifying the information within a given column has no corresponding perspective in Zachman's framework.

Comparison between the two frameworks could be drawn on the basis of the rules that govern the framework. In Zachman's framework the first rule is that the order in which the columns are listed is of no importance. Contrariwise, in the IFW there is a deliberate order in the views and columns, which is intended to act as a stability factor. However, there is also some flexibility to accommodate individual work preferences, as the order in which the columns and cells are used in a particular project could be designed by the users. The two models further differ on the basis of existence of basic models that support each column. Whilst Zachman advocates the use of such models, the IFW purposefully avoids such a generalisation, which again contributes to consistent terminology and flexibility in individual applications. Both frameworks agree on the on the uniqueness of the columns, rows and cells and the recursive logic of the frameworks, as specified by Sowa and Zachman (1992a).

Evernden (1996) uses two other criteria for comparing the IFW with Zachman's framework, i.e. the Focus and nature and the Main processes supported by the models. As his work is based on Zachman's earlier version of the framework, it could be argued that these are no longer applicable. The differentiation after re-positioning Zachman's framework as an enterprise integration framework is presented in Table 4.5.

Criteria	IFW (Evernden 1996)	Zachman's Framework	Zachman's Enterprise Architecture
Focus & nature	▪ Information	▪ Systems	▪ Enterprise information or Systems
Main deliverables	▪ domain models and reusable information components	▪ Stand-alone system	▪ Enterprise models, reusable enterprise components or a stand-alone system
Analogy wth	▪ city planning and urbanism	▪ building architecture	▪ building architecture
Main processes supported	▪ Information management	▪ System development	▪ Enterprise management, incl. information management
Analysis & Integration of	▪ multiple methodologies, domain models, architectures, work practices	▪ domain models, architectures, work practices	▪ domain models, architectures, work practices
Types of processes	▪ Processes that create or use information (since most processes have information inputs and outputs, IFW can be used in many situations)	▪ Processes that create or use information	▪ Processes that create or use information

Table 4.5: Comparison of the Information FrameWork and the Zachman framework (based on Evernden (1996)).

4.1.2.1.3. Deficiencies of the Information FrameWork

The IFW is a descendant of the Zachman framework and as such has addressed many of the deficiencies listed in Section 4.1.1.4. It is a much younger theoretical construct and has not had the marketing and consultancy support of an organisation such as ZIFA. Any criticism to the tool could be made only on the basis of publications of its author and case study material provided by IFW adopters. These factors limit the evidential material for the critical evaluation of the work and result in a more restricted set of deficiencies. These in the context of IA for e-business networks are as follows:

- Scope of application: As Evernden (1996) argues, the IFW has provided industry-wide models for analysis, design and development, and shown how to align business and information systems analysis and modelling techniques in support of application development and business process re-engineering. It has also

  "defined a set of road maps that combine the best elements from diverse methodologies into a project-based methodology chain" (Evernden 1996).

  Although this framework has a wider focus than its predecessor, i.e. it could be used to manage complex information structures in an industry, rather than only in one organisation, it is not clear whether and how it could be applied in the analysis and development of information architecture for e-business networks.

- Limitations of the descriptions of the work: One of these limitations refers to the Ownership dimension, which, as described, is only partially reflecting the complexity of responsibilities of the actors in the information lifecycle. Similarly, without consultancy support it could not be established whether the Generic Template row accommodates for the different presentation formats and styles that could exist for each of the levels of constraints, e. g. textual, pictorial, audio-visual etc.

Despite these deficiencies, the Information FrameWork is a better match for the IA needs of e-business alliances (Table 2.14), as it is process-based, focused on information management, rather than on system development, and its deliverable is a set of integrated systems.

4.1.2.2. The Evolution of the Information Framework

Evernden has continued his work on information architectures and over the last years he has reported on the development of two other frameworks, the Information Model (WorkSpace International 1999) and The Evernden Eight (Evernden 2002). The analysis of the potential role of these models as information architecture for e-business networks follows the description of the models.

4.1.2.2.1. <u>The Information Model</u>

The Information Model (tIM) (WorkSpace International 1999), a classification model of management concepts that provided a comprehensive list of nearly 5000 domain concepts and classifications for these concepts, i.e. a concept 'knowledge-tree'.

The tIM structure has two key dimensions:

(1) Types of Information

(2) Levels of Understanding.

In terms of the first dimension, tIM introduces a structure very similar to this of the IFW. It distinguishes management, business and technical perspectives of the information and defines a set of categories within each of them (Table 4.6).

Management categories	Business categories	Technical categories
▪ Organisation Structures ▪ Organisation Strategies ▪ Skills	▪ Business Data ▪ Project Templates ▪ Product Templates ▪ Process Templates.	▪ Application Interfaces ▪ Networks ▪ System Platforms

Table 4.6.: Initial set of categories in the tIM (WorkSpace International 1999)
N.B. This list has been expanded further in the 2002 version of the model.

The second dimension, Levels of Constraints, is decomposed to the levels:

- Definitional Information
- Representational Information
- Interpretational Information
- View Information.

The tIM introduced some alternative names for sections of the model, e.g.

- Structure - Process
- Strategy - Purpose or Motivation
- Skills - People,

thus bridging the terminology gap between Zachman's framework and the IFW. However, accommodating such flexibility in the labels for the areas that the model covers, is a double-edged sword that in some cases could lead to confusion over the meaning of the label.

It is easily noticeable that the IFW and the tIM differ predominantly in the way the components are labelled. In terms of Dimension 1:Types of Information the tIM category Product Templates corresponds to the Solution column in the IFW and category Process Templates matches the Workflow column. The Project Templates (Fig.4.3) is the only tIM component that does not have a 100% match. Evernden (Workspace International 1999) argues that it describes using information models to define strategies,

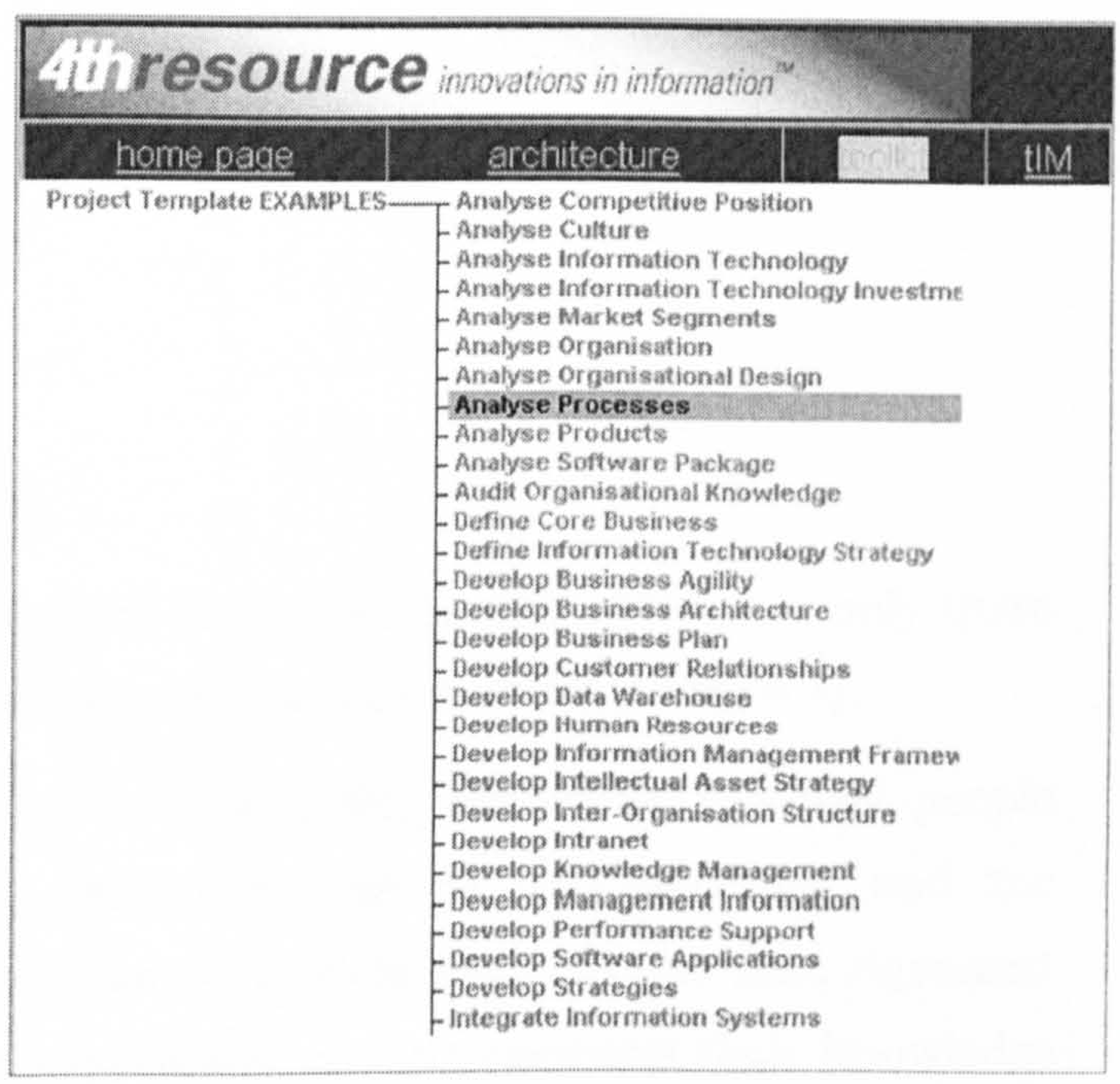


Fig.4.3: Project templates in the Information Model
(http://www.4thresource.com/timdemo/timdemo_index.htm

defines business requirements, or analyses business processes.

Correspondingly, the only column in the IFW that has not had a match in the tIM is the Function column that incorporates direction, market and resource management, business operations, et al. It could be argued that the Project Template component in tIM corresponds to the Function column in the IFW, as both columns address similar information needs and information categories.

With regards to Dimension 2:Levels of Constraints, close examination of the two frameworks confirms that the Definitional information in the tIM corresponds to the Deconstructional level in the IFW, the Representational information to the Composition level and the Interpretational Information to the Implementational level. The fourth level of constraint in the tIM, the View Information, does not have a analogous level in the IFW. Evernden defines this level as including subsets of the previous three levels that identify the needs and perspectives of particular people or groups. Analysis of its connotation confirms its similarity with the Ownership dimension in the IFW.

Evernden argues that

> *"An important step in defining an information architecture that meets your specific needs is to select the dimensions that are relevant and that can be managed effectively by your organisation."*
>
> (WorkSpace International 1999)

Albeit tIM lists only two dimensions WorkSpace have identified six such dimensions:

1. Types of information
2. Levels of understanding
3. Representations
4. Transitions over time
5. Tacit/Explicit
6. Processes of using information.

The number of dimensions is the same as this in the IFW, however, only three of the above dimensions have their counterparts in the IFW (Table 4.7)

In the new dimensions, Levels of understanding addresses the way people understand information, i.e. by recognising words and language and the meaning they convey, by applying mental models and theories that represent any relationships between the components, and by applying their knowledge and experience in practice. The Representations dimension addresses the deficiency of the IFW discussed earlier, by acknowledging that same information could be represented in different ways and that in different context some representations are more appropriate than others. Finally, the Tacit/explicit dimension is introduced to facilitate the recognition that information and knowledge could exist in tacit, as well as in explicit form.

4.1.2.2.2. The Evernden Eight

The next evolutionary transformation of the Information FrameWork is The Evernden Eight (Evernden 2002). This multi-dimensional model of information architecture is based upon eight dimensions, each of which is represented by an axis on the diagram illustrating the model, each of which is presented as an axis on the graphical illustration of the model (Fig.4.4):

- **Dimension 1: Types of information** covers conceptual categories that help in understanding and using information more effectively. Business processes, customers, strategy and purpose, places and locations, etc. are some examples of types of information.
- **Dimension 2: Levels of understanding** stands for the variety of techniques used to gain understanding or finding meaning in information, i.e. definitions, models or theories and the interpretation and use of information in practice.
- **Dimension 3: Types of representation** stands for the different formats and styles used for presenting formal/informal information and cover how easy it is to use and understand it. Examples include printed documents, hierarchy diagrams, pie chart, e-mail messages, etc.
- **Dimension 4: Levels of transition** allows for distinguishing the changes that information undergoes over a period of time and using this understanding to extract better value from information by using the most relevant and most up-to-date information. Version releases, stages of capability or growth and present or historical information are some examples here.
- **Dimension 5: Types of knowledge** recognises the different types of knowledge, namely explicit/tacit and conscious/unconscious and provides new opportunities for creative and original use of information and avoidance of misinformation.

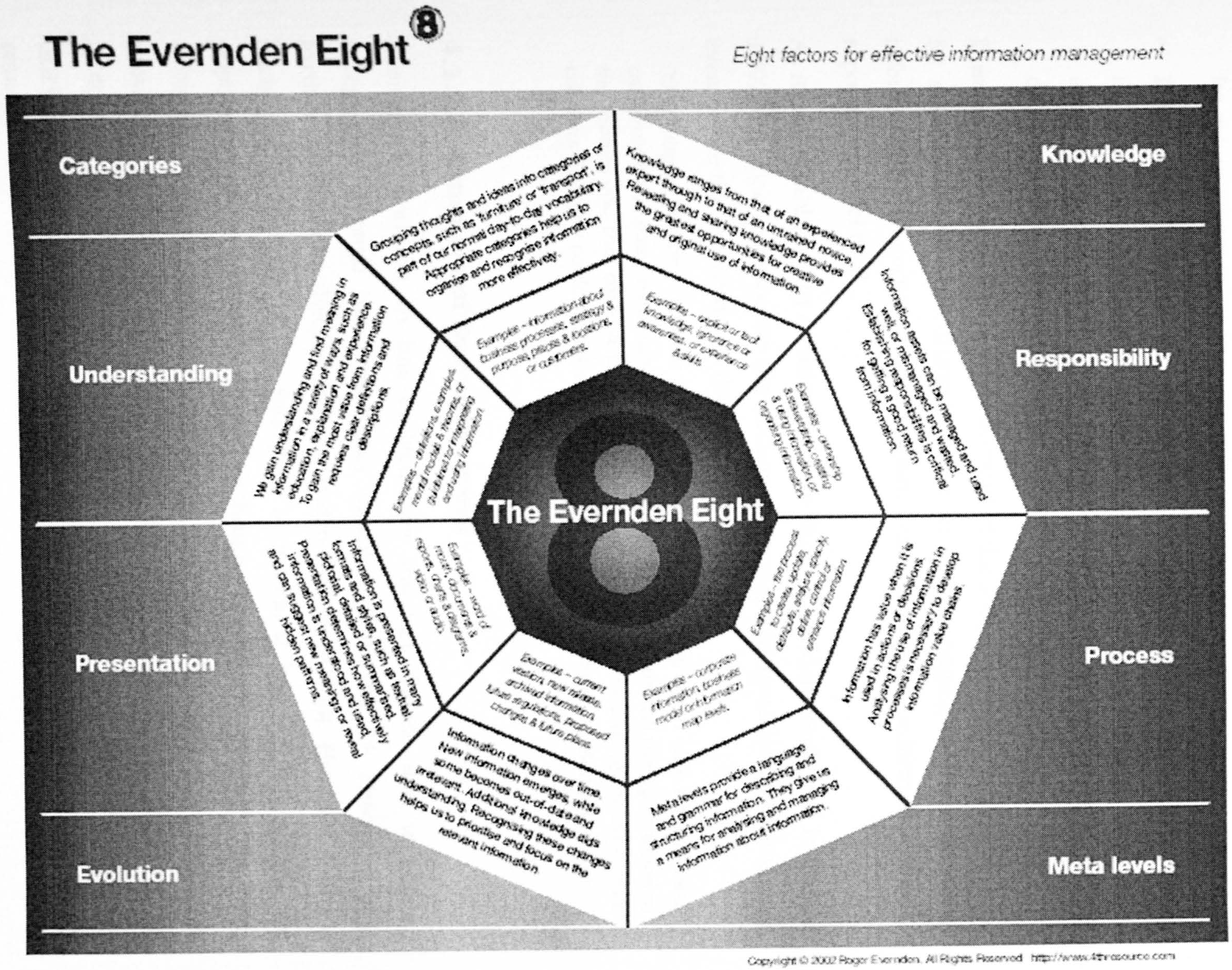


Fig. 4.4: The Evernden Eight, Available at: <u>*http://www.4thresource.com/downloads/evernden8.pdf*</u>

- **Dimension 6: Levels of responsibility** is related to the way an actor interacts with information, i.e. whether the actor is managing, controlling, wasting, etc. information. Explicit recognition of this relationships is critical for gaining most value from the information.
- **Dimension 7: Types of processes** refers to the stages if the information lifecycle that information goes through, i.e. create, update, distribute, analyse, specify, define, own, control, enhance. These are essential for the development of information value chains.

Dimension 8: Meta levels takes account of the language and grammar needed for describing and structuring information and managing information about information, e.g. corporate information, business model, information model, repository model et al.

As it was established in an interview with Roger Evernden conducted in August 1997, the idea to associate the domain concepts with meta levels was around even before the emergence of the Information Model.

> *"One way of thinking of these domain concepts is that they are a little bit like meta constructs: the basic meta concepts which are used to structure all the information in the framework, that could actually take all of the concepts across all of the difference columns and you could turn it into a meta model."* Evernden in Bobeva (1998)

4.1.2.3. Summary of Evernden's work

Evernden's work on IA has evolved over the last decade and is gaining recognition through his consultancy establishment, the 4th Resource, and further publications (Evernden & Evernden 2003a, 2003b). However, being a fairly young member of the family of IA works, it has yet not gained the popularity of its antecedent, the Zachman framework, neither has been subjected by third parties to a systematic empirical evaluation. This study has provided a critical evaluation of the work based on Evernden's publications, an interview with him and case study material posted on the 4th Resource web site (www.4thresource.com). A comparison of Evernden's work based on the above sources (Table 4.7) evidences that The Evernden Eight is the most complete of the three architectural frameworks. It also indicates that, same as with Zachman's work, terminology could present a problem to a person who is familiar with the previous work, as most of the original labels of the dimensions have been preserved, whilst the their connotation has changed.

The IFW (Evernden 1996)	WorkSpace International (1999)	The Evernden Eight (Evernden 2002)
1. Types of information	1. Types of information	8. Meta levels *(as larger categories/types)*
2. Levels of constraint		1. Types of information *(more detailed categories)*
	2. Levels of understanding	2. Levels of understanding
3. Content		
	3. Representations	3. Types of representation
4. Transformation over time	4. Transitions over time	4. Levels of transition
5. Ownership		*(could be one of the levels of responsibility / Dimension 6/)*
		6. Levels of responsibility
	5. Tacit/explicit	5. Types of knowledge
6. Methodology chain	6. Processes of using information	7. Types of processes
		8. Meta levels *(as language and grammar)*

Table 4.7: Information Architecture dimensions in Evernden's works (Based on Evernden (1996), WorkSpace International (1999) and Evernden (2002)).

Similarly to the Zachman' ISA, Evernden's earlier works for information architecture do not fully support inter-organisational electronic integration and inter-organisational information systems. It is the intention of this work to extend the above models on the basis of the Evernden Eight to address the requirements of e- business networks.

4.1.3. EVALUATION OF THE EXTENT TO WHICH EXISTING INFORMATION ARCHITECTURES MEET E-BUSINESS REQUIREMENTS

Sections 4.1.1 and 4.1.2 introduced the works of Zachman and Evernden as the most influential and sophisticated developments in the field of I(S)A. Architectural perspectives and principles of these analytical tools were discussed and compared in the search of similarities and distinctions.

This section introduces a mapping document (Table 4.8) to establish the extent to which the state of IA art, (Sections 2.1.2, 4.1.1 and 4.1.2), provides for the management information characteristics outlined by Periasamy & Feeny (1997) (Table 1.4) and supports the information needs of e-business alliances, as identified in Section 2.3 (Table 2.14).

Table 4.8. Addressing the requirements for e-business IA. (1 of 2)

The IA needs to enable the provision of information on:	Zachman's works	Evernden's works	Other Advanced IA (as in Table 2.8)
Business alliance characteristics			
Structural characteristics (as in Table 2.12)		✓	
Values shared by the formation		✓	
Expansion constraints			Environment
Ownership type			
Governance structure			
Trading mechanism			
Participant characteristics			
Participant 'hard' **characteristics**	✓	✓	Organisation/structure
Values of the participant	✓ (if documented in Strategy)	✓	Business rationale
Competencies	✓	✓	People
Relationship characteristics (as in Table 2.14)		✓ (through Levels of Responsibility)	
Business information characteristics:			
Information on product/service	✓	✓	Data
Management Information: (as in Table 1.4)	✓	✓	Data
Scope			
Aggregation level			
Time horizon	✓	✓	Time
Required accuracy			Environment
Usage frequency	✓	✓	
Class		✓	
Presentation media		✓	Presentation/ Decription
Form		✓	Presentation/ Decription
Nature		✓	
Overall emphasis		✓	
Location / placeholders of the information	✓	✓	
Ownership of the information	✓	✓	People
Description & analysis of business situations		✓	Solution/ Business function
Control /Access /Inf. visibility	✓	✓	Control & behaviour
Process flow	✓	✓	Process
Bounds		✓	

Table 4.8. Addressing the requirements for e-business IA. (continued) (2 of 2)

The IA needs to enable the provision of information on:	Zachman's works	Evernden's works	Framework component
Technical characteristics			
Application (as in Table 2.14)	✓	✓	Application
Operator of the platform	✓	✓	People
Technical link	✓	✓	Technology
Protocols	✓	✓	Systems Interface
Basis for the intra-org. integration	✓	✓	Systems Interface
Basis for the inter-org. integration		✓	Systems Interface
Standard type			
The IA needs to adhere to the following rules:			**Supported in**
The unit of analysis should be changed from a single organisation to a network of organisations			The Evernden Eight only
To focus on the description and analysis of business situations and less on the management of technology			Zachman's and Evernden's works
To provide for a relationship, rather than functional approach.			**No evidence**
To be modular to allow reconfiguring and adapting according to the changes in the environment.			All
To allow information to be distributed within the alliance with regards to space, time and functions.			All
To allow managing information and switching of partners with minimum cost and risk implications.			**No evidence**
Security tags to placeholders of the information, rather than to content, to allow continuous update and immediate access.			**No**

Based on this analysis it is apparent that currently few IAs support softer aspects of information, such as values, culture, ownership, and behaviour. These are inherent in system characteristics as interaction, interdependence and integration, as recognised by system studies. In search of further clarification on how such softer features should be represented in IAs for e-business alliances, relevant works in system thinking and system dynamics are discussed in the following section. Other conceptually related studies from the field of Software Engineering and business network analysis are also briefly reviewed there. These are going to be preceded by a more 'hard-oriented" view of IA, i.e. the one introduced in the field of website design.

The above observations lead to two propositions reflecting the need for softer components in IAs, which were subsequently discussed with the participants in the primary research:

P1: In a networked environment the data needs to carry some **contextual tags** (based on the role of the information user), e.g. ethical and organisational issues, to inform the user of the **physical and situational context**.

P2: IA needs to cater for information behaviour (events, transformation, next stage, current/up-to-date).

4.2. OTHER RESEARCH WORKS RELEVANT TO INFORMATION ARCHITECTURE

> *"It will be a challenge for many IT organisations to service this need as it requires mastery of disciplines outside the compass of most IT professionals."*
>
> Benjamin and Blunt (1992)

This section references works in several disparate research areas that introduce concepts, features, problems and principles related to information and its use. It is envisaged that with the IS being a multi-disciplinary area, new views and ideas could come from other IS research areas such as web design, systems thinking and virtual team management, would instil fresh ideas to help the further development of IA knowledge to allow to inform the gap illustrated in Table 4.8 between what is required for IA for business networks and what is currently provided by the IA reviewed. It is not the objective of this study to provide in-depth introduction to the theories and models used as a basis for the proposed IA for e-business networks, but to discuss how they could be related to IA. Nonetheless, tables and figures are included to highlight the essence of these works. This familiarisation with the related works is considered to be an important factor for understanding of the grounds for the expansions of IA framework suggested in Chapter 5.

4.2.1. IA MODELS INFLUENCED FROM THE WEB DESIGN SCHOOL

At the American Society for Information Science (ASIS) Summit on Defining Information Architecture in 2000 several models of information architecture were presented, of which two are of particular interest to this research, these are the model proposed by Louis Rosenfeld , president of Argus Associates, and this developed by Denn and Maglaughlin (Denn & Maglaughlin 2000).

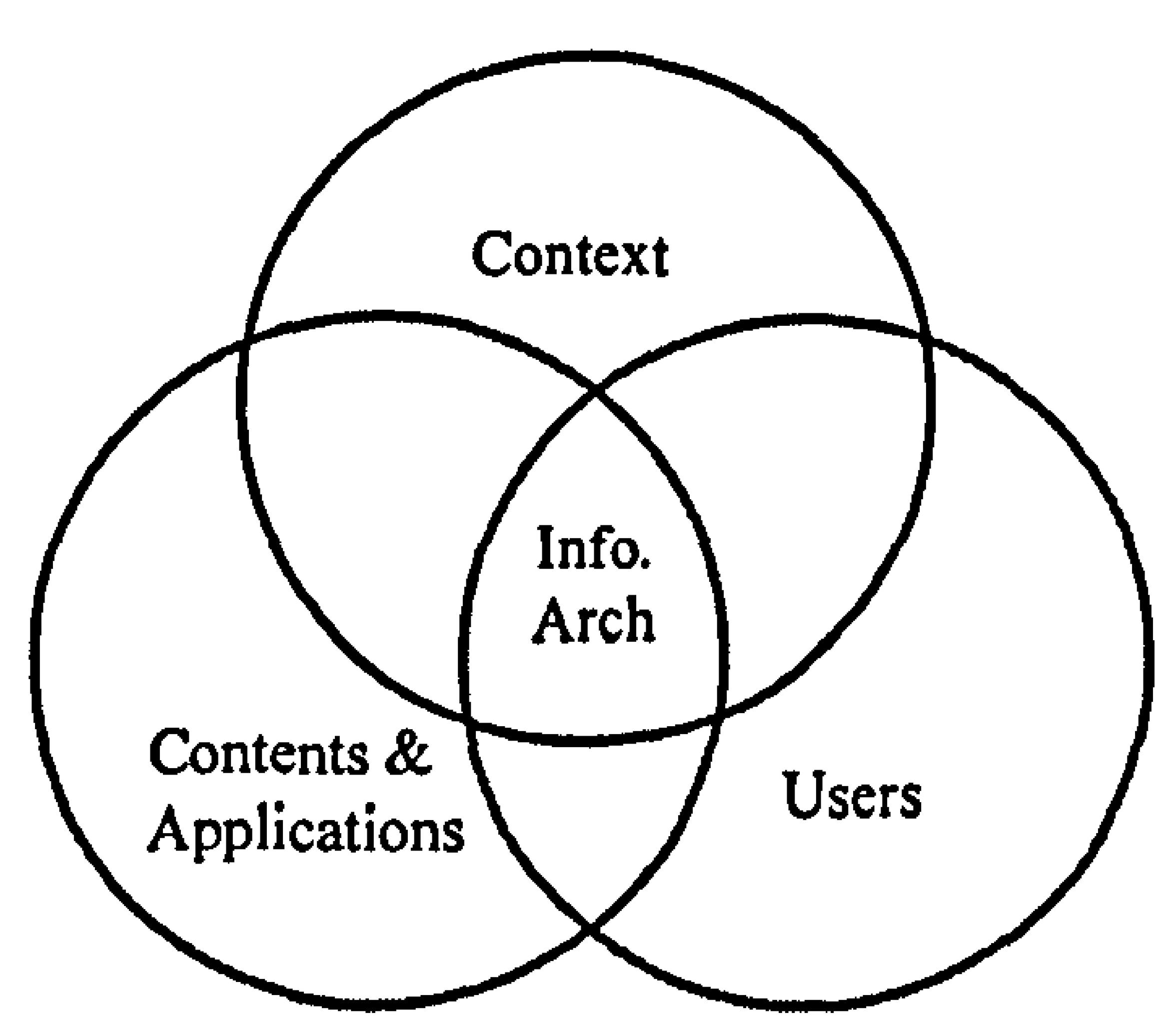


Fig.4.5: Louis Rosenfeld's model of Information Architecture (Denn & Maglaughlin 2000)

Louis Rosenfeld's model (Fig.4.5) represents information architecture as the intersection of three major perspectives, namely the content and applications included in the architecture, the users who will be using the architecture and the context (including business goals, politics, culture, etc.) in which the architecture exists.

Denn and Maglaughlin used this model as a starting point for an IA model-building exercise seeking the views of the 300 participants in the ASIS'2000 summit to produce a single model of information architecture that "*would be simple enough to be easily understandable yet complete*" (Denn & Maglaughlin 2000). The outcome of the exercise, validated with participants in the event, was the Information Architecture model v0.01 (IAMv001) (Fig.4.6).

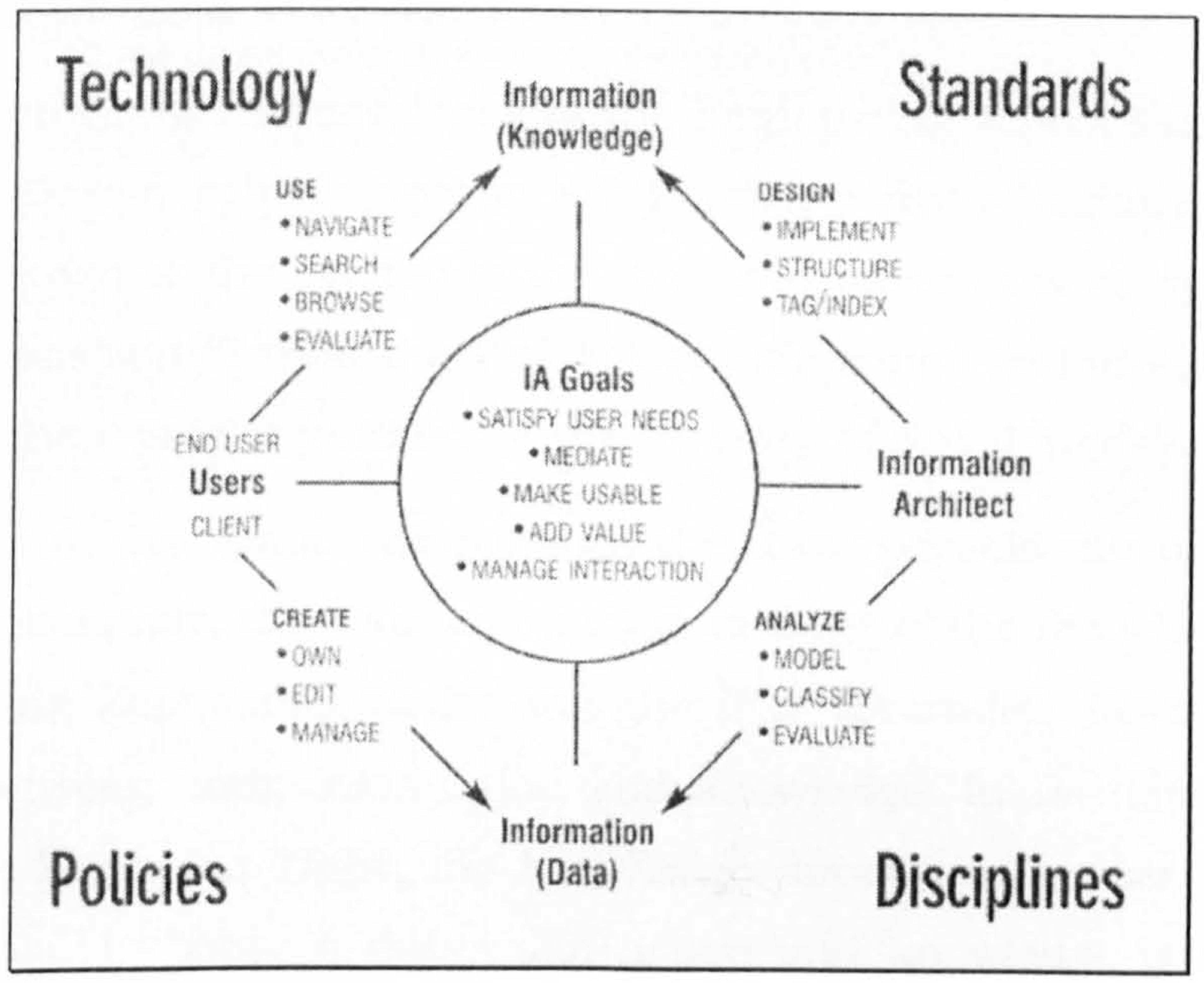


Fig.4.6: Information Architecture model v0.01 (Denn & Maglaughlin 2000)

The IAMv001 is a two dimensional model, where the horizontal axis represents the people involved in information architecture, with the users on the left and the people involved in building and managing the architecture, the information architects, on the right. Two larger groups of users are identified, i.e. the client for whom an information architecture is developed, and the end users of that architecture.

The vertical axis represents the different types of information, with data (raw information) at the bottom and knowledge at the top.

Further, the quadrants within the model represent the kinds of operations that the people perform on the information, i.e. Create, Analyse, Design and Use, each of which is decomposed into several sample activities. At the side of each quadrant, but not related to the content of this particular quadrant only, are the facets of the context of the architecture, namely technology, standards, policies and disciplines. These are recognised to influence the architecture process, but indirectly.

A distinctive feature of this work is the inclusion of the goals of the completed architecture. These are pictured in the centre of the model, at the intersection of the vertical and the horizontal axes.

4.2.1.1. Web design models and Information Architectures from the Engineering school

The IA architecture models developed in the Engineering school (Section 2.1.2) and the Web Design school (Section 4.2.1) are relatively similar. One could immediately recognise the overlap of the data and technology components. As there is no discussion of what the Technology component includes, it could be assumed that there is an agreement in the coverage of this dimension.

With regards to the Data component, the two schools introduce some variations. For example, the Data abstraction in most of the models in the first school, including Zachman's works and the IFW (Evernden 1996), does not differentiate between data, information and knowledge. In the latest work of Evernden, The Evernden Eight, the Knowledge dimension appears, although still the relationship between data, information and knowledge is not clearly presented. A point to note in the IAMv001 is that knowledge is described as structured information (only), which presumably insinuates that the structure imposed on the data reflects the experience and expertise of the information architect who created it.

It is difficult to ascertain what is the equivalent to the quadrants in the IAMv001. Immediately one could think of the Function abstraction in Zachman's Framework, and this would have been true if only this abstraction were not representing the business processes. The more appropriate match seems to be the Perspectives dimension. Hereby the following correspondences are observed:

- The Create quadrant that includes the Own, Edit and Manage activities corresponds to the Planner's perspective and in certain cases to the Owner's dimension.

- The Analyse quadrant with core activities being Model, Classify and Evaluate, is analogous to the Owner's perspective where a high-level information model is created.
- The Design quadrant with the Implement, Structure and Tag/Index activities is corresponding to the Designer's perspective and to the Builder's perspective.

As Zachman's Framework does not incorporate User's perspective, the Use and Create quadrants are not fully represented in the above listed perspectives.

The IFW (Evernden 1996) presents a better equivalent to the IAMv001 quadrants in the face of the Workflow column. Similarly, the Responsibility and Type of process dimensions in The Evernden Eight offers true correspondence to the quadrants.

The Users component in IAMv001 is not explicitly identified in the any of the architectures from the Engineering school, although it could be assumed that it is partially covered by the People sub-architecture. The Information Architect component in the IAMv001 is covered both by the People abstraction and the Perspectives dimension in Zachman's Framework and in the Structure column in the IFW (Evernden 1996).

Three context facets in the IAMv001, Policies, Disciplines and Standards, are segregated in lesser extent in the works from the Engineering school. It could be argues that they are partially represented in the Strategy and Interface column in the IFW. However, they do not have a corresponding component in Zachman's Framework, not even in its Motivation abstraction.

Denn and Maglaughlin (2000) acknowledge further deficiencies of their work:

> *"we believe that we needed more than one model of information architecture or a model with multiple dimensions, depending on the perspective from which you are approaching it."*

They recognise some of these perspectives as being:

- The presentations of IA (what an IA looks like)
- Processes for building an IA
- Relationships among stakeholders involved in IA
- Place in overall system design
- Staff positions contributing to IA development, use and management.

The first two have already been introduced in Evernden's works in the form of the Types of representation and Methodology chains, respectively. These and the rest of the perspectives proposed in the web-version of IA are going to be considered when designing the IA for e-business networks (Chapter 5).

4.2.2. IA AND SYSTEMS THINKING

Systems view has been adopted by writers and researchers in ecology, anthropology and organisation and management theory, e.g. Kenneth Boulding, Herbert Simon, Stafford Beer, Talscott Parsons, James Miller, Russell Ackoff, Peter Checkland et al. The common thread in their studies is the holistic perspective that allows them to build upon the diverse knowledge from relevant disciplines and apply this knowledge when conducting analysis. In the field of management studies, this translates into viewing an organisation as a living organism, rather than as a mechanistic model. It is recognised that a Systems stand implies subjectivist views, which are contradictory to the epistemological foundations of post-positivism. This study, however, does elude its post-positivist views, but refers to the Systems Theory fundamental models in search of an inspiration for new ideas for a more comprehensive way of structuring the softer information needed in strategic alliances.

In the 1940's Ludwig von Bertalanffy proposed General System Theory (GST).

> *"Its subject matter is formulation of principles that are valid for "systems" in general, whatever the nature of the component elements and the relations or "forces" between them"* von Bertalanffy (1968)

Emery (1981) argues that Von Bertalanffy's search for dynamic principles that are common to all kinds of systems, living and mechanistic, has been preceded by Koehler's work on open and closed systems and by Angyal's work on the holistic principles and concepts of systems. Kast and Rosenzweig (1972) identify references arguing that the philosophical roots of the General Systems Theory go back even further, to the systematic thoughts of the German philosopher Hegel (1770-1831). Similarly, Checkland (1999) traces this back to holistic thinkers such as Aristotle and Marx.

There is an on-going dispute on conceptualising systems thinking, Systems Theory and General Systems Theory, emphasising on the ontological and epistemological differences in the views of their proponents. Provost (2003) defines Systems Theory as a deductive principle of mathematics and with regards to the General System Theory, he quotes Mesarovic explaining that:

> *"General System Theory uses the weakest mathematical structure which is compatible with the intuitive meaning of the concept."*

Checkland (1999) recognises that the problem with GST is that it pays for its generality with lack of content and argues that although the project of the development of a mathematically expressed general theory of systems has failed in its application, the development and use of systems ideas has flourished. Emery (1981) established some of the reasons for the wide-spread adoption of General Systems models being the *"apparent determinateness"* they provide to natural and social scientists. GST adoption in other fields of science has been driven by similar motives.

As outlined earlier, System Thinking and System Practice do not form the core of this thesis; hence, only relevant parts of three prominent works in the Systems studies field are briefly reviewed below in search of theoretical basis for any proposals for new perspectives and abstractions in information architectures. These are root definitions and the CATWOE activity model in Checkland's Soft Systems Methodology (SSM), Beer's Viable System Model (VSM) and Forrester's systems Dynamics Model (SDM). It is deemed that the way they have mastered to classify, explain and graphically present complex system issues that have sustained the test of the time are beneficial for any further developments in Information Architecture. It is not the purpose of this study to present an in depth analysis of these complex theories, rather than to highlight key points that confirm the need of certain architectural components in information architectures.

4.2.2.1. The root definitions in SSM (Checkland & Scholes 1999)

The root definitions are sentences describing in depth transformation that takes place in systems. Checkland (1976, in Checkland & Scholes 1999) suggests that well formulated root definitions should be structured around the six core characteristics of the human activity system, i.e. the CATWOE elements (Fig. 4.7). He further argues that a root definition built in such manner will be rich enough to form the basis of a conceptual model of the system.

- C (Client) – The victims or beneficiaries of T;
- A (Actor) – Those who would do T;
- T (Transformation) – the conversion of input to output
  (To do X by Y to achieve Z, meeting Efficacy, Efficiency and Effectiveness criteria);
- W (Weltanschauung) - The world view which makes this T meaningful in context;
- O (Owners) - Those who could stop T;
- E (environmental constraints) – elements outside the system which it takes as given

Fig. 4.7: The CATWOE mnemonic (Checkland & Scholes 1999)

The enterprise and the business network are driven by the human activity system, which is a fact recognised in one of the fundamental works on Information Systems Architecture (Sowa & Zachman 1992a). The information used in these systems undergoes transformation, some of which might not be recorded explicitly, but could be done verbally (particularly true for non-computer-based information systems). The Information Architectures developed for business systems facilitated by electronic communications are already taking into account the specifics of the technological infrastructure, to the extent that these have been unanimously agreed. There are no disputes on whether Technology is a part of the infrastructure and context or of the architecture of the information itself. However, the reviewed IA works do not inform as well of the softer factors in information infrastructure. Furthermore, they omit to recognise that when replacing verbal communications with electronic communications much of the information context (also a substantial part of the information that is exchanged) is lost.

Herewith it is argued that information architectures for electronically mediated business systems should inform of contextual information such as the core components of the human activity system. It is noticeable that the information architectures reviewed earlier already underpin only three of the six CATWOE elements of Soft Systems. Thus,

- A (Actor) is represented in the People abstraction ;
- T (Transformation) is grounded in the dimension Levels of Transition/ Transformation and also partially covered by the Function, business process abstractions in the dimension Types of Information;
- E (Environmental constraints) is the most difficult system characteristic to map, for as identified earlier, the environment could involve technology, i.e.

be represented by the widely recognised Hardware, Software and Communications abstractions, as well as not so popular abstractions such as Policies, Standards, Business objectives and Organisation/structure.

The rest of the components, i.e. the C (Client), W (Weltanschauung) and O (Owner), do not have architectural foundations even in the Advanced Information Architectures. Being aware of the larger picture is something that is particularly important in distributed environments, where actors should not only be skilful to perform their imminent tasks, but should also be able to make informed judgements on the information they use and the quality of their work. To accomplish this successfully they would need access to further contextual information as the one currently provided on technology and organisational strategy and structure lacks to address aspects such as ownership and previous experiences (as a reflection of the worldviews). This is one of the major differences with Zachman's work that implies tight specialisation and argues that actors at the lower organisational levels do not need to be aware of the larger picture.

Amongst the rest of the architectural works discussed in this chapter, the IAMv001 provides the CATWOE C (Client) element in its component Clients. However, it is not as clear whether or how it supports the W (Weltanschauung) and O (Owner), although it could be argued that the Information (Knowledge) end of the Information continuum informs the W (Weltanschauung).

The Evernden Eight architectural model, however, fully supports the W (Weltanschauung) element through its dimensions Levels of understanding and Types of Knowledge. Similarly, the O (Owner) has its architectural foundation in the Levels of Responsibility dimension.

Checkland (1999) further suggests that a model of a system should include not only the necessary activities, but also the processes of monitoring and control that strive to ensure that the system could survive in a changing environment. This extended view of system's processes is not recognised in neither of the architectures reviewed earlier. The closest notion is the contextual information on Policies, Standards and Disciplines, suggested by the IAMv001. The understanding in this study is that an information architecture as the foundation for managing information has to accommodate monitoring and control and this new component has to be related to the abstractions in the Business view, if not being a separate abstraction in that view.

4.2.2.2. Beer's Viable System Model (VSM)

The Viable Systems Model (VSM), developed by Stafford Beer, is a comprehensive theoretical model defining the organisational prerequisites for the viability of systems. The model identifies that any organism or organisation that is *"capable of maintaining its identity independently of other such organisms within a shared environment"* (Beer 1984) needs to possess five functions which he calls System One to System Five (Fig.4.8). Beer has also developed a set of principles and laws describing how the systems interact with each other and with the environment and guarding against vulnerability.

The VSM has been widely recognised as a conceptual model applicable to information systems design and management (Espejo 1989; Jackson 1988; Freed 1996). Similarly to other models (Galbreith (1973) cited in Jackson 1988) it recognises that each organisation is an information-processing system, not just having one (Freed 1996).

⇒ **System One** (Produce) consists of various viable autonomous parts of an organisation and produces the viable system of which it is part.

"In a recursive organisational structure, any viable system contains, and is contained in, a viable system." Recursive System Theorem (Beer 1984)

⇒ **System Two** (Anti-oscillatory) is about co-ordination. It is necessary to ensure the integrity of the components of System 1 via information and communication.

⇒ **System Three** (Inside and now) is a control function establishing overall stability among basic units of the organisation. It must ensure that System 1 implements policy effectively resource allocation, providing for synergies;

⇒ **System Four** (Outside and Future) is the intelligence function that brings together internal and external information. It deals with long term and overall outside environment, diagnosis and modelling of the organisation in its environment and switches information between System 5 and the lower-level systems.

⇒ **System Five** (Policy) is responsible for balancing the internal and external demands as represented in the requirements of Systems '3' and '4'. It must also represent the ethos of the whole system profile to any wider system, of which it is part.

Systems 2-5 comprise the management "meta-system".

Fig. 4.8: The VSM Systems according to Stafford Beer.

Although this study on Information Architecture is not going to engage in depth with the VSM, the core architectural principles of the VSM have been reviewed in the context of building an Information Architecture for Business Networks and as a result, the following two observations related to the vertical and horizontal specialisation are made:

(1) The VSM with its recursive ability copes well with horizontal and vertical interdependencies within a system. Similarly, any IA framework for business networks should be recursive, which will allow to reflect the vertical interdependencies displayed within the business network. When applied to business network scenarios, the business network itself represents the viable system at the root of the hierarchy and the participating organisations, the network nodes, are the various viable autonomous parts of System One. In a similar pattern each of the business networks nodes could be viewed as a viable system, too, as the Recursive Systems theorem (Beer 1984) states, and as such, could be considered as a cohesive organisation of the five VSM systems presented in Fig.4.8. Each viable system (i.e. business network or a node in the business network) has its own information architecture, where the five VSM systems are represented with appropriate perspective or abstractions. The IA reflects the vertical interdependencies of the system hierarchy.

(2) Parallel could also be drawn between the I(S)A and the VSM, based on the notion of horizontal interdependence. In the VSM Systems Two, Three, Four and Five form the organisational meta system, that is responsible for integrating and guiding the parts of System One. Similarly, if cognate relationships are drawn between the perspectives and abstractions in information architectures and the five sub-systems constituting a system, within an information architecture there might be dominating perspectives/abstractions that are defining further a core perspective/abstraction. This would enable to differentiate any components relating to the infrastructure and context of the information that need to be delivered as part of the information architecture.

With reference to meeting the information needs of the five supporting systems, it could be argued that the most common perspectives in the information architectures (Section 2.1.2.3, Table 2.8), i.e. Data, Applications, Hardware, Network and People, could be viewed as descriptors of the parts of System One (Produce). Such a viewpoint would affirm their position as core components. It difficult to establish whether Beer's Systems Two, Three, Four and Five that refer to the business functions of co-ordination, control, intelligence and policy (Espejo 1989) could be represented in an information architecture by the Function abstraction. The latter is a highly disputable IA component, for, as it was mentioned earlier, its scope is very loosely defined, often covering both business functions and business processes. The position taken in this study is that the I(S)A component Function stands for the business processes within System One and does not include the management 'meta-system'. However, there are I(S)A works that meet closer the needs of the above mentioned meta-systems, e.g. Control & behaviour (Van Swede & Van Vliet 1993) and Environmental factors (Patterson 1994). However, no evidence was found on any more recent development in this area. Considering Espejo's observation that Beer's model advocates that

"in truly effective organisations, policy, intelligence, control, coordination and implementation are distributed at all levels" (Espejo 1989),

it is assumed that, if represented, these components would enjoy similar popularity across the I(S)A works as, for example, the Data component. However, as pointed above, most current I(S)A works have only elements supporting the implementation function (i.e. System One), but do not have components/dimensions related to the management 'meta-system', which is an issue that has to be addressed.

4.2.2.3. Forrester's Systems Dynamics Model

System dynamics is a discipline that

"combines the theory, methods, and philosophy needed to analyse the behaviour of systems in not only management, but also in environmental change, politics, economic behaviour, medicine, engineering, and other fields." (Forrester 1991)

Forrester (1991) argues that system dynamics covers *"most of what most people find important."* Similar to the CATWOE model (Checkland & Scholes 1999), the work of Jay Forrester on System Dynamics also points that the current works of IA lack perspectives/abstraction that provide for managing system transformation and the results of it.

Forrester recognises that whilst information about the parts of a system is readily available, there is limited representation of the changes this information undergoes over time. To address this issue, he suggests three classifications of information – the mental data base, the written data base and the numerical data base (Forrester 1991) (Fig.4.9). He explains how the quantity, richness and reliability of the information decreases when moving down from the largest pool of information, i.e. the mental data base to the smallest data base, i.e. the numerical one.

Conversely, the ease of exchanging information and, hence, the availability of this information increases when moving down to the numerical data base.

"Missing from the numerical data is the direct evidence of the structure and policies that created the data."
(Forrester 1991, p.25)

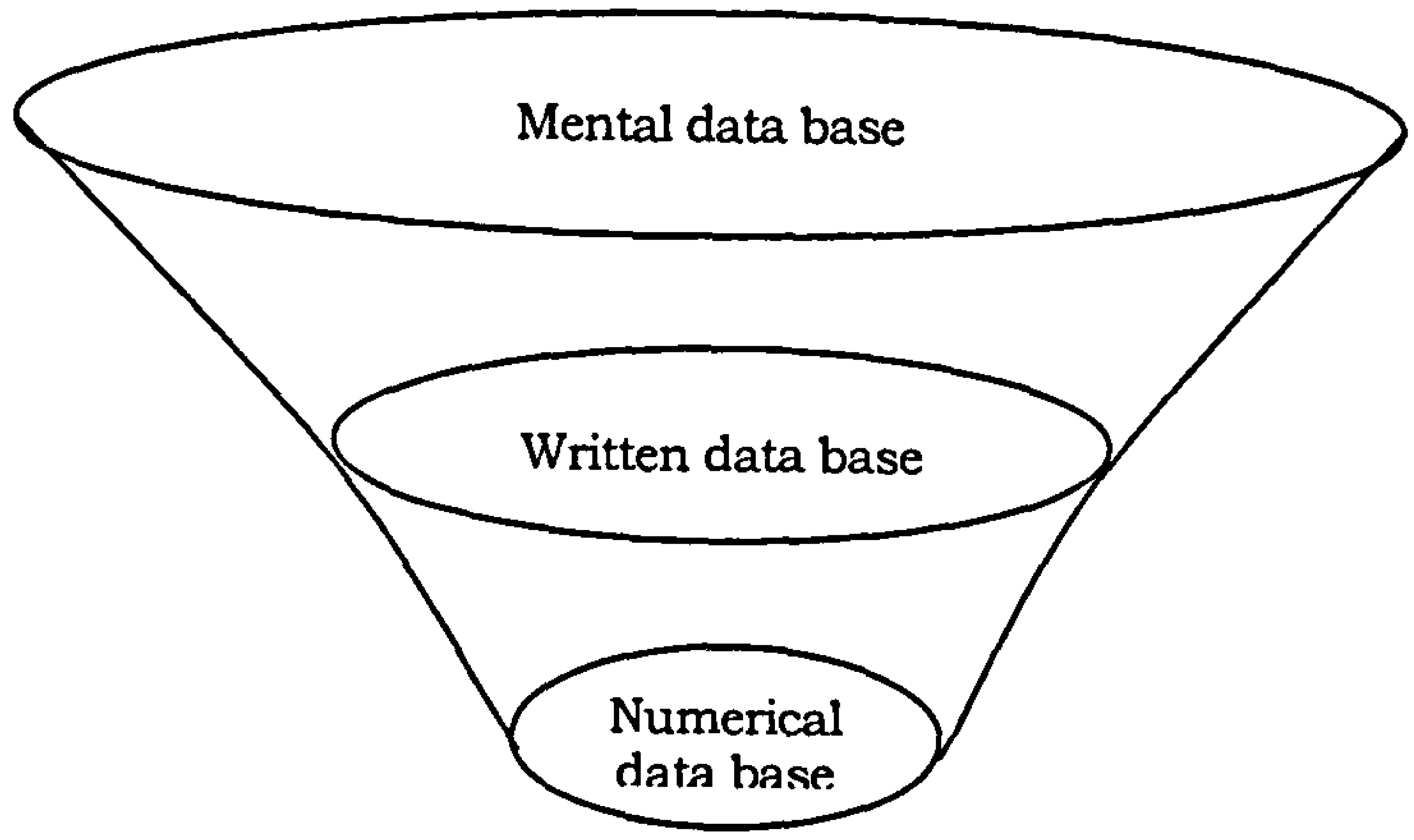


Fig.4.9: Decreasing information content in moving from mental to written to numerical data base.
(Forrester 1991, p.23)

Currently I(S)A is a part of the written database, either numerical or not, but its ultimate goal is to model the mental data base. In an e-business environment the danger is that there will be further reduction in the information content, as the information needs to be codified in order to enter the numeric database. Alternative measures need to be put in place, to ensure that any lost content is substituted appropriately.

Although it is unrealistic to think that all aspects of system dynamics could be covered by Information Architecture, expansions of current work could be considered to accommodate more perspectives to reflect the behavioural expectations and the actual behaviour. By doing this, the IA will provide for reducing the discrepancies between the observed structure and policies, the intuitively expected behaviour and the actual behaviour. Furthermore, this will enable the analysis of the use of the information based on the collected historical data, which could in turn lead to the amendment of the structure and policies (and the information on them) to provide for better system performance.

4.2.3. IA AND SOFTWARE ENGINEERING

The IA for business networks will be used for integrating the information resources of electronically-mediated business alliances. As such, the theoretical and empirical work in the field of software engineering could serve as another source for identification and justification of I(S)A perspectives/abstractions. Amongst the best practices that could be considered are:

- Standards and regulations, e.g. ISO9001 – for identifying new perspectives/abstractions
- version control - for enhancing the work on the transformational aspects
- integration testing – for horizontal alignment of the information architectures of the business units in a business network
- object-orientation inheritance principles – for ensuring vertical interdependencies within a business network.
- analysis of the software development problems - Kovitz (1999) describes five problem domains: Information problem, Control problem, Transformation problem, Workpiece problem and Connection problem (Table 4.9). Jackson (2001) furthers the work by proposing five problem frames corresponding to the types of requirements. It could be speculated that the large scale patterns of software problems they describe, are related to insufficient information given to the developers, which reinforces the need of certain information characteristics that are currently missing from I(S)A frameworks.

Requirement	Description	Problem frame
Queries	Requests for information about some part of the problem domain	Information
Behavioural rules	Rules according to which the problem domain is to behave	Control
Mappings	Mappings between data input to and output by the software	Transformation
Operations on realized domains	Operations that users can perform on objects that exist only inside the software	Workpiece
Correspondence b/n domains	Keeping domains that have no shared phenomena in corresponding states.	Connection

Table 4.9: Five different problem frames, based on Kovitz (1999, p.73)

Some applications already provide statistics on document management and use that on demand could give users information about the context and infrastructure of the work. (Fig.4.10 and Fig.4.11). Usually these are implemented to reflect industry standards and requirements and the provision of these resides with the vendor of the application and the vendors of system development platforms. The identification of these is a result of pragmatic heuristic evaluation, rather than of a theoretically grounded systematic study. This study provides a bridge between the best practice in industry and analytical tools for managers, such as the I(S)A frameworks.

Received: from mailgate.immense-isp.com (mailgate.immense-isp.com [121.214.11.102]) by mailhost3.immense-isp.com (8.8.5/8.7.2) with ESMTP id LAA30141 for <tmh@immense-isp.com>; Tue, 18 Mar 1997 14:41:08 -0800 (PST)
Received: from firewall.immense-isp.com (firewall.immense-isp.com [121.214.13.129]) by mailgate.immense-isp.com (8.8.5/8.7.2) with ESMTP id LAA20869 for <tmh@immense-isp.com>; Tue, 18 Mar 1997 14:40:11 -0800 (PST)
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Received: from mail.bieberdorf.edu (mail.bieberdorf.edu [124.211.3.78]) by firewall.bieberdorf.edu (8.8.5) with ESMTP id LAA61271; Tue, 18 Mar 1997 14:39:08 -0800 (PST)
Received: from alpha.bieberdorf.edu (alpha.bieberdorf.edu [124.211.3.11]) by mail.bieberdorf.edu (8.8.5) id 004A21; Tue, Mar 18 1997 14:36:17 -0800 (PST)
From: rth@bieberdorf.edu (R.T. Hood)
To: tmh@immense-isp.com
Date: Tue, Mar 18 1997 14:36:14 PST
Message-Id: <rth031897143614-00000298@mail.bieberdorf.edu>
X-Mailer: Loris v2.32
Subject: Lunch today?

Fig.4.10: Reading Email Headers (Lucke 1997)

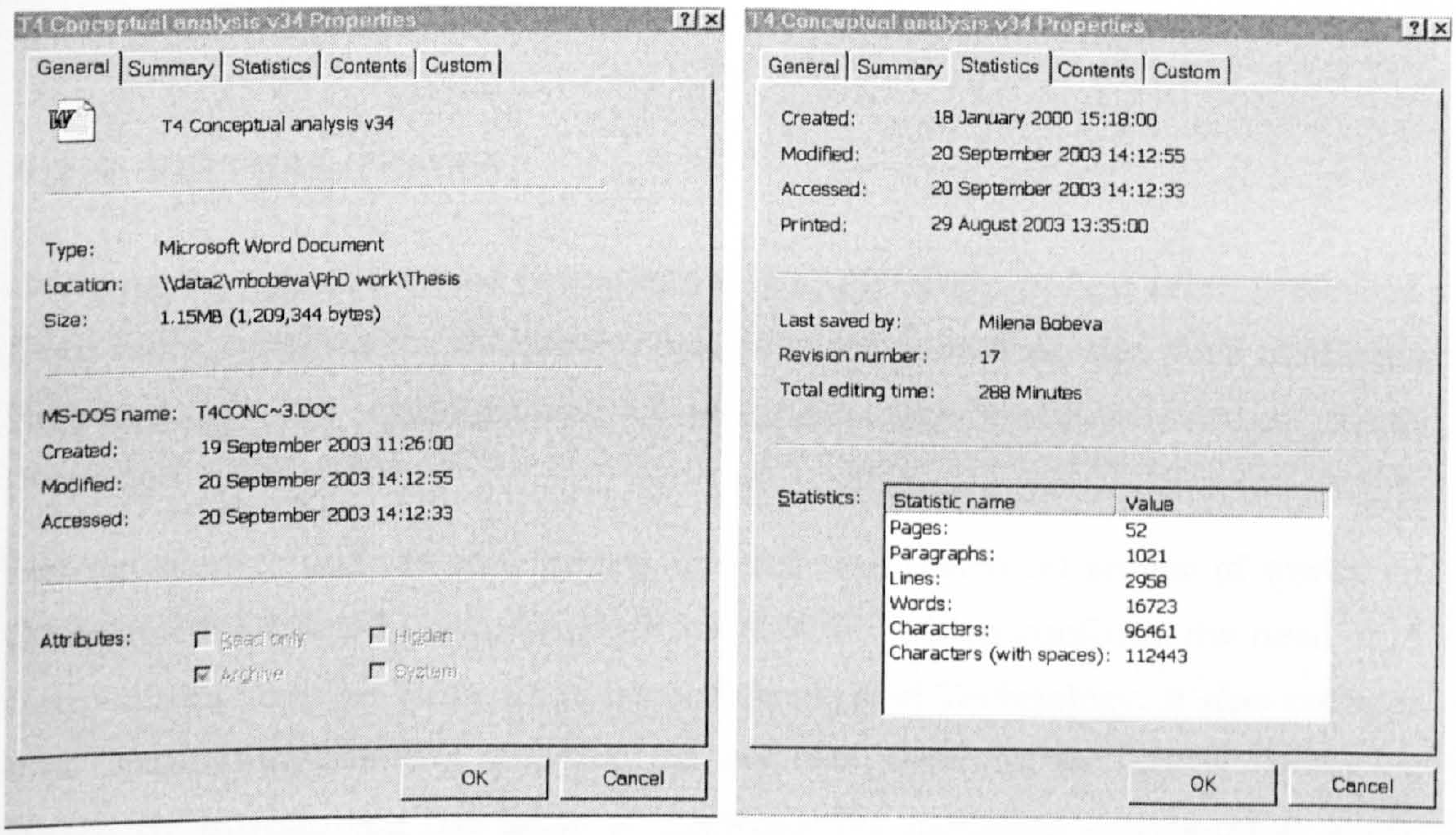


Fig.4.11a: Document statistics - Microsoft Word

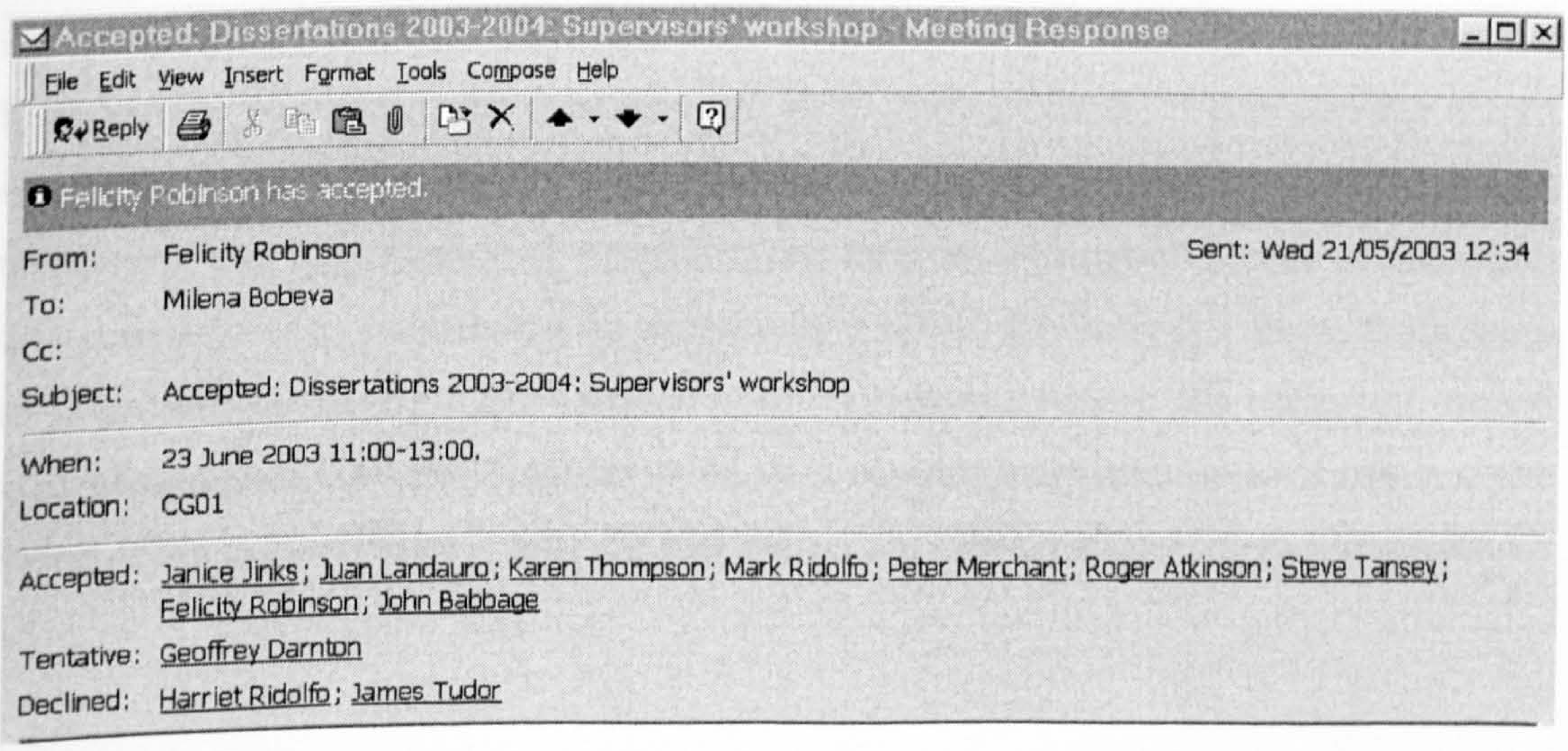


Fig.4.11b: Document statistics – MS Outlook

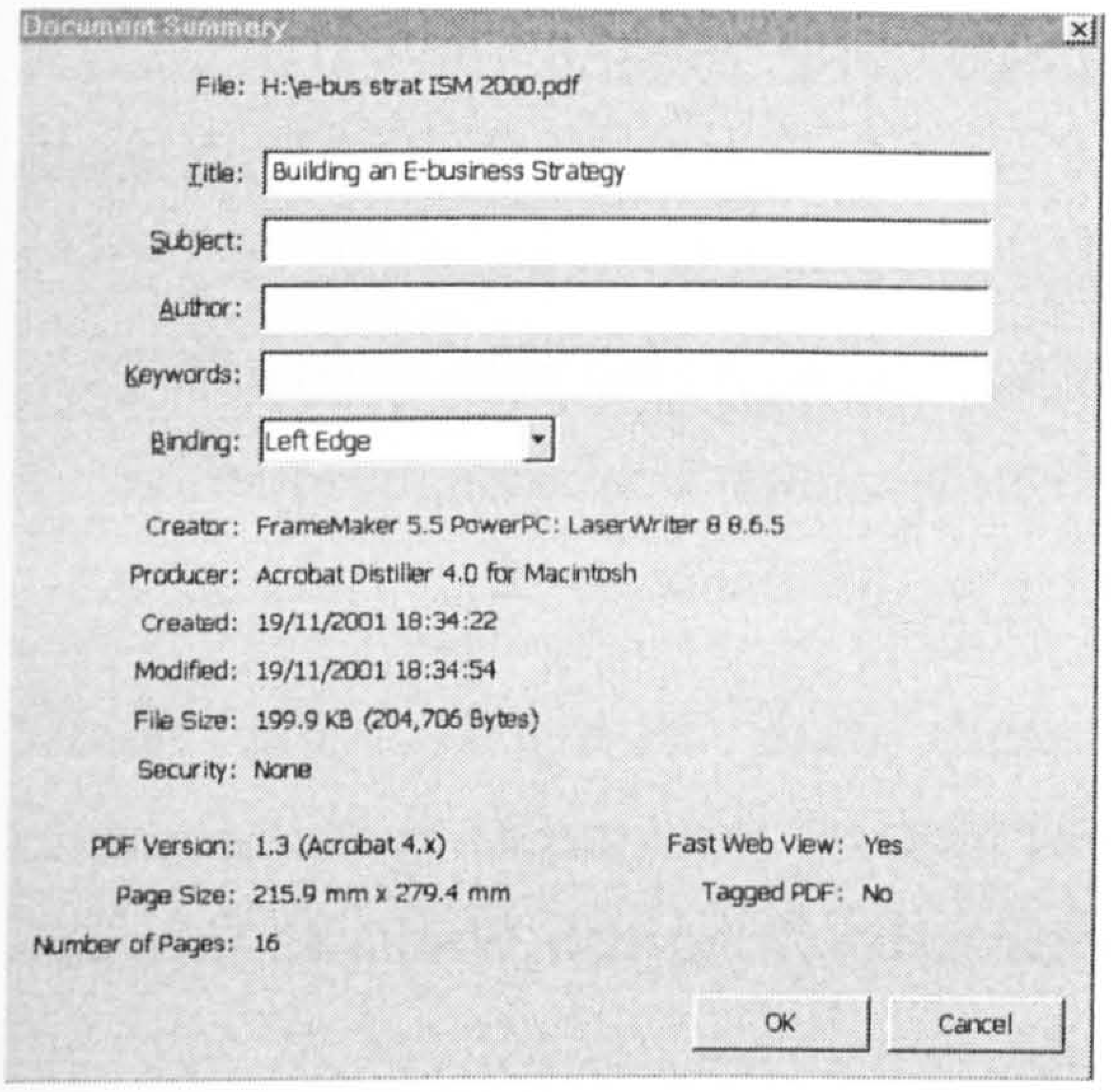


Fig.4.11c: Document statistics - Adobe Acrobat

4.2.4. VIRTUAL TEAMS

Bringing the topic of virtual teams into this study might at first seem irrelevant. Even more, because the discussion here is based mostly on the work of Martha Haywood on the management of geographically-distributed/virtual teams (Haywood 1998, 1999).

The decision to include this subject domain was based on review of works on Computer-Supported Co-operative Work (CSCW), which confirms the need of IA components such as Time, Behaviour, Process and Technology. It also outlines that Ownership, Sharing and Context are also essential for CSCW (Hollocks, 2002). By introducing the issue of electronically mediated collaborative work, this paper aims to raise awareness firstly of the opportunity to use other research areas such a Management Studies, as a basis for reviewing the healthiness of existing IA frameworks, even though these other studies might not employ the term 'information architecture' at all. Secondly, such research reinforces the importance of revisiting the information architecture to establish any amendments postulated by the changes of the working patterns, from face-to-face communication to distance communication where the physical, social and situational context of all involved in a certain business activity are not the same. This is particularly true for electronically mediated business networks.

Haywood (1998) outlines four principles of effectively communicating at a distance:

"1. Standards for availability and acknowledgement were defined and respected;

2. The team members replaced lost context in their communications;

3. The team members regularly used synchronous communication;

4. Senders took responsibility for prioritizing communication."

Whilst she recognises that these principles are independent of the communication technology, the first two are related to issues that appropriately designed IA could deliver. Furthermore, Haywood outlines the relationship of the type of availability standards appropriate for a team member with the person's of group's job role, the latter already being recognised as a component in IA, i.e. the People abstraction in Zachman's Framework. Taking the issues of standards a step further, it could be argued that knowing the standards for data, process, network et al, would replace some of the physical and situational context of the particular task that

"... many forms of electronic communication can reduce, eliminate or distort"

(Haywood 1998).

The third principle highlights the issue of trust and the importance of the social context. The latter is possibly the most difficult one to digitise, as it is grounded in tacit knowledge. However, as Haywood argues, provision of availability standards sets a foundation for establishing trust amongst team members and organisations, which in turn could influence positively the success of a project.

The fourth principle for effective distance communication is related to the prioritising of communication. Having a common understanding of the priority of communications media is also considered as a standard that ensures team integration and trust. These standards depend on the context of the network in general and impact the time management (the Time abstraction) and the performance, in general, of the business network.

Haywood affirms that building a good infrastructure for a distributed team involves technology, policies and processes. In relation to the latter she introduces the issue of corporate memory and defines it as

"...whatever systems your team has in place to retain the knowledge to repeatedly manufacture you r product or perform your service."

Haywood (1998)

Further, she argues that

"Processes must be defined, documented, and placed in a corporate memory system before an organisation can repeatedly build a product or provide a service."

This notion of corporate memory aligns with one of the perspectives of IA introduced by Evernden in the Evernden Eight IA framework, namely the Evolution one. However, an organisation could only provide for building a corporate memory like a series of snapshots of IA. Haywood (1998) recognises that

"In reality our communication can't be successful unless the receiver acknowledges, understands and acts on the information."

Respectively, the role of IA could be only as a foundation for enhancing the understanding of the information that will inform for better operation and decision making.

The arguments related to the corporate memory could trigger associations with research in Knowledge Management (KM). Although it would considered whether to explore how KM researchers see the relation between IA and KM, given the research constraints, this subject domain that was not included in this study. This is an option that could be explored in future IA studies.

Reflecting on the brief outline of the relationship of Haywood's research with IA, it is recognised that there are numerous studies in the field of computer-supported collaborative work, virtual organisations, distributed systems, organisational behaviour, et al., that are likely to provide similar and further ideas and justifications of any pending expansions of IA frameworks. However, thorough review of these and related research areas will prove to be blurring the focus of the research and be impractical in terms of the time deadlines. It is proposed that future research studies address the issues of how research in any of these particulars area impacts on the development of IA.

4.3. CONCEPTUAL ANALYSIS: SUMMARY

This chapter critically reviewed the most detailed and publicised IA frameworks, these of Zachman and Evernden and establishes that the newest of the reviewed works, Evernden's work, incorporates the essence of the rest of the set of Advanced IA tools and provides a sound foundation for any extension work.

A critical analysis of the extent to which the Advanced IA works presented earlier in Section 2.1.2 address the IA requirements of e-business alliances (Table 4.8) ascertains that even the most elaborate of these works fail to provide full support for electronic integration within an e-business network. It further outlined six requirements that are not addressed by any of the examined frameworks, mainly:

- Governance structure
- Trading mechanism
- Scope
- Required accuracy
- Aggregation level
- Standards.

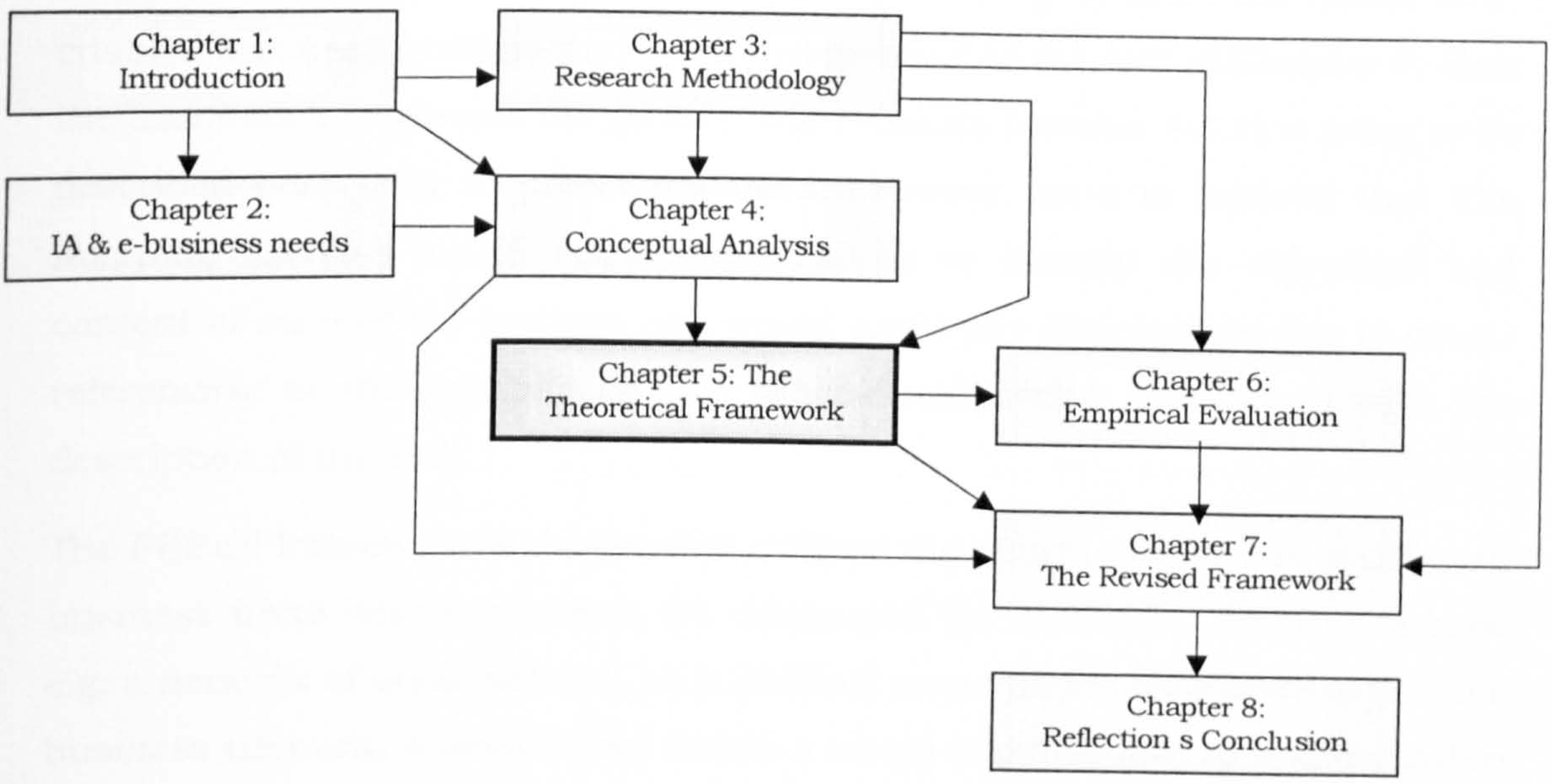
In search of ideas for addressing these requirements and enhancing the current state of IA art from the related subject areas of Software Engineering, System Analysis and virtual teamworking were also examined and discussion of how they inform the current research documented.

The final outcome of the analysis of previous empirical and theoretical work confirms Evernden's checklist for IA frameworks (Table 2.2) and outlines a few additional requirements for frameworks aspiring to address the needs of e-business systems that could be added to the set listed in Table 4.8:

1) To be able to serve platform-independent and dynamic systems.
2) To capture the richness and complexity of systems through the employment and integration of different theories.
3) To meet both theoretical and heuristics criteria for selection and evaluation, e.g. Evernden's checklist for IA frameworks (Table 2.2).

The following chapter presents an enhanced framework for information architecture for electronically mediated business networks, that builds up on the above recommendations and expectations of such IA.

Chapter 5: A Theoretical Framework for Information Architecture for Business Networks



> *A theory is a statement of relations amongst concepts with a set boundary assumptions and constraints.... ...The purpose of theoretical statement is twofold: to organise (parsimoniously) and to communicate (clearly)."*
>
> Bacharach (1989)

This chapter presents a theoretical framework for information architecture for electronically mediated business networks, named FEBuS. The framework adheres to the requirements for framework aspiring to meet the needs of e-enabled business systems that were summarised at the end of Chapter 4. How the framework addresses the generic requirements (Section 4.3.1) is going to be described here prior to presenting the framework, as it is believed that this mapping exercise would enable the readers to identify the objectives and content of each of the sections and would avoid any distractions due to cross-referencing to the previous chapter when familiarising themselves with the description of the tool.

The FEBuS framework is designed to address the information needs of different business units whose practices are dominated by electronic communications, e.g. a network of organisations, an individual organisation as a node within the business network, a department within a single organisation, or a team within a department (Generic Requirement 3). As specified in Chapter 3, Research Methodology, the framework was developed using a triangulation of methods, namely theoretical analysis, formal and informal interviews with NHS IS specialists, an interview with the author of one of the IA frameworks studies here, and subjective argument. The foundations of the work, i.e. Zachman's Framework, Evernden's models (1996, 2000, 2002), the System Thinking fundamentals and Software Engineering studies and the work of Haywood (1998), as well as other IA and IA-related works, were already presented in Chapter 2 and Chapter 4. This is accordance with Generic Requirement 4 on integration of the body of knowledge. Triangulating theories from the IS domain with works form other research areas proved to be a rewarding exercise. The resulting framework comprises of a set of dimensions, each of which constitutes of a series of decision-making variables that have to be defined when entering in electronically mediated business relationships.

This chapter introduces the structural and behavioural details of the proposed framework and examines how it maps against the key sources that inspired its development. Sections 5.1.2 and 5.1.3 define the terminology (Generic Requirement 6) and the rules within the framework (Generic Requirement 9). Pictorial and schematic illustrations are used where possible to illustrate the complex organisation of the work.

The core of the framework description is the definition of the content and meaning of its components (Section 5.1.4). The material in this section evidences how Generic Requirement 1 (business focus), Generic Requirement 2 (flexibility), Generic Requirement 7 (consistent terminology) and Generic Requirement 8 (level of detail) are met (Section 4.3.1). The discussion of the FEBuS components (Section 5.1.4) also provides sufficient evidence of how the framework addresses the specific e-IA framework requirements listed in Section 4.3.2. Illustrations of the structure of each components and examples are provided where possible.

Having built principle understanding of the proposed framework, the chapter proceeds to address Generic Requirement 5 through a discussion of the scope and the usability of the framework (Section 5.2).

The fundamentals described in this chapter are the skeleton for the empirical evaluation of the work, described in Chapter 6.

5.1. FRAMEWORK DESCRIPTION

5.1.1. THE NAME AS A SYMBOLIC DESCRIPTIVE

"Names are catalyst for the imagination.
They trigger associations, memories, feelings."

Karen Shriver (ST Information Design SIG 2001)

The name FEBuS was chosen as an acronym for **F**ramework for Information Architecture for **E**lectronically mediated **Bu**siness network**S**, and as a homophone of Phoebus, the Latin name of Apollo, the Greek and Roman god of sunlight, prophecy, music, and poetry. Shriver (ST Information Design SIG 2001) argues that names should generate positive resonance and should have visions. The vision driving the development of this work is that theoretical models as this could enlighten and harmonise the work in context-weak e-business environments. If, for various reasons, it could not be practically employed, it could still be considered as a prophecy, that inspired utterance that businesses in the electronic world require foundations for their work that compensate the deficiencies of globalized, distributed and tacit-information-poor business practices over electronic networks.

The acronym FEBuS could also be deciphered as a **F**ramework for **e-Bu**siness network**s**, as effectively electronically mediated business networks are companies that are engaging in e-business activities.

5.1.2. STRUCTURAL ORGANISATION AND TERMINOLOGY

The FEBuS architectural framework is a customisable n-dimensional form (where $n \geq 3$), with two **types of dimensions**, primary and contextual. The primary dimensions are concerned with essential information about the information object and its immediate business infrastructure, and, as their name suggests, they need to be defined prior to the commencement of any work on the contextual dimensions. The latter are concerned with any additional information that contributes for building user awareness of the nature of the object and the context of the work. The types of dimensions have no corresponding component in previous IA works, as there are no hierarchies within the other frameworks. The term **'dimension'** is used here as an analogue to the terms 'sub-architecture' and 'perspective'. Any sub-dimensions should be treated as architecture views (See Dimension 1 'Types of Information'), i.e. presenting different aspects of the same information object. To illustrate dimensions, different shapes are used, based on the number of views each dimension has (Fig. 5.1). The priority of the dimension, i.e. primary or contextual could be illustrated through the use of different colours or outlines.

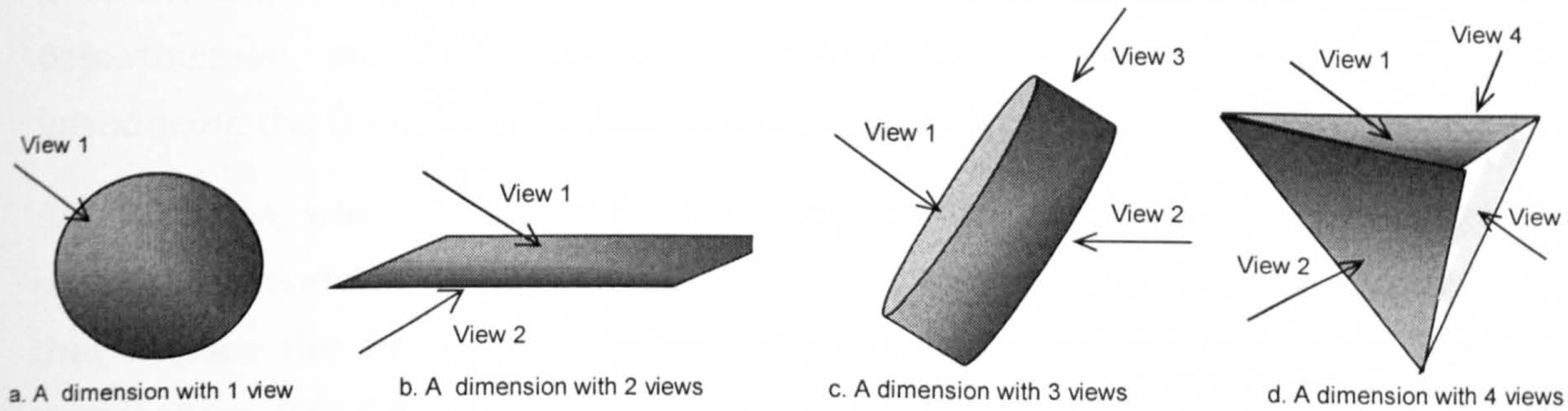


Fig. 5.1. Illustrating FEBuS dimensions

Each dimension constitutes of one or more **information categories**. The information categories are discrete components that help users structure and analyse information. Often these are referred to as 'abstractions'. An information category is defined by a set of **attributes,** each of which defines a certain aspect of the information category. The information categories and attributes are pertinent to the business needs of the business unit in focus. They are customisable, but should be consistent within the boundary of the business network. The symbols used to illustrate these components are presented on Fig. 5.2.

In cases where the number of attributes is very large, the attributes could be combined into logically related groups, called **information clusters**. By reducing the number of items presented to the user at a time, the clusters provide for less information overload and better management of the information content. In very large and complex systems, an information cluster could present a nested hierarchy, i.e. each cluster could consist of a set of sub-clusters.

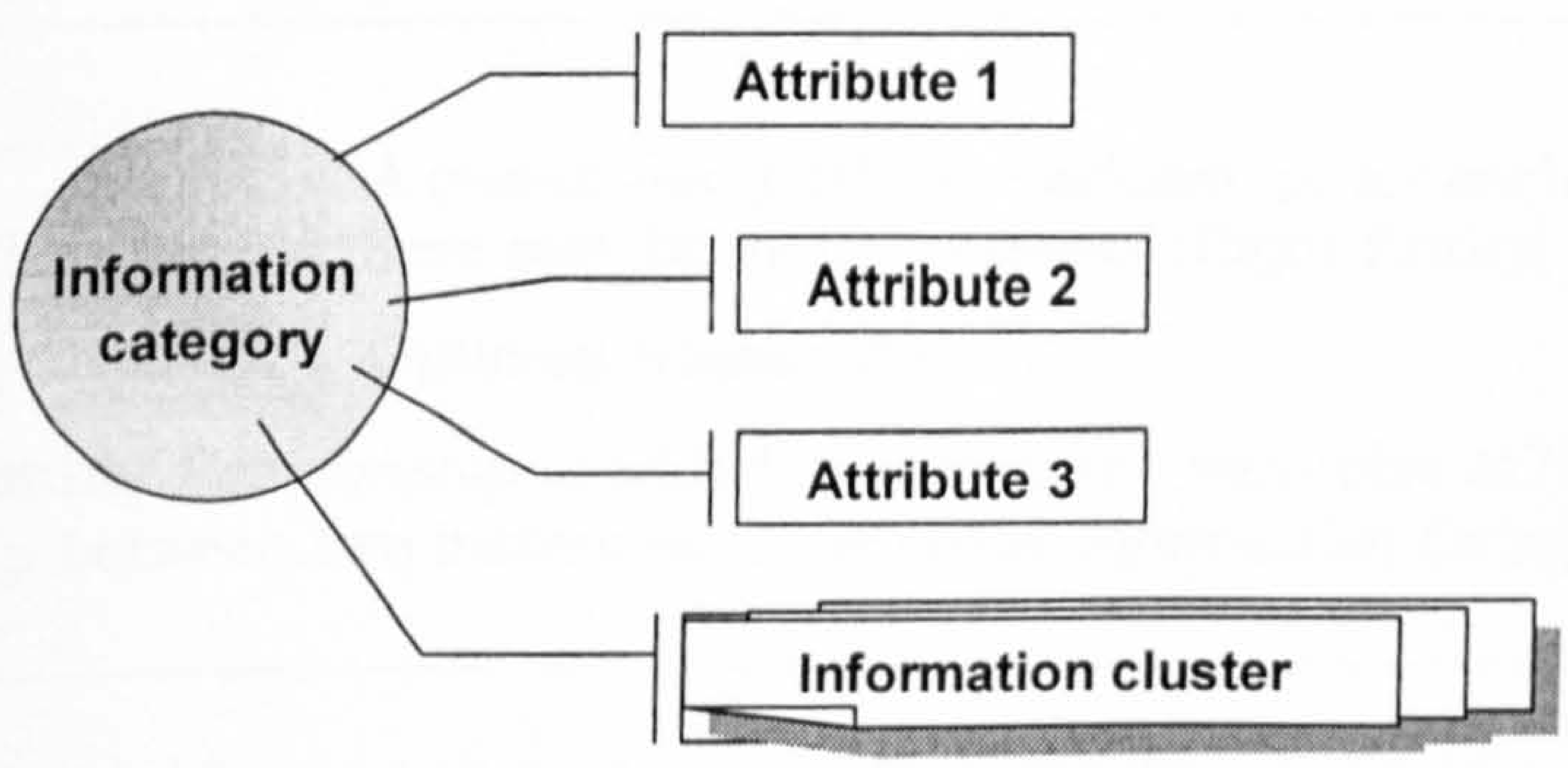
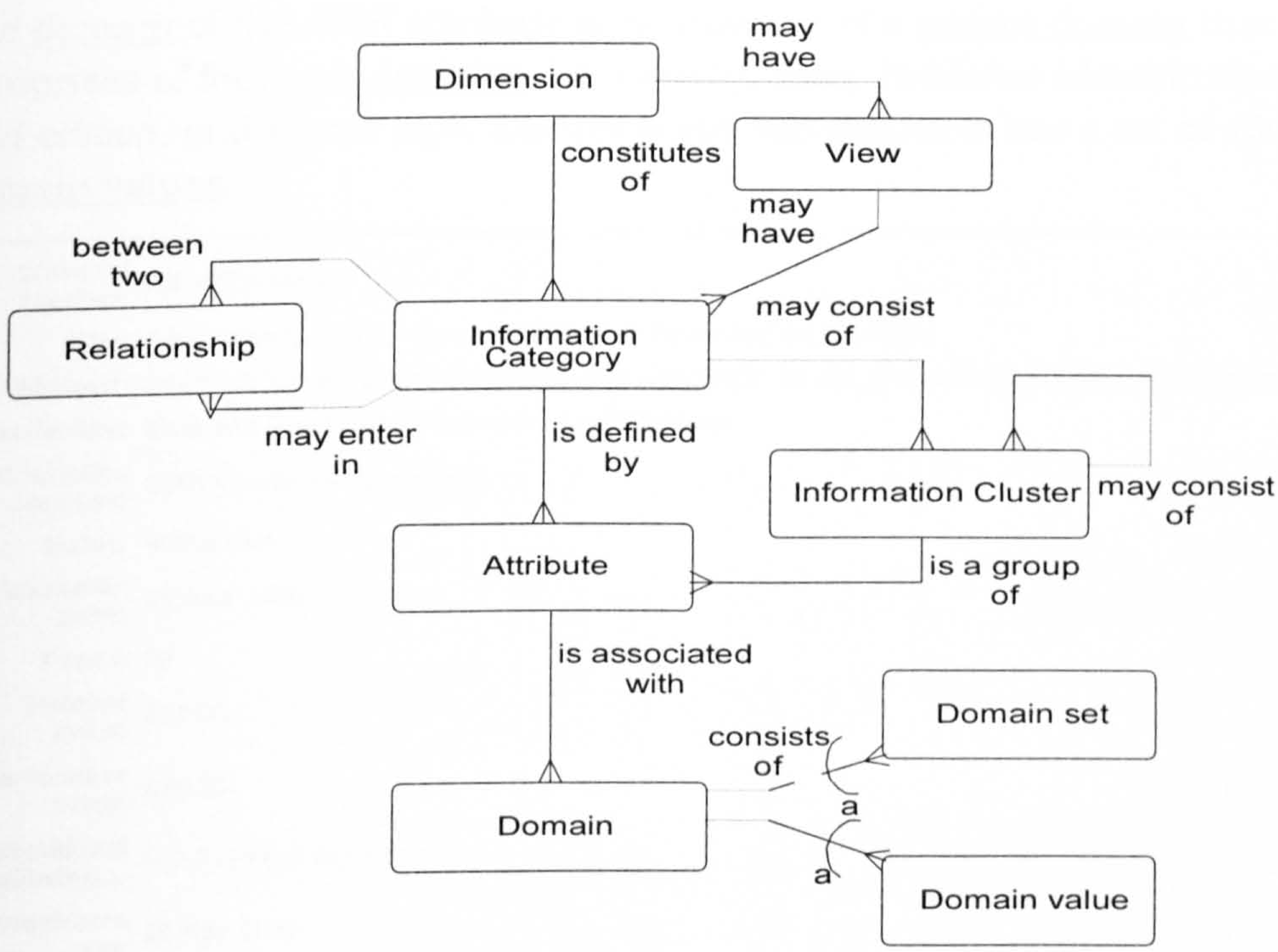


Fig. 5.2. Illustrating information categories, attributes and information clusters

Each attribute is associated with certain **domain value** or **domain set**. Large domains, also called **parent domains**, could be divided into sub-domains. The values within each domain (sub-domain) are either based on established or emerging theory and practice, or determined by the organisation due to their uniqueness. The domains could be illustrated either through colour-coding or through the inclusion of a character representing the respective domain in the attribute boxes, e.g. N for numeric, D for date, HR for all users from the HR department(s), etc. These are to be decided by the users at the time of introducing the framework in their business network.

An alternative way to highlight the hierarchy and use of the terms is through a conceptual model of the framework terminology (Fig.5.3). A` worked example that applies the FEBuS terminology (Fig.5.4) to the on-line information on standards (Fig.5.5), provided by the British Standards Online (http://bsonline.techindex.co.uk) is also provided.



Key: A one-to-many (M:N) relationship, for each value of the [Left Entity] there may be many values of [Right Entity]

--------------- Optional relationship.

Note: The entity *Relationship* is added to resolve the recursive M'N relationship between two instances of the entity *Information Category.*

Fig. 5.3: Conceptual model of the framework terminology

Fig.5.4. Example: Using the FEBuS terminology

In one of the primary dimensions, *Types of Regulations*, there are four information categories: *Standards, Policies, Regulations* and *Templates*. The *Standards* category could be decomposed into six information clusters (SLBS 2001):

- *Glossaries or definitions of terminology*
- *Dimensional standards*
- *Performance Standards*
- *Standards Methods of tests*
- *Codes of Practise*
- *Measurement Standards.*

Each standard is defined by a set of attributes, e.g. *Standard Number, Title, Status* et al (see Fig. 5.3 for the full set of attributes used by the British Standards Online library).

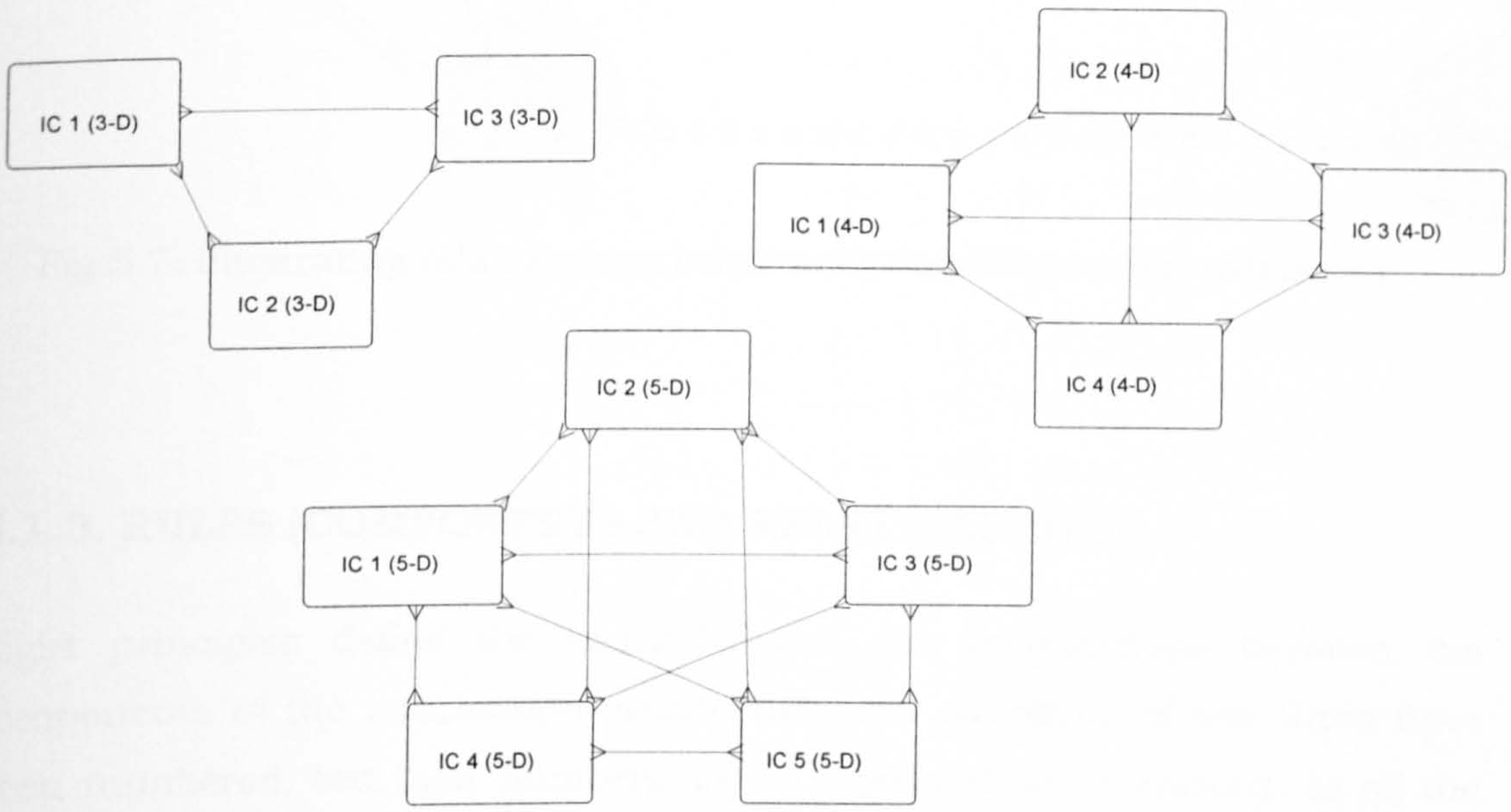
The domain of the *ISBN* attribute is an example of a parent domain that comprises of four sub-domains, i.e. *Country code, Publisher identification, Title and edition*, and *Check digit.* Each of these sub-domains has a set of allowable domain values.

Standard Number:	BS 4821:1990
Title:	Recommendations for the presentation of theses and dissertations
Abstract:	Advice on format, use of word processing equipment, details of presentation and provision for microfilming.
Availability:	Electronic Download for subscribers and Hardcopy
Subscription Modules:	GBM54 (Historical Standards)
Status:	Withdrawn
Publication Date:	29 June 1990
Pages:	32
Member Price:	£37.00
Non-Member Price:	£74.00
International Relationships:	ISO 7144 Not Equivalent
Withdrawn On:	15 May 1998
Replaces:	BS 4821:1972
Descriptors:	Theses, Documents, Design, Archive documents, Text, Illustrations, Binding, Typography, Tables (data), Pagination, Bibliographic references, Title pages, Contents lists, Annexes (documents), Copy preparation, Editing, Publishing, Word processing
ICS:	01.140.20
Title in French:	Recommandations pour la pre´sentation des the´ses et me´moires
Title in German:	Empfehlungen fuer die Gestaltung von wissenschaftlichen Arbeiten und Dissertationen
ISBN:	0 580 17813 7

Fig. 5.5: Attributes used by British Standards Online for definition of standards (British Standards Online 2001)

Each information category (IC) could enter into a **relationship** with any other category, including the categories in its own dimension. This could be a M:N relationship, where a value of the first information category (IC1) could be related to N values from the second category (IC2), and a value from the second category could be related to M other values from the first category. Two different ways are used here to present this complex structure, a conceptual model similar to the one used in relational databases (Fig.5.6) and a pictorial illustration (Fig.5.7). These are initial attempts that could be improved substantially with some professional support from graphic designers and with software support, as discussed in Section 5.2.7.

Fig. 5.6 illustrates cases with three, four and five information categories (IC), where all ICs enter in relationships with each other. The groups are indicated with se are (3-D), (4-D) and (5-D), respectively.



Key: IC = Information Category
A many-to-many (M:N) relationship, optional on both ends, i.e. for each value of [Axis X] there may be many values of [Axis Y], and vice versa.

Fig.5.6: Examples of types of relationships within groups of 3, 4 and 5 components.

Fig.5.7 presents a few more interesting cases, i.e. where an IC does not enter in any relationship (D1:IC1), ICs that enter in relationships only with other ICs from the same dimension (D2:IC1 and D2:IC2), an IC that enters relationships only with ICs from other dimensions (D3:IC3). For clarity, the notation used to represent the relationships distinguishes the internal and external for the dimensions relationships by using dotted lines for external relationships. The figure also illustrates that dimensions could have one or more categories.

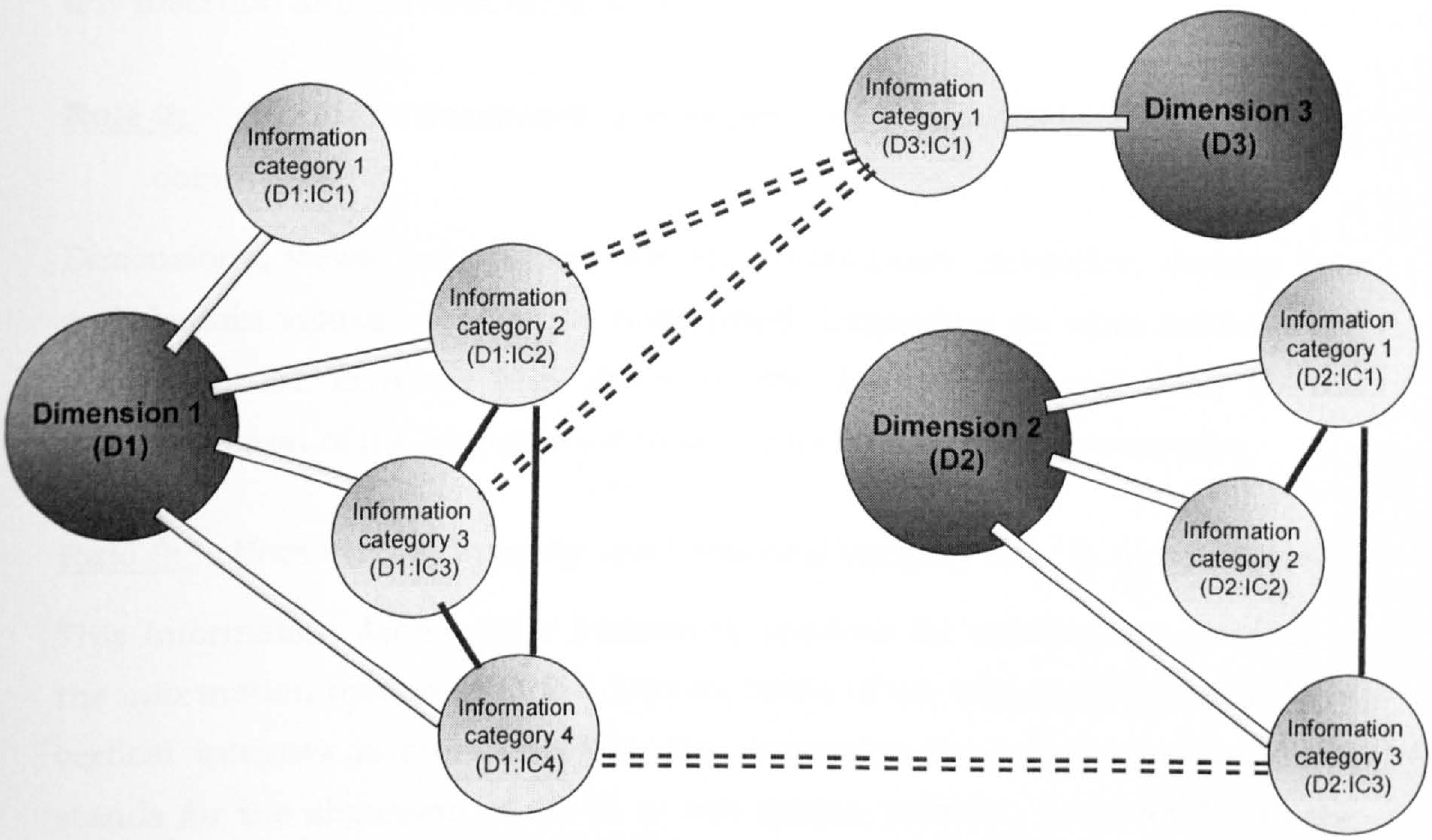


Fig.5.7: Illustrating relationships between FEBuS information categories

5.1.3. RULES (COMPONENTS AND RELATIONSHIPS)

Eight principles define the hierarchy and the relationships between the components of the information architecture. For simplicity of use these have been numbered, but their numbers do not represent any hierarchy, as all the principles have relatively equal ranking. The rationale and the implications for each principle are discussed after each of the principles is introduced.

Rule 1: The Information Architecture is based on modular components.

The modular organisation provides for the framework to adapt to changing requirements and different business scenarios. If not all of the listed types of information are present in a company, then some of the modules might be removed. This also allows for the framework to be extended with additional components or to be flattened as per the business scenario.

The customisability of the framework also ensures that obsolete modules can be replaced with minimal impact on the overall architecture. Should any modification of the framework is considered, the update has to be examined for any insertion and deletion anomalies.

Rule 2: Any of the framework components could be considered as a modular component.

Dimensions, views, information clusters, information categories, domain sets and domain values could all be customised. Depending on what modules are discarded, an extreme trim down of the framework could lead to the transformation of the framework into any of its foundational frameworks.

Rule 3: Both vertical integrity and horizontal integrity have to be considered.

This Information Architecture framework provides for establishing integrity of the information resources at the different levels of the business hierarchy. Here vertical integrity is represented by the dimension Levels of granularity and stands for the alignment of the IA at sub-system (network node) level with the superior IA, i.e. the IA at a system (business network) level and vice versa (Fig.5.8). For example, the corporate IA needs to be guiding the development of the IA for the departmental IA. Similarly, the IA of the business nodes could determine the IA for the business network. The direction followed to ensure the vertical integration, i.e. top-down or bottom-up, would be determined by the involved parties, but in most cases it would be related to the stability of the business configuration. For example, in internal and stable business networks it will be top-down and for dynamic networks, where there is no dominant node, it would be bottom-up. Every component in a business network IA is presented in at least one of the IAs of the node organisations (e.g. D2:IC2 exists only in the IA for Organisation 2, but not for Organisation 1).

Horizontal integrity is the integrity between IA components of information architectures of partnering business units with the same level of granularity, e.g. the nodes of the business network. Corresponding cross-sections have to be synchronised through the business network level, so that the information content is consistent.

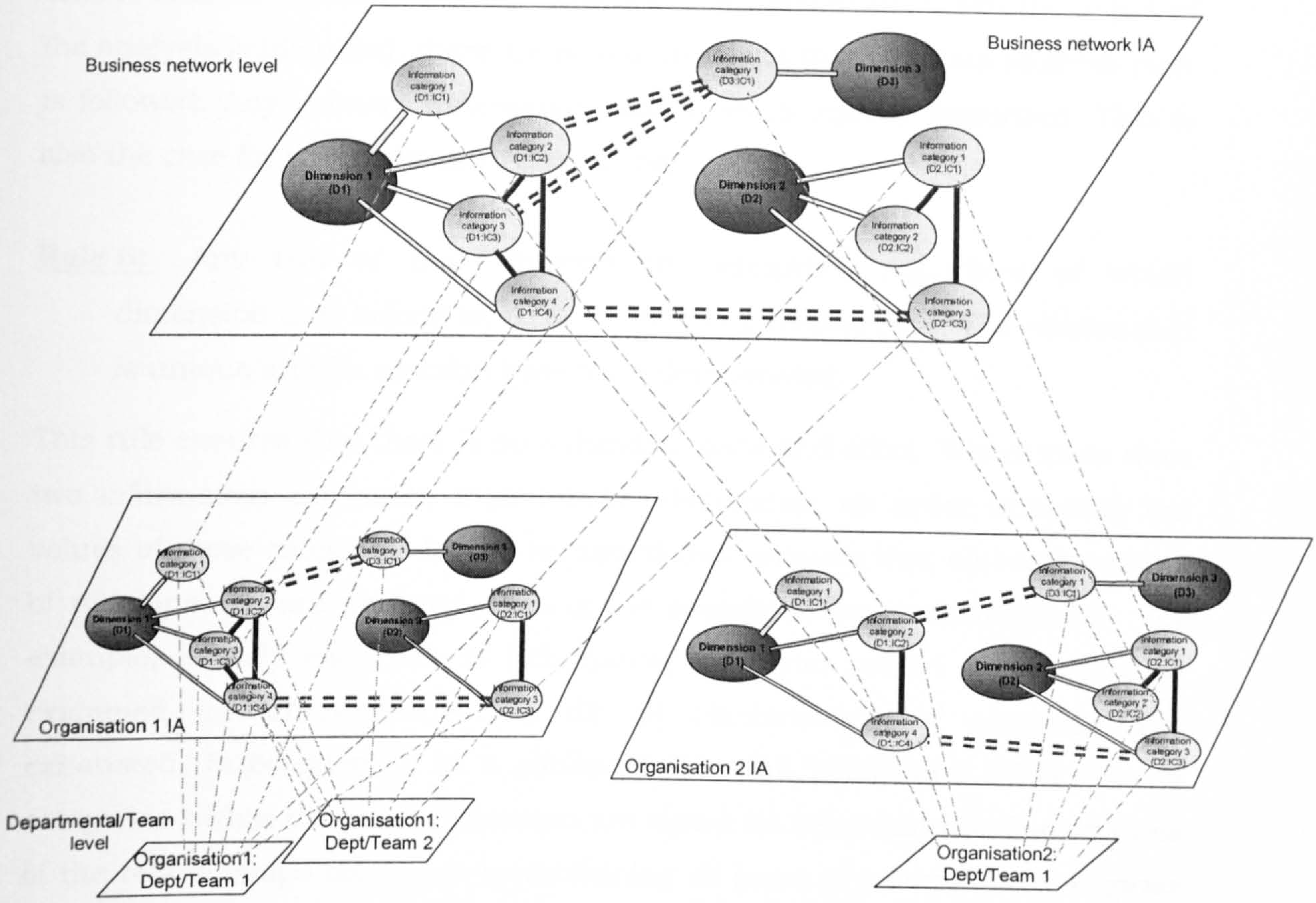


Fig.5.8: Illustrating vertical and horizontal integrity in FEBuS

It is advisory that any decision on taking out modules should be carefully considered and agreed both vertically and horizontally, as this would inevitably impact on the richness of the information content.

Rule 4: The order into which the dimensions are reviewed depends on the type of the dimension. The primary dimension is set first, followed by the contextual dimensions.

It is understandable that to be able to develop or analyse an information architecture for a particular working systems, the boundary of the system needs to be clearly defined. This is achieved through establishing the Business view, in particular the data and business processes that drive the system, with reference to the organisational and technological characteristics, too. Only then further contextual information could be added.

Rule 5: Dimensions of the same type (i.e. primary or contextual) are equally important. There is no particular order to follow when working with dimensions of the same type.

This is another example of the flexibility of the framework. When the object of the analysis is identified, there are no requirements that a certain analysis path is followed. Any primary information dimension is equally important. This is also the case for the contextual dimensions.

Rule 6: Any two or more information categories, regardless of which dimension they belong to, could enter into a relationship. The relationship is unique and its specifics have to be documented.

This rule ensures that there is no redundant data and effort. Where more than two information categories enter into a relationship, an order in setting the values of these categories has to be agreed that ensures that all combinations of relationships are explored. Setting the specific order is customisable. For example, initially each pair of information categories within a dimension is examined for interdependencies, till all combinations of categories are exhausted. Subsequently, in a similar pattern all triads and other sets of categories within the same dimension are tested for relationships. The analysis of the relationships continues by examining all pairs of information categories from different dimensions, then all triads, etc. The specifics of each relationship could be documented in an intersection cell. It is obvious that this could be a rather laborious exercise, even is it does not include detailed supporting documentation. However, a tool used in data modelling, the Entity-Entity matrix, could be adapted for the needs of the first parse of the analysis of pairs of information categories. Here this tool is labelled IC Pairs Relationships Matrix (See Table 5.1).

For the examination of triads of categories, a similar matrix, the IC Triads Relationships Matrix, is prepared based on the results of the first round. In it, the values of the rows are populated with the pairs of related information categories (See Table 5.2).

		Dimension 1 (D1)					Dimension 2 (D2)				D.....	Dimension n (Dn)		
		IC1.1	IC1.2	IC1.3	IC1..	IC1.p	IC2.1	IC2.2	IC2..	IC2.q	....	ICn.1	ICn	IC n.r
D 1	IC1.1	✗												
	IC1.2		✗	✓			✓							
	IC1.3			✗								✓		
	IC1....				✗									✓
	IC1.p					✗								
D 2	IC2.1						✗			✓				
	IC2.2							✗						
	IC2....								✗					
	IC2.q									✗				
D.	......													
D n	ICn.1											✗		
	ICn												✗	
	IC n.r													✗

Table 5.1: The IC Pairs Relationships Matrix (example of completed template)

N.B. In this example $n \geq 2$, $p \geq 3$, $q \geq 2$, and $r \geq 1$; Normally, the number of $IC \geq 1$.

	Dimension 1 (D1)					Dimension 2 (D2)				D.....	Dimension n (Dn)		
	IC1.1	IC1.2	IC1.3	IC1..	IC1.p	IC2.1	IC2.2	IC2..	IC2.q	....	ICn.1	ICn	IC n.r
IC1.2 + IC1.3	✗	✗	✗										
IC1.2 + IC2.1		✗	✗			✗							
IC1.3 + IC n.1			✗								✗		
IC2.1 + IC2.q				✗		✗			✗				
IC1.p + IC n.r					✗								✗

Table 5.2: The IC Triad Relationships Matrix (template)

N.B. In this example $n \geq 2$, $p \geq 3$, $q \geq 2$, and $r \geq 1$; Normally, the number of $IC \geq 1$.

Rule 7: The existence of a relationship between any set of information categories depends on the specific business scenario.

This rule ensures that users are aware that not all pairs/sets of information categories should be cross-referenced. Still, all possible relationships have to be examined at the beginning of the IA work to decide on which of the relationships are valid for the business unit.

Rule 8: The IA is an evolving framework.

The IA should be continuously reviewed and redesigned for reliability and performance. This should be done at each of the granularity levels and changes should be communicated to the affected parties.

5.1.4. FEBUS COMPONENTS

"It is neither possible nor desirable to define an information architecture in a top-down, linear fashion. The various architectural activities must be carried out together, with appropriate synergy between them."

Darnton and Giacolleto (1998)

As specified earlier, the framework integrates two types of dimensions, primary and contextual. These are defined below.

There could be cases, however, when decisions on the primary information content could depend on the value the context adds. In such cases, the work on the contextual information categories could be conducted in parallel with the work on the primary information content.

5.1.4.1. Primary dimension

It is proposed that the framework has only one primary dimension, Type of Information, that, similarly to its counterpart in the Evernden Eight (Evernden 2002, Evernden & Evernden 2003a) provides the categories that are used to structure or analyse the information on the nature and characteristics of the business, i.e. the object of the analysis. The set of categories, or the types of information, could vary based on what is the information need of the user, e.g. whether they are interested in the strategic or general organisational aspects, the business-specific aspects, or the technical details. Based on these needs, this dimension is divided in to sub-dimensions, called Views. Currently, in conformance with the Information FrameWork, there are three distinct views, i.e. Organisational, Business and Technical view. The existence and the importance of these views has already been justified (Evernden 1996).

In previous works the assumptions were that these views should be based upon the role of the user, i.e. strategist, manager, business analyst or designer, or technical architect or builder. This framework isolates the roles into a separate dimension, called Roles (See Dimension 6), which provides for customization to different business scenarios. There is also a dimension that defines the level of access to the information, Dimension 5: Types of Information Management (IM) processes. The relationship between these three dimensions allows for more agile approach to accessing and securing the information contained in the categories in Dimension 1. More details on managing the roles and IM processes and how they counteract with D1:Types of information, is provided below in the sections describing Dimension 6 and Dimension 5, respectively.

*

Dimension 1: **Types of Information**

Dimension 1.1: **Business view**

The Business view provides users with understanding of the data, its position in relation to existing business functions (e.g. Marketing, Research & Development, etc.) and the processes that manipulate this data (Fig.5.9).

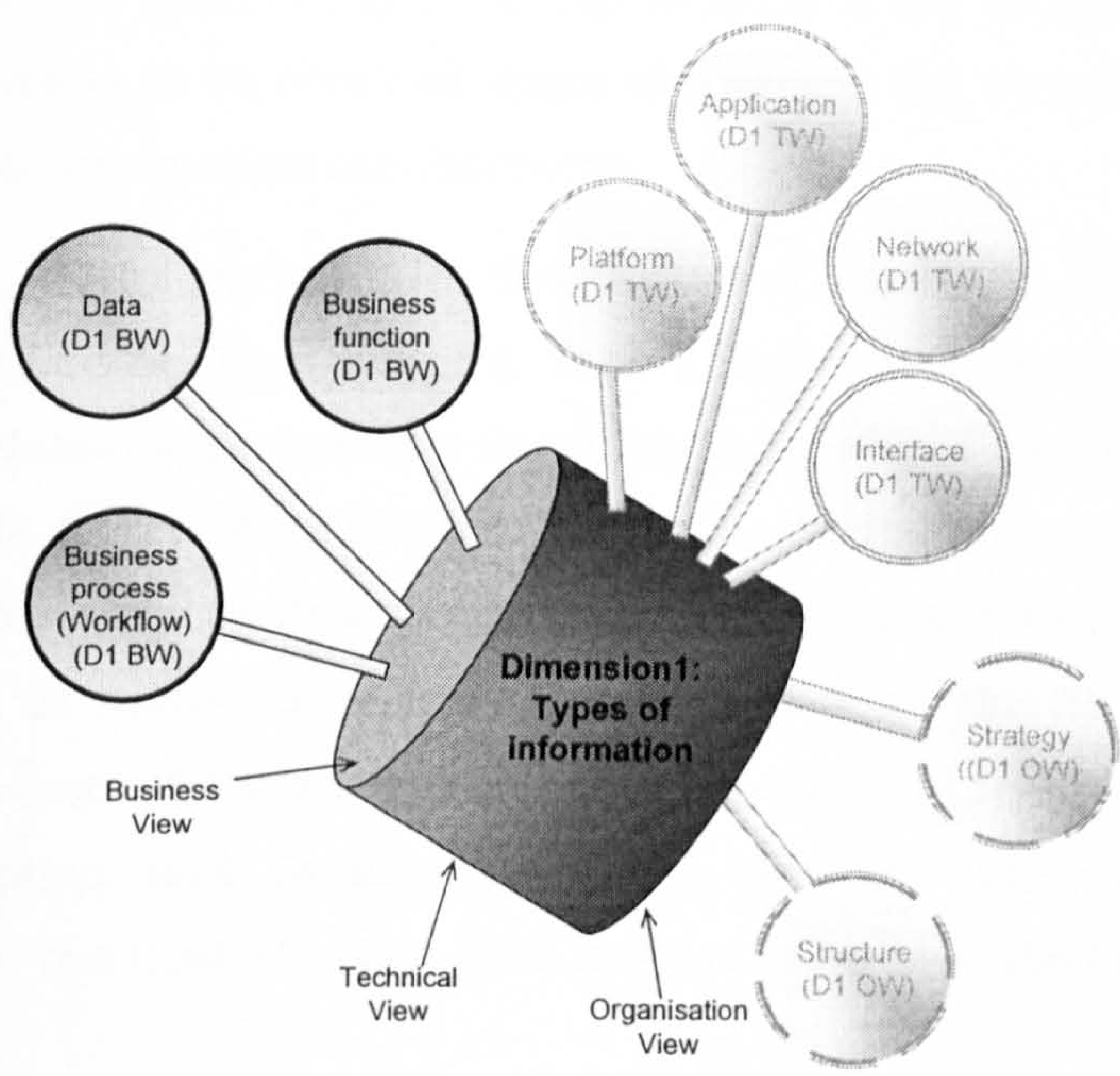


Fig.5.9: Information categories in the Business view of D1: Types of information

Two of the information categories in this view, Data and (Business) Process, are core abstractions in any I(S)A framework and the agreement of the need of these categories is unanimous, although the definition of the meaning and content of these has been subjected to different interpretations. The third category, Business function, has been recognised in many I(S)As, although in some of them it was labelled 'Function' The analysis of the content of the latter recognises two extreme understandings of the term 'function', this of a 'function' as a macro-process and 'function' as a 'micro-process'. The first one was exemplified in Evernden's IFW (Evernden 1996), where 'function' denotes a class of business processes. The second interpretation is this employed in the work of Van Swede and Van Vliet (1993), where a function is an activity within the system or as the work done to transform input into output. Similar definition of a function is supported by SSADM, i.e. an elementary low-level process that handles the effects of an event (Weaver et. al. 1998). The work of Sowa and Zachman (1992a) applies a more flexible understanding of a function, by linking the meaning of the term to the roles in the system development. This allows 'function' to denote either a class of business process (Planner's view), the processes the business performs (Owner's view), application function (Designer's view), computer function (Builder's view) or language statement (Sub-contractor's view). To avoid this confusion and to remove any semantical ambiguity, the FEBuS employs the labels of 'Business function' and 'Business process'. The correspondence of the vocabularies of the different perspectives is to be reviewed when discussing the vertical integration of the multi-levelled information architectures.

The category **Data** is the container for descriptors of the set of things that are important to a business. The different data items could be related to one another and the relationships between them are represented with diagramming techniques such as Entity Relationship Diagrams. Each data entry is defined by generic attributes such as Item Description, Item Domain and Item Cost. It is recognised that in many cases Item Description could be an information cluster including other attributes defining more specifically the business data. Whist the Description and Domain attributes are well recognised in the previous IA studies, the Cost of a data item has not been identified in any of the studied works.

The content of IC **Business process** is the equivalent to the content of the Function sub-architecture in Zachman's framework and in the Workflow category in Evernden's IFW. This category has three information clusters: Process, Event and Next Stage, each of them consisting of a set of attributes providing further detail for the Business process. The Process cluster includes attributes to describe how each process affects the input data, what is its capacity and its cycle time (or duration). The Event cluster informs on the internal and external events that trigger the process, and the Next Stage cluster specifies how the output of this process affects the work of the system, i.e. which process follows or which external party is the recipient of the outcome.

The **Business function** category has been added to inform of the specific functional area, the macro-process, for which the information is valid. This category further allows to differentiate the level of detail provided to information users based on their functional role, e.g. a Marketing office would have a different view of the data than a Customer Services officer would.

Due to the recursive ability of the FEBuS, some conceptual difficulties might be experienced when vertically integrating the focal information architecture with the IA of the superior and/or subordinate business units. For example, if the current focal point is this of an individual business unit, the business process at a macro-level will be the business processes within the business network that the focal business unit is part of. This upper level business process will be identical with a business sub-system integrating all the similar processes of the business units in the business network, which could result in the IC 'Business process' to be compared with the Business System Architecture (BSA) as defined by Periasamy and Feeny (1997). Similarly, working on the vertical integration downwards, i.e. with subordinate business units, the business process will be represented at the lower hierarchical levels through a series of sub-processes, each of which will provide a more detailed, but partial picture of the focal process. This decomposition could result in using the term 'business process' in the sense of a 'function'.

In summary, the Business view of the FEBuS is very closely related to the Business view in Evernden's IFW and addresses the Data and Function perspectives in Zachman's framework. It could be further argued that this view describes the work of Beer's System One, (Produce).

<u>Dimension 1.2:</u> Organisation view

The Organisation view incorporates two information categories, i.e. Strategy and Structure, which enable the differentiation of individual business units (Fig.5.10). The first one is a repository for any long-term view on the goal and position of the company and could be related to Beer's System 4 (Outside and Future). In Zachman's framework the content of this category is presented by the Motivation abstraction and covers aspects from business goals, business plan in the upper levels of description, to knowledge architecture, design and definition in the lower levels. The name for this category in the FEBuS IA is in agreement with the terminology used in Evernden's framework.

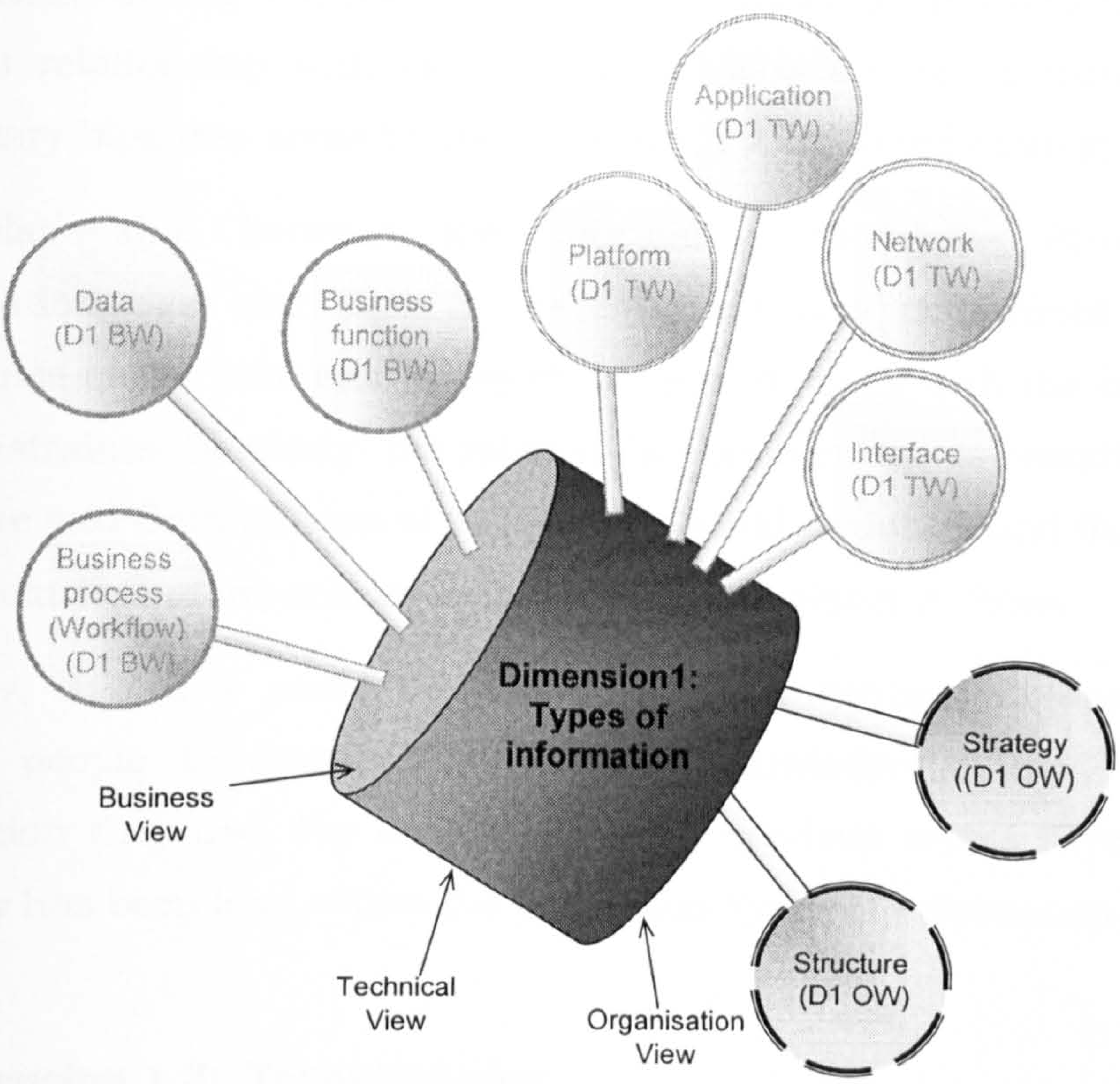


Fig.5.10: Information categories in the Organisation view of D1: Types of information in the FEBuS

The **Structure** abstraction illustrates infrastructure and the reach of a particular information item and is analogous to the People abstraction in Zachman's framework, as defined in the perspectives Planner and Owner. The same reasoning as in the case with the Strategy IC drove the choice of name for this category in the FEBuS.

In previous I(S)A works (Table 4.7), despite the different labels used to denote these categories, there is uniform understanding of their importance.

In addition to these two components Evernden (1996) proposes that the Organisation view includes a third one, Skills, that describes the core competencies that the users of, or the actors within the system, should possess. The understanding that underpins the design of the Organisation view in the FEBuS is in discord with Evernden's view, based on the arguments that the set of skills resides with the users of the system and the actors in it, but not with the organisation itself. The set of skills is determined by the roles the actors have in the development and management of the system. Therefore, the Skills information category is better logically positioned in Dimension 6, Roles.

As indicated on Fig.5.9, the information categories in this dimension may not enter in relationship with each other, i.e. it is not an expectation that an elementary business should have an explicitly formulated strategy.

The relationship between the information categories Strategy in the Organisation view and Data in the Business view determines the strategic importance of the information object, i.e. how it aligns with the business goals and constraints. Similarly, the relationship between the information categories Structure and Data informs of the organisational structure and the units within this structure that are related to the information object in focus.

Arguably, this view could be considered as a contextual dimension, as it enables people to develop further their knowledge on and trust to the information they use. For consistency with previous works (Evernden 1996), this view has been kept within the dimension Types of information.

*

Dimension 1.3: Technical view

The technical view in the FEBuS (Fig.5.11) also manifests the agreement of the I(S)A researchers and practitioners.

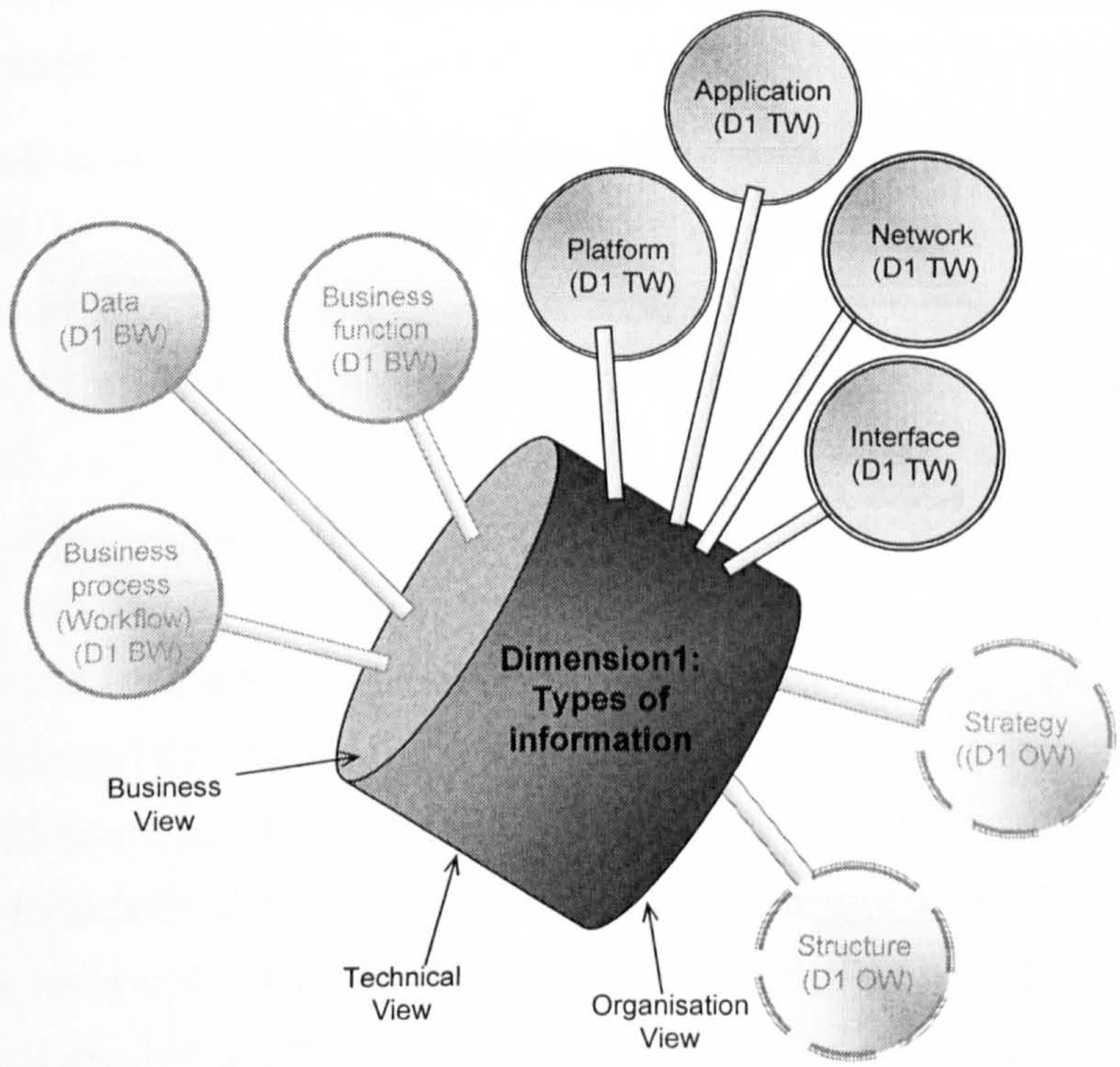


Fig.5.11: Information categories in the Technical view of D1: Types of information

However, there is not a uniform view on what the components within this perspective are, neither what is the relationship hierarchy between Information Architecture, IS Architecture and IT Architecture (Chapter 2). There are authors who argue that IT architecture is separate from the IA architecture (Periasamy & Feeny 1997), although they admit that there is a two-way relationship between these two architectures. Others (Evernden 1996) define Information architecture as dominating the architectural set. The stand here is that technical categories should be included as a core part of the Information Architecture to inform of any issues related to the use of technology, mostly because in the Information Age greater amounts of information exist in electronic format and are used, managed and disseminated by the means of ICT. The components, however, will also act as an interface to a more detailed IT Architecture, i.e. they have to be a part of the IT architecture, or consistent with their counterparts in an IT Architecture, if such is in place. The technical categories in this framework are those components that enable and ease the mapping of the IA and IT architectures. This separation of the technical components in the FEBuS also positively affects the usability of the framework. The FEBuS to be accommodated for paper-based environments, too, by stripping off the technical components and reviewing and dimensions and categories dependant on them.

It is recognised that with the convergence of information and communication technologies it becomes increasingly difficult to differentiate the information categories within the Technical view. For example, a Personal Data Assistant (PDA) device with an Internet connection could be considered both as a piece of hardware, and as a communication device. At the same time, it is also a challenge to differentiate between application software and communication software, e.g. Microsoft Outlook, America Online. The subdivision of the technical view into the above information categories is based on analysis of the I(S)A works reviewed in Chapters 2 and 4 and on the notion that many existing technical architecture models in industry define that the technical components consist of an interface layer, a network architecture and a systems platform. Each of these layers is represented by a single category, which is consistent with Evernden's approach. The correspondence of these three components with Zachman's framework has already been identified when comparing the IFW with Zachman's work (Fig.4.3 and 4.4.)

The fourth information category Application informs on the applications used in the business system, e.g. Billing and collection system, Personnel system, et al. It acts as a high-level interface between the user and the business data. Seemingly it corresponds to the Application Architecture as identified by Periasamy and Feeny (1997), namely

> *"a graphical model showing the major applications which make up or will make up an organisation's integrated information system and how these applications relate to each other in terms of the data flows between them."*
>
> Periasamy and Feeny (1997)

However, the FEBuS uses this component not only to indicate 'computer-based business applications' or 'software applications', but also through relationships with other information categories to inform on the current use of and any potential for the system resources. For example, the relationship with the IC Business function (D1:Business view) defines which business function benefits from a specific application or what applications serve a particular business function. The relationship with the IC Based on role (data perspective) in D6:Role characteristics informs on who are the stakeholders of a specific application. Further relationship includes a relationship with the IC Data in the Business view of D1:Types of information, which focuses on the compatibility of the data across applications, which could lead to ideas on prospective integration of data subsets. In addition, this category could be referenced with the Version releases information category in Dimension 4: Transition and the relationship will inform of the version number of the application and any incompatibilities. An illustration of these internal and external for the dimension relationships is presented on Fig.5.12.

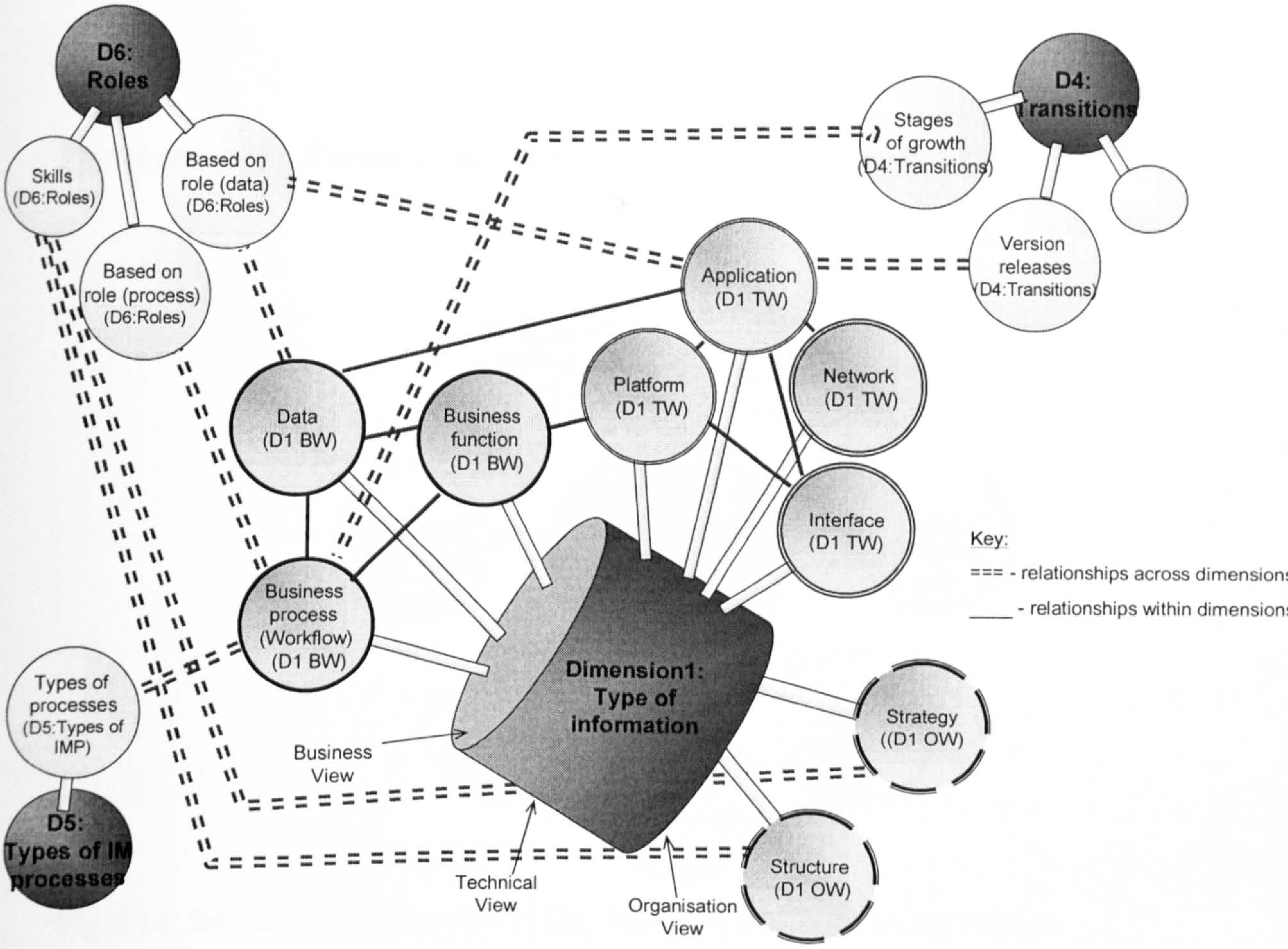


Fig.5.12: Relationships in D1:Types of information

5.1.4.2. Contextual dimensions

Information Architecture, as viewed from web information architects is the intersection of three perspectives, Content & Applications, Context and Users. The latter two have been omitted in most of the works on IA conducted by IS developers. In the FEBuS the contextual dimensions address the deficiencies in previous work by informing of information characteristics and behaviour related to the context of the information object and the roles of those using it.

As the rules of operationalising the framework determine, the work on the contextual dimensions commences after the different information views have been set.

Dimension 2: Forms of existence

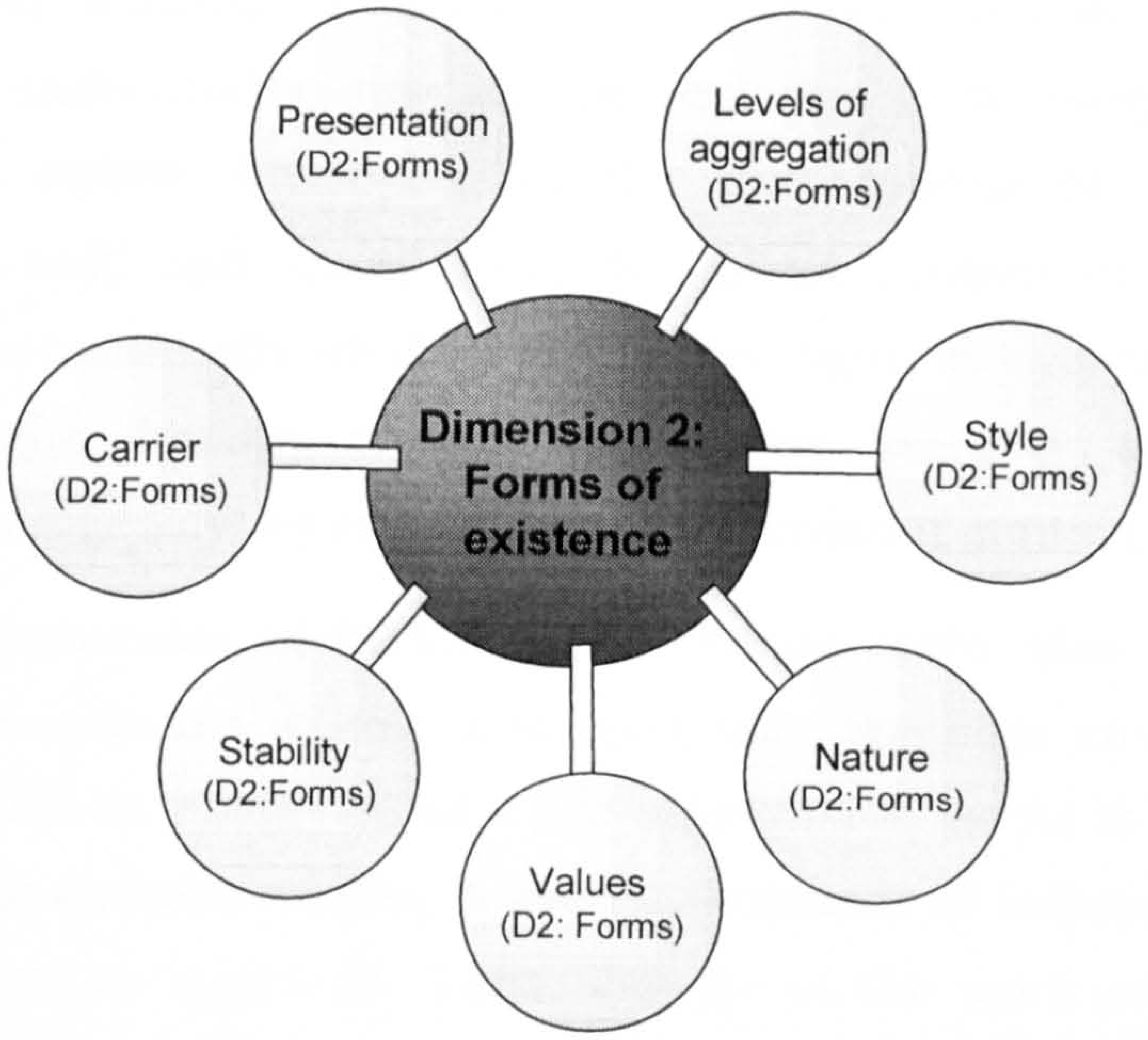


Fig.5.13: Information categories in D2: Forms of existence in the FEBuS

This dimension comprises of seven information categories (Fig.5.13) and is grounded in works such as The Evernden Eight (Evernden 2002), the IAMv001 (Denn & Maglaughin 2000), the Management information characteristics framework (Gorry & Scott-Morton 1971; Periasamy & Feeny 1997). The dimension provides the structure to explore and define all forms and ways of presenting an information object. It unites two dimensions in the Evernden Eight, these of Types of representation and Types of knowledge. Evernden differentiates several taxonomies of types of knowledge: explicit/implicit, hidden/available; missing or not; formal/informal; quantitative/qualitative. Of these, the latter two dichotomies are employed in the FEBuS, as they clearly relate to information, as well as to knowledge. They are represented in the information categories **Style** and **Nature**, respectively. The IC Style was recognised in the work of Periasamy and Feeney (1997) as well, although there it existed under the name of Class. The alternative label was considered, but rejected as potentially confusing for software engineers who could associate the term class with a different meaning, e.g. as a general template used to create specific instances or objects (Dennis *et al.*2003).

The IC Nature is also representing the Nature characteristic of the information, (Gorry & Scott-Morton 1971) that is expressed with the values 'soft' or 'hard' and informs of cases where the information is heavily dependent on the individual values and perceptions. It is recognised that even if there are subtle differences in the connotations of 'hard' and 'quantitative' and 'soft' and 'qualitative', the target content of these two categories would substantially overlap. Hence the decision was taken when describing the value domain of this information category to use the taxonomies interchangeably, as required by the imminent context.

The remaining taxonomies identified by Evernden were also tested on relevance to information management in electronic business environment. The view with regards to these is that when information exists in electronic form, certain characteristics related to the development of information into knowledge could not be captured. Thus, despite of the work carried into codifying different types of knowledge, i.e. explicit/tacit and conscious/unconscious, it is the explicit, conscious information that is recorded in electronic format. The dichotomy conscious/unconscious was considered as more applicable for socio-psychological behavioural studies, rather than in this research, where the assumption is that the use of ICT for capturing information is always a conscious act. Still, given the achievements in Artificial Intelligence in managing tacit information, the taxonomy explicit/tacit has been included as an information category named **Values**. The need for this component is also justified by its ability to cater for business units and alliances that do not or only partially employ ICT.

The rest of the categories in this FEBuS dimension were founded in the forms of information recognised by Gorry and Scott-Morton (1971) and enhanced later by Periasamy and Feeny (1997) (see Table 1.4). Thus the information category **Presentation** was based on the dichotomy Form with values 'textual' and 'pictorial', but expanded its domain to include another value, this of 'sound'. The dichotomy Presentation media (e.g. written/oral) was the foundation of the IC **Carrier**, but expanded to incorporate other values, e.g. 'electronic', 'paper'.

The information category **Levels of aggregation** was added to represent the dichotomy Aggregation levels with values 'detailed' and 'summarised'.

Another component in this dimension, the IC **Stability**, was added to reflect the dynamics of change in the different types of information. As identified later, it could also be related to the change pattern of some contextual information, such as the categories in D3:Levels of understanding and D7:Types of regulations.

The information continuum presented by Periasamy and Feeny (op.cit.) includes other criteria that were built into other FEBuS dimensions. For example:

- Source (internal/external) relates to Dimension 9: Level of granularity;
- Scope (narrow/wide), required accuracy (high/low) and usage frequency (frequent/infrequent) could be determined by examining the relationships between the information categories within the Business and Organisation views in Dimension 1: Types of information;
- Time horizon (historical/future) in the categories in Dimension 4: Transitions.

Dimension 3: Levels of understanding

This dimension has its roots in the Evernden Eight. It explains how actors in a business network acquire their understanding of the meaning of data. The introduction of categories such as definitions, models and theories (Fig.5.14), provides the framework for enhancing user's ability to comprehend and use information.

The relationships of the categories within this dimension with the information categories in the Business view are of primary importance for the appropriate information documentation. Every information object has

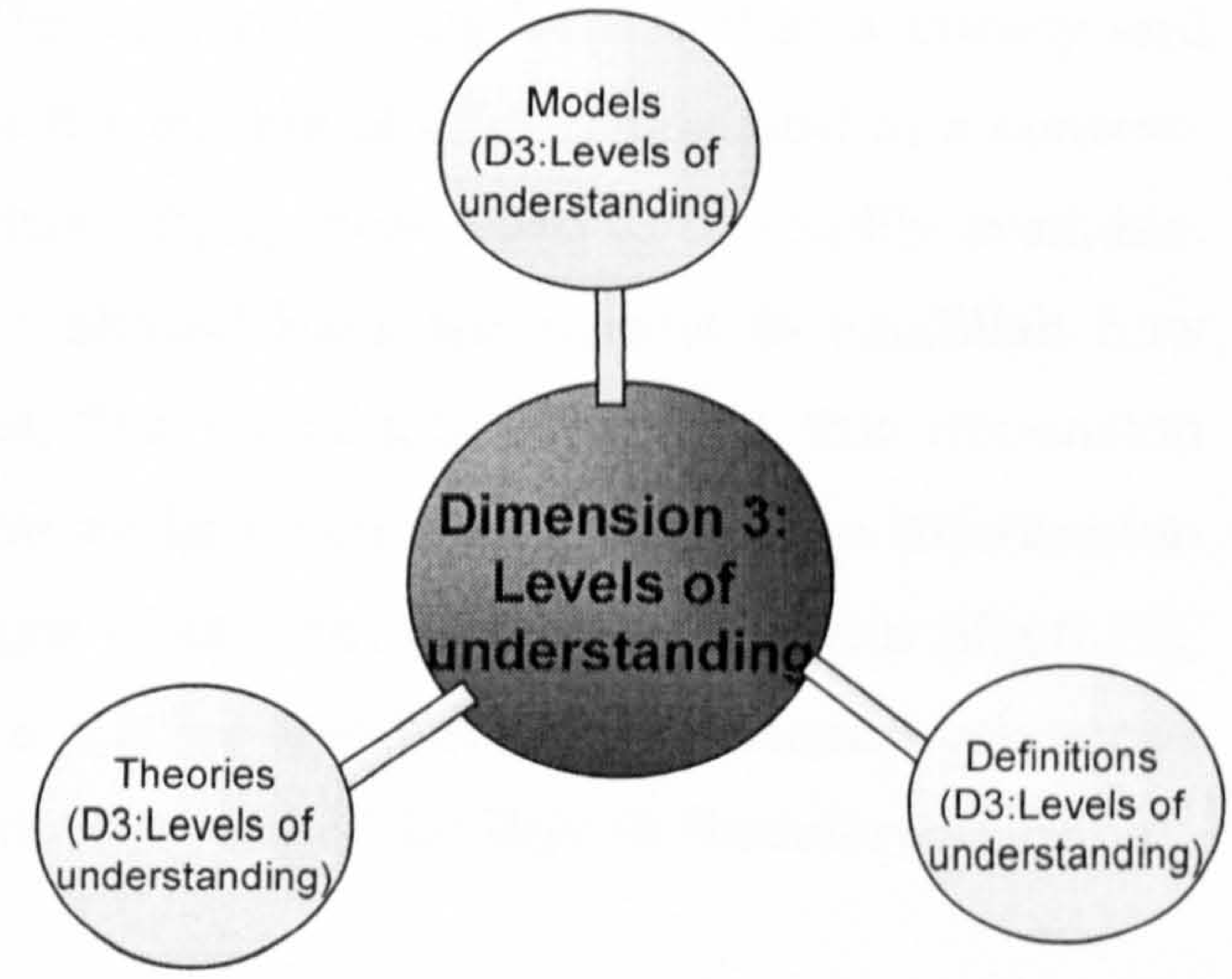


Fig.5.14: Information categories in D3: Levels of understanding

to be related to a **Definition** that also has a detailed description of the expectations of this object. This will help in managing assumptions, which, in a global virtual team environment could prove to be problematic due to a number of reasons, including cultural, demographic and language differences.

Models, Templates are the second information category within this dimension. They are important as they are normally based on mathematical, graphical or computer-based simulations, which give a clearer representation of the object or phenomenon in focus.

Similarly, the information category **Theories** equips users with information at hand about formally recognised and tested theoretical underpinnings, if any, that could be used for the development and management of the information object.

<u>Dimension 4:</u> Transitions

This dimension reflects the need of awareness of the transformation that an information object could go through. Kovitz (1999) and Checkland and Scholes (1999) reflect this need by including a Transformation perspective in their works, Gorry and Scott-Morton (1971) and Zachman (1986) classify this as a Time abstraction, whilst Evernden(1996) in his Information FrameWork refers to is as Transformation over time and later on, in the Evernden Eight labels it Levels of transition, or Evolution.

In agreement with these previous studies, the FEBuS incorporates this dimension as a quality measure. The understanding here is that accuracy and timeliness are two of the criteria for the quality of information and in a context-weak environment, such as the virtual office, these need to be readily available. Any user of the information object should have the means to establish how trustful the information at hand is. The transition audit that this dimension offers is one way of doing this. The audit could be based on the information categories of Version releases, Stages of growth, Status time stamp (Fig.5.15). The example on Fig.5.5 illustrates a similar structure of information categories representing the Transition within time employed by British Standards Online.

As its name indicates, the category **Stages of growth** notifies of the development stage, e.g. pre-contractual, contractual or post-contractual. These values could be managed by building a link to the Process category in the Business view in D1:Types if information. It could further be linked to the D6:Roles characteristics and to the descriptors of the position of the business unit in the business network (D9:Levels of granularity). This complex relationship could be used for building in security measures such as setting different sets of IM processes (Dimension 5) per a role and cascading them across the different levels of granularity, based on the value of the category Stages of growth. For example, if the values in the category are defined as pre-contractual, contractual and post-contractual, a during the contractual stage a designer at a business network level could have full access rights to a certain information object, same as a designer at the business network node. After the completion of the contract the business network designer could have only monitoring rights, whilst the designer at the business network node could have retained the full access to the information object.

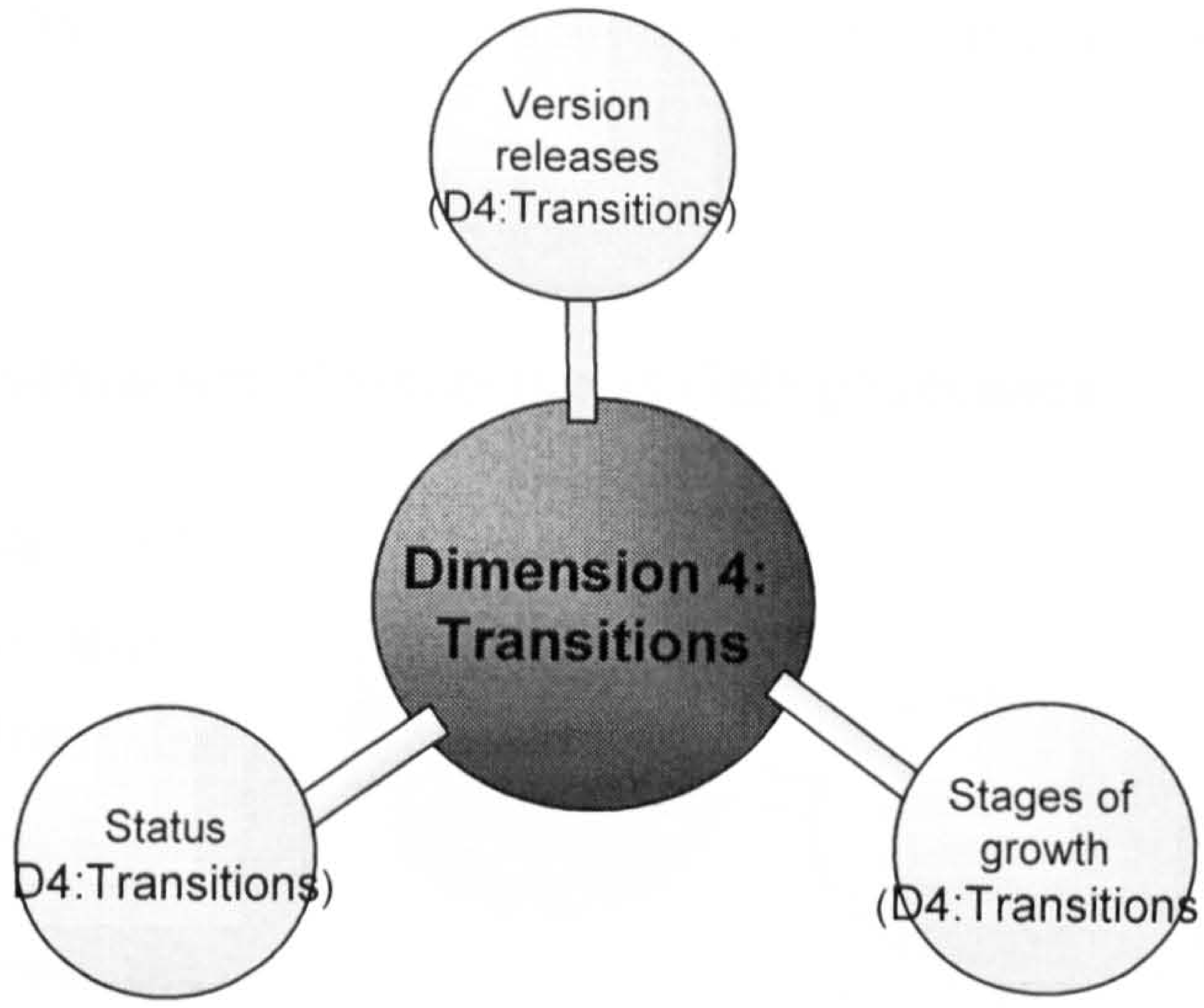


Fig.5.15: Information categories in D4: Transitions

The **Status** time stamp is another informer of how current the information is. As illustrated on Fig.5.6, its domain could include values such as 'current', 'withdrawn' or 'draft'. Alternatively a more generic dichotomy could be employed, e.g. present/historical.

The IC **Version releases** informs on the version history and in cases where the user has access to the full versions list, it could be considered that it eliminates the need for the IC Status. Thus, if we know the current version number of an information number, we could conclude whether this is current or historical data,. However, this category does not inform on the current stage of development or capability. As it is the easiest to manage in an electronic environment, and users of the framework could easily relate to it, this category is usually listed in first place.

Dimension 5: Types of Information Management (IM) processes

This dimension has only one information category (Fig.5.16) and is the correspondent to the dimension Types of process in the Evernden Eight.

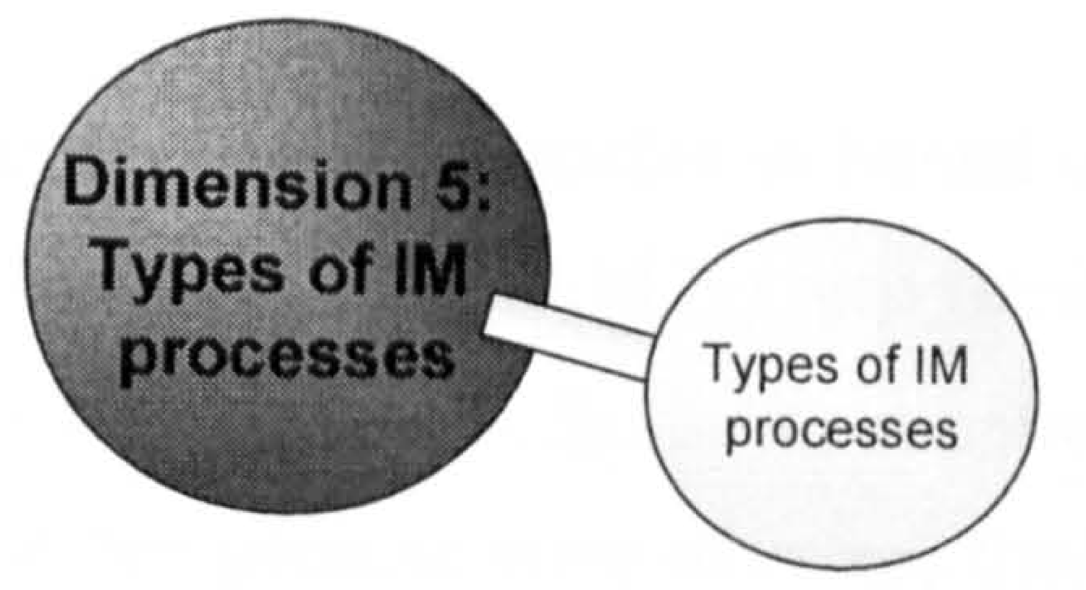


Fig.5.16: Information categories in D5: Types of IM processes

It is the part of the framework that attends to the manipulation of data, a feature which presence is also identified by Cashmore and Lyall (1991). As Evernden and Evernden (2003a) specify, the process aspect of information is absolutely critical, as "*information only really becomes 'information' when it is used in some form*". The dimension is a building block currently incorporates only one information category, IM processes, which is the key mechanism for providing differentiated access to information. The list of processes could comprise of processes such as:

⇒ define	⇒ update	⇒ query/specify
⇒ create	⇒ add/enhance	⇒ own
⇒ read/analyse	⇒ distribute	⇒ control

The dimension is a building block for defining the Role responsibilities and as such is in mandatory relationship with D6:Roles and the Data information category in the Business view of D1:Types of information.

Dimension 6: Roles Characteristics

The Role dimension consists of the three information categories, Roles (data management perspective), Roles (process perspective) and Level of competence/Skills (Fig.5.17), each of which could enter in a relationship with the other two.

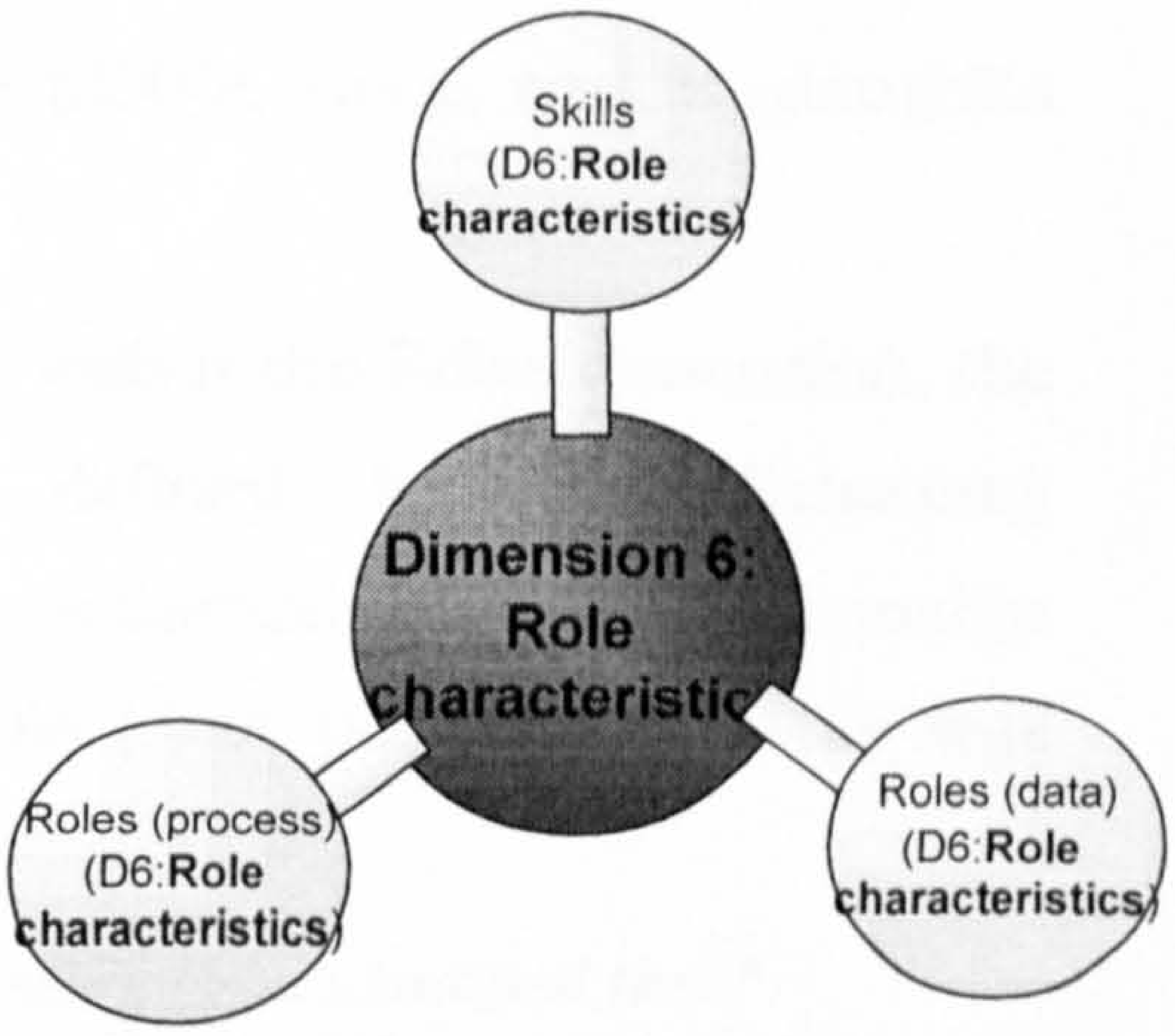


Fig.5.17: Information categories in D6: Role characteristics

The following list of roles exemplifies the information content of the **IC Roles (data management perspective)**:

⇒ Owner	⇒ Manager
⇒ Controller	⇒ User
⇒ Planner	⇒ Analyst
⇒ Designer	⇒ Builder

As it could be observed, the set of roles from a data perspective is based on the perspectives identified in Zachman's framework, which could be supplemented by additional roles, such as manager, controller and user. Such an amendment to the original set is envisaged to provide a more generic view of roles, that goes beyond the system development focus and recognises that there are actors who are only using the information, or controlling (but not necessarily planning) its development and use. The theoretical underpinnings for the manager and controller roles reside in systems thinking. Checkland and Scholes (1999) argue that processes should include both the core processes and the monitoring and control ones. This has been further reinforced by the review of Beer's Viable System Model that confirmed that the management 'meta system', i.e. control, policy, intelligence and co-ordination, should be part of any system description, striving to sustain its existence. System 3 (Control) is of particular relevance to the suggested amendments to the Roles list. Current works on Information Architectures (with the exception of the work done by Van Swede and Van Vliet (1993)) do not address feedback and control aspects. The argumentation for enhancing the roles list in the FEBuS is that each of the core processes of planning, analysis, design and build have their corresponding role, and so should the supporting processes of monitoring and control.

The information categories within this dimension have further theoretical support in the works of Belbin (2003), Currie (2000), Denn and Maglaughlin (2000), Kovitz (1999) and Yu (1995).

The content of the second information category within the Roles dimension, the **Roles (process perspective)** could be defined by the dichotomy source/recipient. This component is largely informed by the relationship between the categories Data, Process and Role (data perspective). This was included following the argument that

"In developing a model, its purpose and recipient require to be identified first."

(Periasamy & Feeny 1997)

The relationship between the two Roles categories could further specify the flow of data with regards to the actor working with this data, e.g. whether a Manager is the Source or the Recipient of certain data/information. Understandably, the Source aspect of the Role (process perspective) is not equivalent to the Owner aspect of the Role (data perspective). A point to note here is that an actor could take several roles with regards to the management of a particular data item.

The third of the information categories in this dimension, **Level of competence/Skills** refers to the taxonomy of requirements for each role. If required, further to the definition of skills required, this component could have other attributes, referring to the scope, priority and type of the requirement. The Scope attribute is could be defined as either Generic skills or Specific skills, where Generic skills include, for example, presentation skills, whilst an example of specific skills is command of SPSS, Java programming skills, etc. The Priority attribute could have a domain including the values of 'Desirable' and 'Essential'. The Level of competence/Skills information category could also accommodate information on professional or educational qualifications that would be helpful as a benchmarking criteria, or as a factor for building up confidence in the source or recipient of the information, based on the skills and qualifications s/he possesses. This could be achieved by adding another attribute with a domain defined by the set of values: 'skill/competence', 'professional qualification', and 'educational qualification'.

The responsibilities of each role, as typically outlined in a job specification, are built into the relationship of the role with other information categories, such as IM processes or the Data category. Should outsourcing takes place, a relationship with another dimension, i.e. Levels of granularity (I.e. internal, extended or external) should be examined. This relationship will provide for building in additional security measures, based on the level of externality of the actors and their responsibilities.

As with the rest of the information categories, the attributes and value domains of the information categories in D6:Roles characteristics is dependent on requirements of the specific business system.

Dimension 7: Types of Regulations

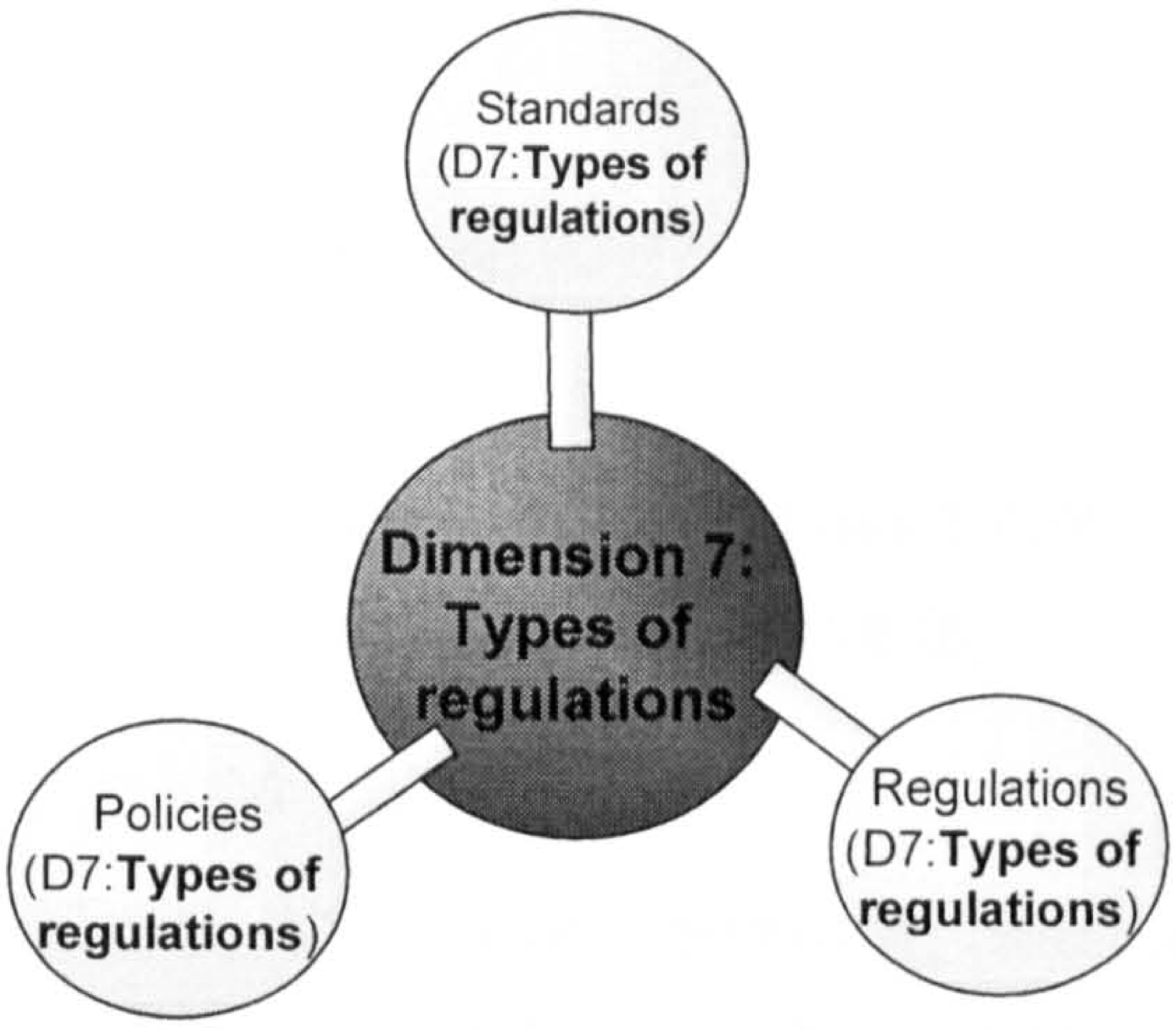


Fig.5.18: Information categories in D7: Types of regulations

Standards, Policies and Regulations are the contextual components within Dimension 7: Types of Regulations (Fig.5.18).

Similarly to the categories Strategy and Structure from Dimension 1: Types of information, they are recognised by web information architects (Denn & Maglaughlin 2000), researchers in system thinking (Checkland 1999) and consultants on management of distributed teams (Haywood 1998). Forrester (1991) also suggests a category in the mental database of a system that addresses policies, i.e. 'Observed structure and policies' (cf. Fig.4.8). The above propositions have been largely ignored by the family of Advanced Information Architectures (Table 2.7). It could be argued that knowing the standards for data, process, network et al, would replace some of the physical and situational context of the particular task that "*... many forms of electronic communication can reduce, eliminate or distort*" (Haywood 1998).

Furthermore, provision of availability standards sets a foundation for establishing trust amongst team members and organisations, which in turn could influence positively the success of a project.

The FEBuS Dimension 7: Types of Regulations addresses these observations by providing three information categories to provide details on the political, legal, economic, environmental, social & technological constraints that regulate the performance of the system.

Standards, **Policies** & **Regulations** relate to and provide information on:

- System 2: Coordination (Beer 1984)
- System 5: Policy (Beer 1984)
- Environmental constraints (Checkland 1999)

- information characteristics such as *Aggregation level* (e.g. detailed or summarised), *Class* (e.g. Formal or Informal), *Required accuracy* and *Usage frequency* (Gorry & Scott Morton 1971)
- *Access, Security* and *Reach* as aspects of Information Architecture (Currie 2000)
- The *Weltaanschlung* component of the root definitions (Checkland 1999) and to the contextual information as understood by Haywood (1998)
- availability and acknowledgements (Haywood 1998).

Examples of the entries in the Standards IC include ISO9001, internal standards for availability and acknowledgements; XML as a document and message standard, et al. Similarly, The Data Protection Act 1998, The Disability Discrimination Act 1995, The Human Rights Act 1998, et al. could form some of the content of the IC Regulations. The last of the categories in this dimension could include company or business network internal policies such as Environmental policy, policies on Health and Safety, on e-mail and Internet use et al.

Dimension 8: Levels of granularity

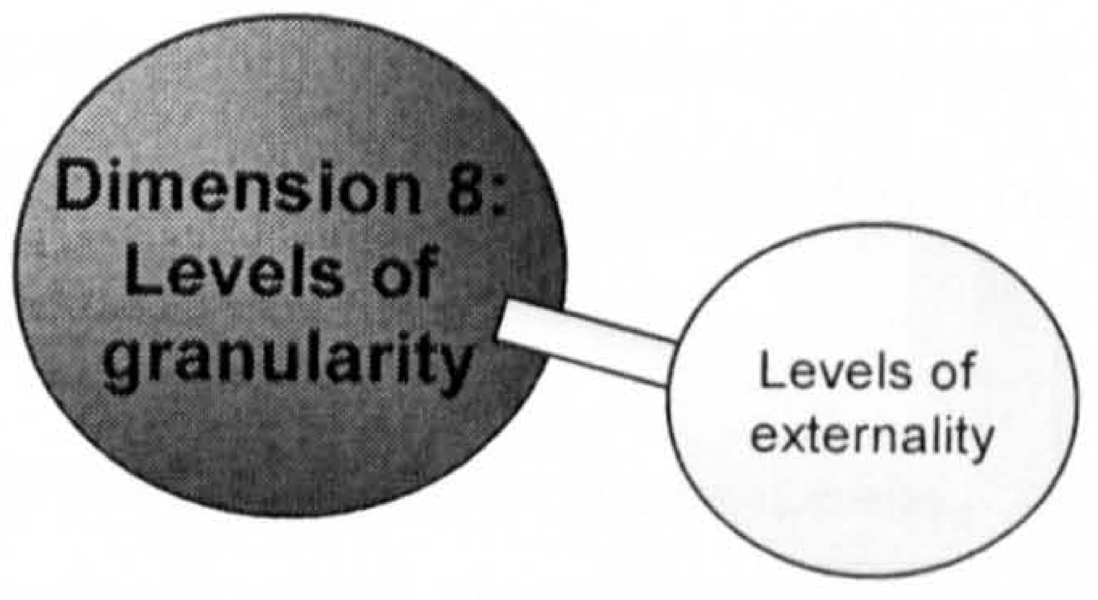


Fig.5.19: Information categories in D8: Levels of granularity

This dimension currently comprises of one information category only (Fig.5.19) that deals with the hierarchy of the alliance or the levels of externality and informs on the scope of the information as understood by Gary and Scott-Morton (1971) and Currie (2000). It is characterised by two attributes, *Business network type* and *Focal business unit,* reflecting the external and internal focus of analysis, respectively. The values for the *Business network type* belong to a domain that illustrates the span of the business network, e.g. global, industry-specific, within an enterprise or extended to customers. Respectively, the values in this domain could be {Global, Industry-wide, Enterprise-wide, Customer-inclusive}. The values for the second attribute, *Focal Business Unit,* denote the level of analysis within the business network and are tightly linked to the structure of the business system. They could be {Network, Department, Project team, Individual}. The two attributes are complementing each other to represent the focal point of the framework in its imminent network context. Further information on the structural organisation of the business unit in focus is provided by the information category Structure in the Organisational view of D1:Types of information.

The organisation of the Levels of granularity dimension presents a minor modification of a dimension in the Information FrameWork (Evernden 1996), called 'Levels of Ownership'. The latter suggests a population of six variables – global, industry, cross-enterprise, enterprise, local, individual. The modifications suggested in the FEBuS are based on generalisation of the above taxonomy through the merger of the 'industry', 'cross-enterprise' into an information cluster called 'Extended' and the re-labelling 'cross-enterprise' to 'business network' to reflect the common goal of the alliance. The network node is not added as a distinct level of granularity, as it could be any unit from the list of the subordinate of the business network. For example, a project team could form one network node and it could communicate with another node in the business network that could be an organisation. In cases where the project team is not the whole organisation, its IA should be aligned firstly with the IA of the organisation in which the project team belongs. Additionally, the cluster 'Extended' in Evernden's work was broadened by adding a category Customer-inclusive, to reflect the trend for many companies to open their computer networks for the customers and allowing them to pull required information on demand, rather than to wait for it to be pushed to him/her.

Similar simple classification based on the externality of the focal point, is offered by Cashmore and Lyall (1991), who differentiate three levels, these being external, corporate and internal. Checkland (1999) has a corresponding element in the root definition, i.e. the Owner's one.

Another modification of the Evernden's work that the FEBuS suggests is the promotion of 'Local' into an information cluster and its specialisation in information categories as per the business case, e.g. departments or teams.

Thus, for example, in the case of developing an information architecture for a node in a business network formed to build a prototype of a new car model, where the node comprises of a team of four designers, the attributes in the category Levels of granularity will have the following values:

Business network type = Industry-wide

Focal Business Unit = Project team

The *Structure* category in D1:Types of information will describe the arrangement of the team from a managerial point of view. The responsibilities of each of the team members with reference to the data on the car prototype will be represented by the category Roles (with reference to data) in D6:Roles, and their access rights to each of the data objects will be specified by the set of IM processes allocated to them. This mini example illustrates how Levels of granularity is linked to Dimension 1 and could serves as a basis for setting up security measures in place (See the example for Dimension 4: Transition). It also best highlights Rule 3 on the vertical and horizontal integration within the FEBuS (Fig.5.8).

The above discussion of the components of the FEBuS reflects the predominant focus on relationships of complex nature among the information categories in the business network. It is believed that to elicit the information content of these relationships, that intertwines all the aspects and perspectives discussed above, will provide an invaluable source of information for the business alliance. To establish to what extent practitioners recognised these components and relationships an empirical evaluation of the framework was conducted (See Chapter 6).

5.2. CHARACTERISTICS OF THE FEBUS

The FEBuS is a generic framework that allows organisations to design/re-design, integrate, evaluate and build an information architecture that fits with the organisational structure, behaviour and environment of the business unit. It is applicable at different organisational levels, from the business network level to the project team level. The tool builds upon previous theoretical and empirical work and endeavours to go beyond the pure description of e-business system building blocks and their relationships with each other and with the environment, and to enable balancing IT efficiency with business information needs. This is addressed by guarding the electronic enterprise against the sub-optimisation of contextual information and soft system characteristics.

5.2.1. DATA, INFORMATION OR KNOWLEDGE ARCHITECTURE?

The Open Group (2002) defines data architecture as

> *"the structure of an organization's logical and physical data assets and data management resources."*

The presented framework is an INFORMATION framework, rather than a DATA framework, as it not only presents the data, i.e. facts and figures, but also organises this data in a meaningful form, aiming to assist users who need this data in the fulfilment of their purposes. Further, as specified in Section 2.1.1, the data is structured according to its content, form, relevance to user role and business infrastructure, with view to improve user's understanding of the situation/problem and to provide for more effective and productive performance. This determines the role of the framework as an information framework, rather than data framework.

It could be argued that the proposed framework could also be used as a tool for knowledge management, since it is designed to support decision making and could be helpful for enhancing the knowledge of information-users within an organisation. This last statement is true, only if we adopt Chaffey's definition of knowledge management, i.e.

Knowledge management are "*techniques and tools for collecting, managing and disseminating knowledge within an organisation*"(Chaffey 2002)

5.2.2. INFORMATION ARCHITECTURE OR INFORMATION SYSTEM ARCHITECTURE?

This framework is designed as a framework for Information Architecture and conforms to Evernden's definition of Information Architecture (Section 1.3.7). However, as discussed earlier, in e-business context an IA framework is also an ISA framework. The two-fold perspective of 'information system' definition, allows for a wider interpretation of the term IS, i.e. in conformance with the definition provided by UKAIS (1999), or for a narrower technical view, where IS stands for 'computer-based software application'. Whilst the former allows the FEBuS to be used with no amendments, the latter needs only some of the dimensions of the framework to represent information on the four IS components defined by Cashmore and Lyall (1991) and the relationships they maintain.

5.2.3. THE FEBUS AS AN EVOLUTIONARY FRAMEWORK

"Discovery, that is a mix of instinct and method!"

E. Husserl

The evolutionary nature of the proposed framework is determined by the principles that governed the development of the framework:

(1) Using terminology already familiar through previous works on IA.

(2) Using the most widely recognised IA components and previous works on IA as foundations.

(3) Integration with other works in the IS field affecting IAs.

The employment of these principles in the study is discussed below.

The structure and the terminology used here are based on those used by Evernden (2002) for the description of The Evernden Eight framework. Minor variations are introduced to allow for the information clusters to be an optional structural component.

The design of the framework is founded onto the nine most common IA dimensions identified in Section 2.1.2 (Table 2.8). The original labels of the dimensions were kept where possible and any changes in the names were clearly documented. Additional dimensions were built in to reflect the latest research efforts in IA and the raising requirements of e-business identified, documented in Chapter 2. Table 5.3 provides a summary of the works underpinning the FEBuS components and Table 5.4 draws a comparison between the framework that has had the greatest influence on the proposal, i.e. the Evernden Eight, and the FEBuS.

Meta levels as a dimension has been first introduced in the Evernden Eight model and suggested values include 'Language' (e.g. corporate, business model, etc.) and 'Grammar'. The values of the latter variable could represent the information characteristic 'Overall emphasis' and span the continuum from Syntactic to Semantics (Gorry & Scott-Morton 1971).

If we take the level of analysis at a higher level, reviewing the framework itself as a system, the same eight information dimensions could be applied. Language will be described as part of D2: Levels of understanding or D9: Types of regulations. Similarly, the dimension *Levels of constraints* as identified by Evernden (1996) (e.g. Decomposition, Composition and Implementation) is not included as a separate dimension here. The content that this dimension reflects would normally be presented by different instances of the framework, thus maintaining the full set of information pertaining to the respective evolutionary stage.

Table 5.3: Cross-referencing FEBuS components with foundational works (1 of 2)

The FEBuS dimensions and information categories	Foundations	New dimension?
D1: Types of information	12 (Types of information); 3 (Abstractions)	
D1: Types of information: Business view		
Business function	2, 3, 4, 5, 7, 9, 10, 11 (all listed as Function), 14	
Data	1, 2, 3, 4, 5, 6, 7, 9	New aspects* (cost, permitted values)
Work-flow (Business process)	2, 3, 4, 5, 7, 8 (Procedures), 9, 10, 11	
D1: Types of information: Organisational view		
Strategy	2, 3 (Motivation), 4, 5, 6, 7, 19, 6 (Environment strategic factors)	New aspects (rules, values, risks)
Structure	2, 3 (In People); 4 (In People), 5, 7, 16 (System 4)	
D1: Types of information: Technical view		
Network	1, 2,3, 4, 5(Technical structure), 5 (Communication), 6, 7, 8, 9, 10, 11	
Application	5 (Technical structure), 6, 8, 9, 10 (Product)	
Platform	1, 6 (Systems software), 6 (Infrastructure architecture); 7 (Interface), 7 (Platform), 10 (System architecture), 11(In Landscape architecture)	
Interface	7	
D2: Forms of existence	12 (Types of knowledge), 12 (Types of representation), 13	
Based on nature	12, 14, 15	New aspects (descriptors)
Based on values	12	
Based on style	12, 14	New** (formal/informal)
Based on carrier	12, 14	New** (paper/verbal)
Based on stability	12, 14	
Based on level of aggregation	14	
Based on presentation	4 (Presentation), 14, 15	
D3: Levels of understanding	12 (Levels of understanding)	
Definitions		New aspects (incompatibilities)
Models, templates	7 (Solution)	New aspects (Models, templates)
Theories	14	New aspects (Theories)

Continues...

Table 5.3 (cont.): Cross-referencing FEBuS components with foundational works (2 of 2)

The FEBuS dimensions & information catg-es	Foundations	New dimension?
D4: Transitions	12 (Levels of transition), 17(Transformation), 18 (Transformation), 3 (Time), 15	
Version releases	2 & 3 (Time), 4 (Time), 12	New aspects: (currency)
Stages of capability or growth	5	New aspects (status before/after use)
Status (present or historical)	5 (Control & behaviour)	New aspects (currency)
D5: Types of IM processes	12 (Types of processes)	
Types of IM processes	5 (Distribution, Control & behaviour)	New (Based on Info lifecycle)
D6: Roles characteristics	2 (Perspectives); 12 (Levels of responsibility), 16 (System 4)	
Based on role (data perspective)	2, 3, 4, 5 (Control & behaviour), 7 (Skills), 8, 13, 17, 19, 20, 21	New aspects (owner, controller, etc)
Based on role (process perspective)	5, 14	New aspects (source, recipient)
Levels of competence, Skills	7, 14	
D7: Types of regulations	Context (13), 15, 16, 18, 19, 22	
Standards	8	New
Policies	8	New
Regulations	8	New aspects
D8: Levels of granularity	7 (Levels of ownership), 15, 18, 20, 23	
Levels of granularity	12	New

* (New aspects)- This component has been addressed partially in previous works

** (New)- This component has not addressed in any previous work

Key to references:

1 - Devlin & Murphy (1988)
2 - Sowa & Zachman (1992a);
3 - Zachman (1999)
4 - Loosley (1992) cited in Stevenson (1995a)
5 - Van Swede & Van Vliet (1993)
6 - Patterson (1994)
7 - Evernden (1996)
8 - Lehmann (1996)
9 - Tan & Uijttenbroek (1997)
10 - Darnton & Giacolleto (1998)
11 - Miller (2001)
12 - Evernden (2002)
13 - Denn & Maglaughlin (2000)
14 – Periasamy & Feeny (1997)
15 – Gorry & Scott-Morton (1971)
16 - Beer (1984)
17 - Kovitz (1999)
18 – Checklans & Scholes (1999)
19 - Belbin (2003)
20 - Currie (2000)
21 – Yin (1994)
22 – Haywood (1998)
23 – Cashmore & Lyall (1991)

Table 5.4: Cross-referencing FEBuS and The Evernden Eight

The FEBuS	The Evernden Eight
D1: Types of information	D1. Types of information
• Business view, incl. Business function, Data, Work-flow (Business process)	
• Organisational view, incl. Strategy & Structure	
• Technical view, incl. Network, Application, Platform, Interface	
D2: Forms of existence, incl. nature, values, style, carrier, stability, level of aggregation, presentation	D3. Types of representation D5. Types of knowledge *
D3: Levels of understanding, incl. Definitions, Models, templates and Theories	D2. Levels of understanding
D4: Transitions, incl. Version releases, Stages of capability or growth, Status (present or historical)	D4. Levels of transition
D5: Types of IM processes	D7. Types of processes
D6: Roles characteristics, incl. Based on role (data perspective), Based on role (process perspective), Levels of competence, Skills	D6. Levels of responsibility
D7: Types of regulations, incl. Standards, Policies, Regulations	
D8: Levels of granularity	D8. Meta levels (as language and grammar)
	D5. Types of knowledge

* - D5. Types of knowledge is the only dimension from The Evernden Eight that is not fully covered by the FEBuS. Only some aspects of the dimension are partially addressed in D3:Forms of existence

5.2.4. FLEXIBILITY AND ADAPTABILITY

The FEBuS provides a set of IA dimensions and suggests example taxonomy of these dimensions that are applicable to all organisations, regardless of their type, size and market sector. However, individual information architectures could differ due to the size of the organisation and the type of activities, the complexity of its processes and the competence of the people involved with the development and management of the tool.

Furthermore, the recursive logic of the framework and the build-in quality check for vertical and horizontal integration (Rule 3, Section 5.1.3) allow this same analytical construct to be used when addressing the needs of a business network. The participation (or not) in a business network and the complexity of the interactions within this alliance will further determine the specificity of the individual product.

5.2.5. DEVELOPMENT METHOD

Unlike other architecture frameworks, such as tIM (Evernden 2000) and TOGAF (The Open Group 2002) at this stage of the research, the FEBuS does not aspire to provide an architecture development method. This is in discord with the definition of an architecture framework given by The Open Group (2002) (cf. Section 1.3.6), but is a common practice across other architecture frameworks. The argumentation for this here is as follows:

- Organisations usually have their own individually tailored process for describing an information architecture, which the framework could complement, but not discard.
- The decision of how to use the framework will depend on the purpose of the architecture exercise and the respective view/position of the decision maker. Examples of viewpoint include information security, information strategic management, gap analysis, impact analysis, interoperability analysis, process redesign, et al.

However, the development of an IA development method accompanying the FEBuS is being considered for future extensions of the work, mainly for the needs of these enterprises that do not have an IA-building process in place.

5.2.6. MANAGERIAL POTENTIAL (USABILITY)

It is envisaged that the proposed framework provides for an integrated intra- and inter-organisational IS architecture and has the potential to overcome the limitations of the current internally focused IS development considerations and to support the establishment of electronically integrated business networks. It could equally successfully be applied to a single organisation striving for electronic integration. A version of the framework that excludes any references to technology and technology-related issues could be developed to serve as an information management framework for organisations that do not employ computer-based information systems.

Similarly to previous IA analytical tools the FEBuS has a potential as a strategic systems planning tool, as covers four of the five approaches to strategic systems planning as identified by Earl (1993):

1. Business-led – aiming to provide for achieving the business objectives and being supported by the business view of the framework (D1)
2. Administrative – dealing with identifying and allocating IS resources and informed by the Data and Roles information categories, as well as by the categories in the Technical view.
3. Technological – focusing on the production of models and blueprints, usually regarded as an exercise in business and information modelling and based upon the categories in the FEBuS dimension Types of understanding.
4. Organisational – building up the organisational learning about business issues and the IT contribution that is based upon the organisation view of the framework and all the contextual dimensions, incl. Roles, Types of regulations, as well as the focal dimension Levels of granularity.

The only aspect that is not supported is the Method-driven one that requires the presence of a method for application of the framework. The development of such an extension of the work was outlined in the previous section as a further development of high priority.

Further applications of the framework include its use for historical analysis of the transformation or the lifecycle of the information system.

One of the core potentials of the framework is seen as a communication tool in business networks. The framework draws the attention to complex relationships between its components and recognises that to be used as a unit of analysis such relationships will require bringing together IT, IS and business professionals and bridging the gap in the subject, hierarchical or geographical divide. Ultimately, in addition to the importance for managing resources and controlling organisational boundaries, the framework will become recognised as a tool for business network/enterprise integration in its wider definition.

Furthermore, the framework could be employed as a part of quality management system, as it informs on many aspects required by ISO 9001:2000 (BSI 2001). Further details on such application are discussed in Chapter 7.

5.2.7. VISUALISATION AND SOFTWARE SUPPORT

The framework as designed is multi-dimensional organisation of integrated components, where each of the components is explicitly differentiable from the others. As such, visualising it presents a challenge to the researcher. The methods for representing such multi- dimensional relationships was discussed earlier (Section 3.2.3), but none of the graphical presentation tools was found to meet the criteria of feasibility and user-friendliness.

As a result, currently the means of describing the model including the most traditional one, the textual description and a general purpose presentation tool, Microsoft PowerPoint that makes possible the hyperlink navigation within the framework. Due to the multi-dimensional structure of the tool the establishment and visualisation of the dependencies between the components have been one of the major difficulties experienced during the development of the tool. There is an on-going work for identification of suitable mechanisms for a graphical representation of the n-dimensional structure (Giovinazzo 1995). However, other pictorial models such as the ones used by Periasamy and Feeny (1997), together with software applications, are being considered for the their ability to represent information objects and the relationships between them in an easy to understand way. This and the limitation of time have affected the incorporation of software support of the development of individual information architectures.

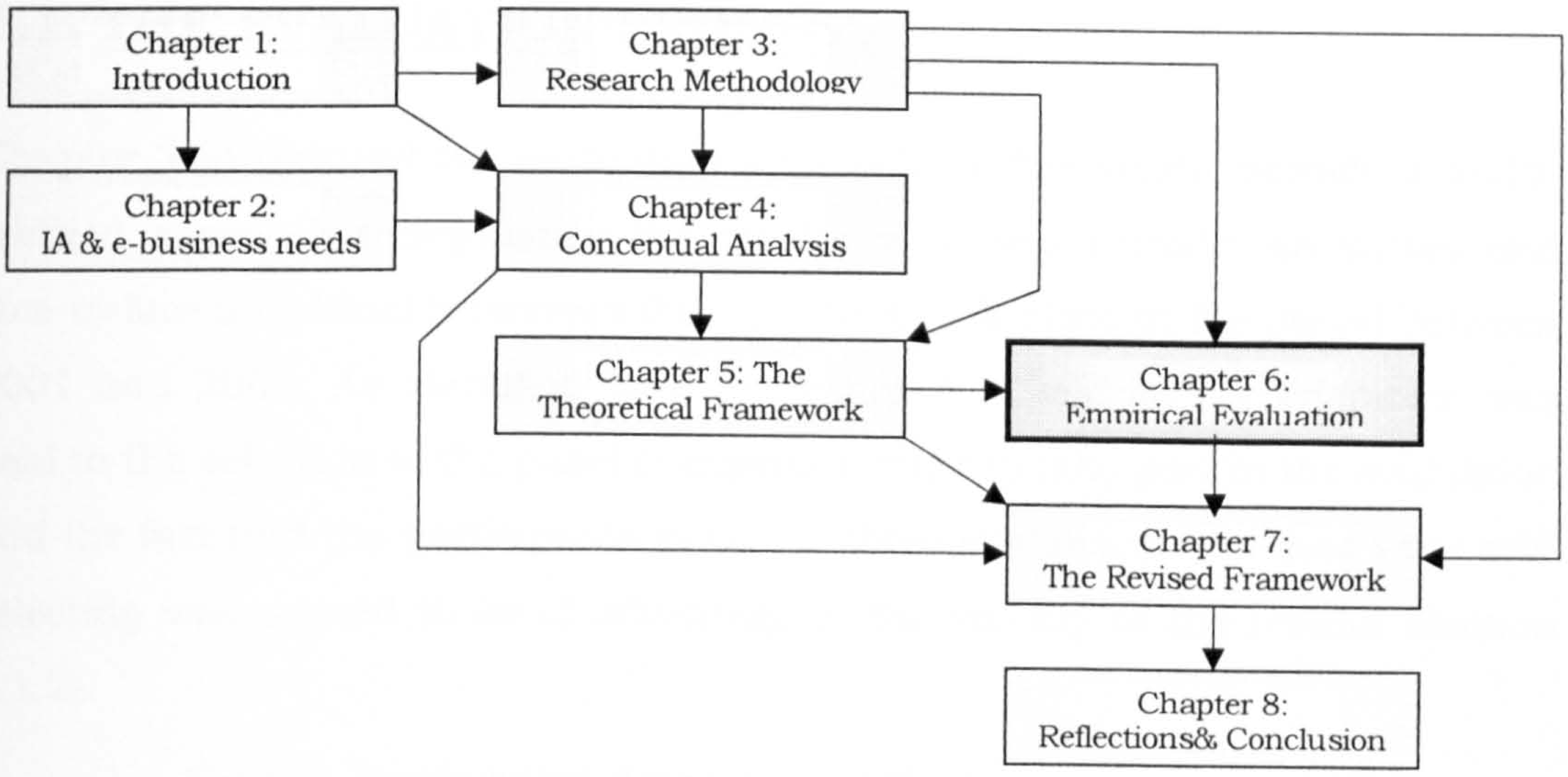
5.3. SUMMARY

"The goal of theory is to diminish the complexity of the empirical world on the basis of explanations and predictions" Bacharach (1989, p.513)

The proposed framework presented in this chapter introduces a conceptual schema for presenting and understanding the information in business systems and in particular in distributed business networks that employ information and communication technologies as a vehicle for their operations and communications. It attempts to meet the information needs of e-business enterprises and networks by using a few key constructs and excluding unnecessary detail. It is envisaged that it will help businesses cope with information overload and the complexities of decision-making in a virtual world, as it attempts to compensate the lack of context in a virtual world by incorporating some of the attributes of the information infrastructure as traditionally understood.

The extent to which the proposed theoretical framework meets the requirements for e-business architectural frameworks (Section 2.3) will be evaluated empirically (See Chapter 6) and any amendments to the proposed structure and rules based on the findings of the primary research will be discussed in Chapter 7: Reflections.

Chapter 6: Empirical Evaluation of the Framework for Information Architecture for e-Business Networks



"It is easier (and more fun) to evaluate a building than to evaluate that building's blueprint."

Toub (2002)

This chapter introduces the evaluation process and tools, and presents the analysis of the primary research findings. Its prerequisites are Chapter 3, that identifies the most suitable for this research multi-method configuration, and Chapter 5, that describes the result of a synthesis of existing information frameworks, IS frameworks, relevant concepts and best practices, i.e. the theoretical framework for Information Architecture for e-business networks.

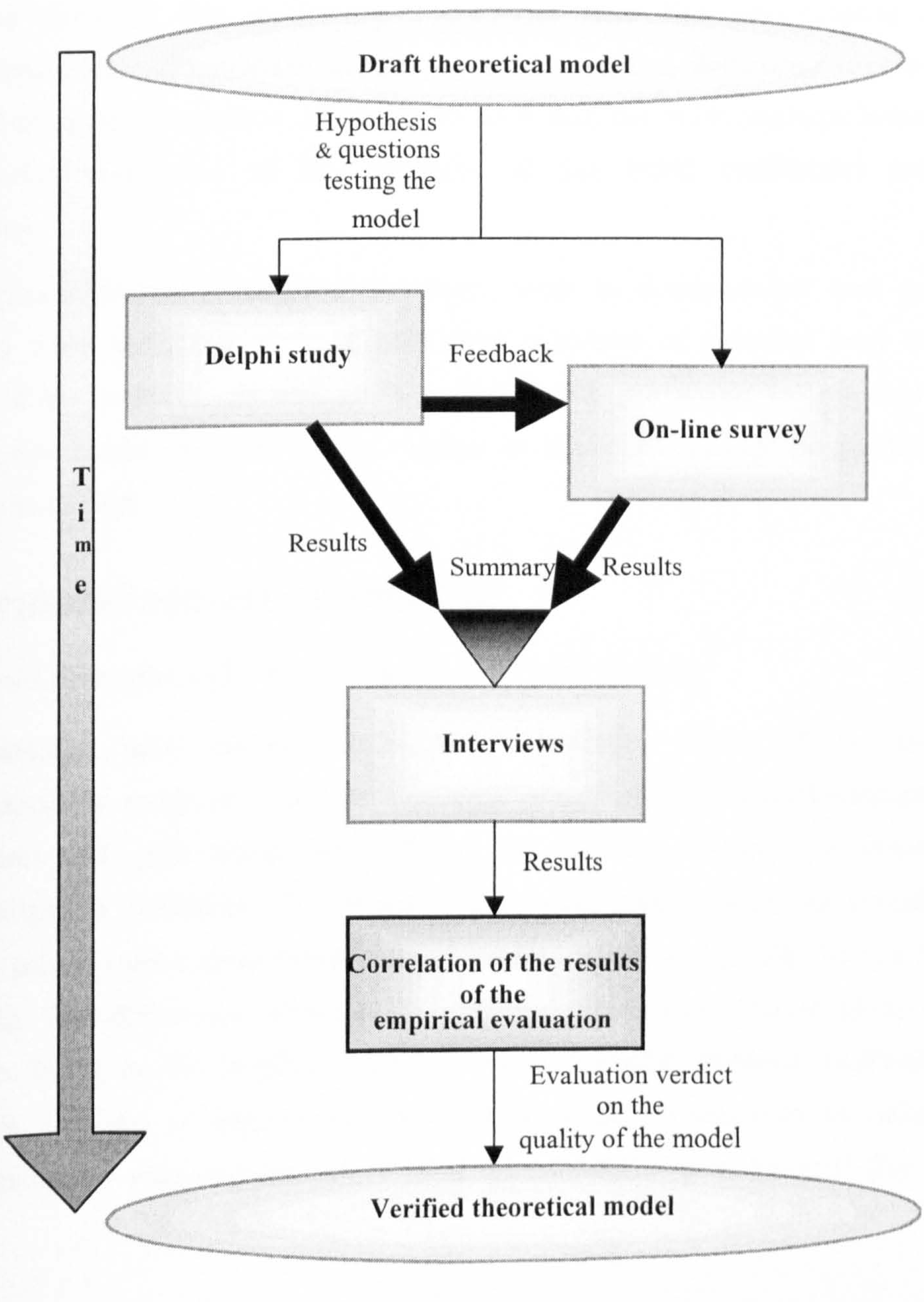
As the research is grounded in the principles of post-positivism, both positivist quality criteria, such as validity, reliability and generalizability, and non-positivist criteria, such as credibility, confirmability, dependability and transferability, have been considered. In meeting these requirements, to provide some contextual information for better understanding of the results, a detailed description of the evaluation process with details of the implementation of the evaluation tests and the evaluations instruments is provided at the beginning of the chapter. Having set the context, the discussion moves on to discuss the findings of the three evaluation tests using the framework structure as a basis. The chapter concludes with a synthesis of the results and a summary of the impact of the evaluation on the proposed framework.

The reflections on the evaluation findings and the changes to the model are presented in the following Chapter 7. The analysis of the quality of the work is included in Chapter 8.

6.1. THE EVALUATION PROCESS

Chapter 3 introduced the evaluation approach in this study, namely a multi-method approach triangulating the results of a Delphi study, an survey and face-to-face individual interviews (Fig. 6.1) that took place in the period between 2001 and 2003. As identified later in Section 6.3, special consideration was paid to the selection of the panel of experts invited to take part in the evaluation and the fact that the participants in all the three evaluation exercises were self-selecting was argued to be of advantage to the validity of the results (Section 3.1.2).

Fig. 6.1: Triangulation of evaluation methods



Bacharach (1989, p.501) proposed that in undertaking theory testing researchers should first assess validity of the building blocks of the framework, i.e. the underlying constructs and the variables, and only afterwards examine how the constructs and variables are assembled into propositions and hypotheses. These arguments, together with the understanding that the proposed multi-dimensional framework is very complex to be fully tested with self-administered questionnaires, determined the decision that the first two evaluation tests should focus only on the components of the IA. Each of the IA building blocks was described with one or more questions (See Section 6.2). Some questions implied relationships between a set of components, but the general intention was that structural submodels and relationships should not be tested explicitly here. Some confirmation of the existence of such might transpire through the qualitative comments that the participants in the questionnaire-based tests, i.e. the Delphi study and the electronic survey, could make. Testing the structure of the framework and the relationships between its components were one of the objective of the third evaluation test, the interviews.

The implementation of each of the three tests is documented and critically analysed here with the view of providing evidence of internal and external validity of the process, as well as to highlight any particular issues that fellow researchers could consider when trying to replicate wholly or partially the evaluation design.

6.1.1. THE DELPHI STUDY PROCESS

The Delphi evaluation (fig. 6.2) comprised of three phases:

- **Pre-study,** also called *Exploration & admin.* This phase included preparatory work on the content and design of the questionnaires (see Section 6.2) and supporting letters, as well as setting the criteria for participants selection. The name *Exploration* was chosen for consistency with other works describing Delphi studies (Linstone 1978; Turoff & Hiltz 1996). The difference with previous studies is in the relative place of this stage. Here, as the Delphi study was used for theory evaluation (Bacharach 1989), the list of issues was developed by the researcher to reflect the perspectives and components of the tested framework. Should the Delphi method had been used for exploring future issues, this list would have been generated by the participants throughout the rounds.

- **Main study** – This phase encompassed three stages, i.e. *Preparation, Evaluation* and *Analysis*. The *Preparation* stage completed the *Selection of participants* and the *Pilot study* of the questionnaire with three informed academics. The *Evaluation* stage involved the initial scoring and review of the scores for each of the issues suggested in the pre-study. As indicated on the implementation chart of the Delphi study (Fig. 6.2) due to the threat of low return rate, midway through the Round 1 of the *Evaluation* stage decision was taken to expand the participants group and there was some iteration to the *Selection* stage. The rest of the rounds in the *Evaluation* stage proceeded in sequential manner. More details on the conducting of the *Preparation* and *Evaluation* stages are given below. The results of the *Analysis* stage is discussed in depth in Section 6.4.
- **Post-study**, also named *Utilisation.* Here, the report with the findings of the Delphi study was developed and the results of the final round were compared to the outcomes of the electronic survey and the interviews. This phase had some common activities with the post-study phases of the other two evaluation tests, hence further details on these are presented in Section 6.3.

In setting up a Delphi panel it is critical that the panel consists of people that are informed and have some experience in the subject area (Dietz, 1987; Ziglio 1996), since their expertise is sought to validate the proposed framework. For this purpose, the Placement office at the Bournemouth University Business School was approached for some information on contact names from the companies that provide placement for the students studying IS-related courses. The list of companies includes companies of different sizes and market sector, but normally the students have an IS professional for a line manager. The questionnaire for **the first Delphi round** (Appendix C3) was sent together with the student performance appraisal forms going to the line managers for Placement 2001, a total of 90 people. A pre-paid addressed envelope was enclosed for participant's convenience and it was requested that the appraisal forms were returned with 2 weeks time. The same deadline was set for the questionnaire.

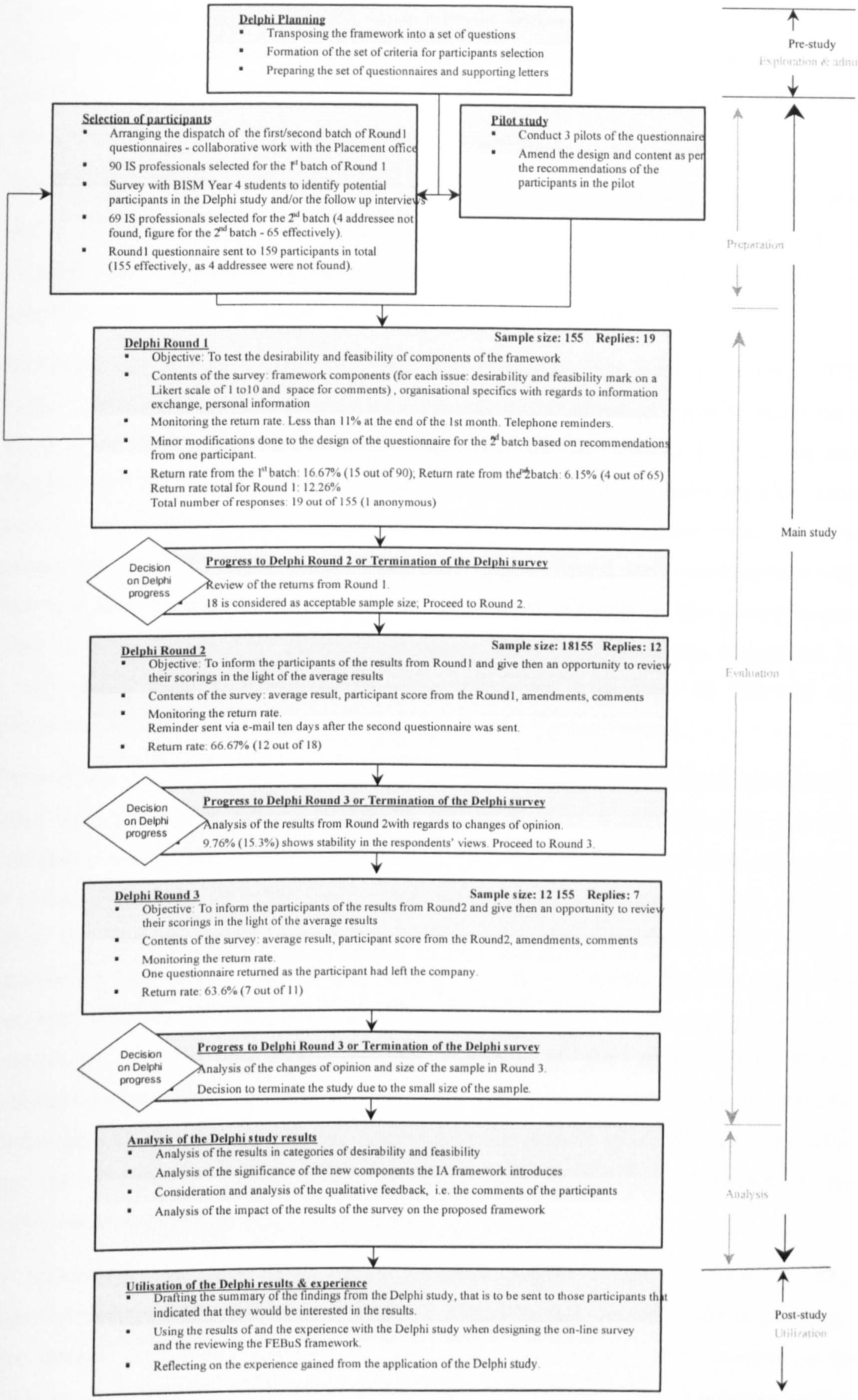


Fig. 6. 2: The Delphi survey implementation chart

The return rate was monitored on a weekly basis. Judging by the amount of questionnaires returned within the first 10 days, contingency measures were planned. These included enforcing the feedback from the first batch of the questionnaire and expanding the research sample.

During the third week after the start of the Delphi study, the placement contacts that had not returned the forms were contacted by telephone to request the expected appraisal and survey. As a result, 15 completed questionnaires were returned in total, giving a return rate of 16.7%.

Although the theory argues that this is acceptable size pane (Linstone 1978; Ziglio 1996) and practice proves that panels of the same or smaller sizes have been used in previous studies, e.g. Burns (1988) (in Hasson *et al* 2000) and Fischer 1978), it was considered that there is potential to increase the panel size by approaching IM managers from placement companies from previous years. All together, the second batch after being filtered for redundancies with the first batch, comprised of 69 questionnaires. The design of the questionnaire was slightly changed to incorporate minor style improvements suggested by respondents from the first batch. To enable the researcher to monitor the returns the copies of this questionnaire were of different colour.

Four of the questionnaires mailed with the second batch were returned with the note that the recipients were not found, or do not work any more for the company. Out of the remaining 65 copies, only four replies were received, giving a return rate of 6.15% for the second batch only. Surprisingly, four months after the second batch was sent another completed questionnaire arrived, increasing the return rate of the second batch to 7.69%. As this reply was received too late in time, even after the second round of the study had been completed, it was not used in the analysis of the study. One of the questionnaires was completed, but did not provide any contact details. Consequently, it was used in the analysis of the results of the Round 1 results, but the number of people invited to participate in the second round of the survey was reduced to 18.

In summary, for the first round of the Delphi study a total of 155 questionnaires were sent and 19 were received within two months of postage. The overall response rate was 12.26%, which is slightly lower compared to other studies (Holsapple & Joshi 2002), but is justifiable given the length of the questionnaire, the potential difficulty of people to associate immediately with the concept of information architecture, and the fact that there were no other incentives associated with the research, apart from the 'feel good factor'.

At this point a decision needed to be taken whether the size of the sample would provide reliable results. Based on Ziglio's observation of previous studies (Ziglio 1996), where good results were obtained from even smaller homogeneous groups of 10-15 experts, it was decided that the size and the composition of the sample were appropriate to proceed to the next stage.

In the second round of the Delphi study 18 questionnaires sent providing information on the group means and the respondent's own score for each of the questions. The letters thanked the participants and invited them to review their score in the light of the average result, if they considered this needed.

Only 6 replies were received within the first two weeks of sending the Round 2 questionnaire. To minimise non-response, the remaining 12 participants were prompted of the expected reply. The reminder was sent via e-mail as in their responses in Round 1 these participants have identified e-mail as most preferred method of communication. As a result of this follow-up, 6 more replies were received, thus totalling the number of responses to 12 out of 18, giving a response rate of 66.67%. The response rate is in agreement with Delphi studies with intra-organisational panels, and even higher than other studies that had employed inter-organisational panels (Holsapple & Joshi 2002). All the 12 responses were valid and used in the analysis.

Two criteria, the size of the participants sample and the stability of the responses, were taken into consideration when deciding whether to terminate the study after the second round or to progress to Round 3. Each of the completed questionnaires was examined to establish whether the participant chose to change the scoring from the first round. The assessment of the stability of the responses generated a result of 15.3 % that is very slightly higher than the threshold figure of 15 % that would determine that the changes in the responses is low enough to justify the termination of the case study (Linstone 1978). Furthermore, a close examination of the change patterns revealed that there were four extreme cases, one with an exceptionally high rate of changes and three with no changes at all. To resolve this dilemma, a five per cent Trim statistic was considered, but rejected due to the small size of the sample. Other Delphi reports were consulted for indication on how to treat such extremes in the results, but the literature provided no details on the change patterns, but only on the change rate. The observed exceptions could be attributed to many factors, including lack of confidence, overconfidence, events that had taken place in between the two rounds to taking the request to complete the questionnaire too lightly. However, in rejection of the latter statement, it has to be acknowledged that in all the three cases with no changes the respondents explicitly indicated that they want to keep to their initial scores. This encourages a speculation that the six non-returns are also happy with their initial views and opted not to send back the Round 2questionnaire, as the supporting letter did not request this explicitly. Such an interpretation ascertains a greater stability of the results and should taken into consideration, would have resulted in terminating the Delphi study. Moreover, that studies involving only two iterations have been reported in the past (Erffmeyer *et al* 1986, Linstone 1986, Holsapple & Joshi 2002).

However, to improve the quality of the results, decision was taken to conduct a **third round of the Delphi study** with the 12 respondents from the second round. In retrospective, it is considered that this and any following iteration could target all the participants in the initial round. However, in the absence of any specific guidelines from the Delphi theory and practice, it was assumed that non-participation was intentional, but not due to concurrence with the results. As the supporting letter did not explicitly request the questionnaire to be returned even if the panellist agrees with all results.

Similar to the second round, the respondents from Round 2 were presented with the mean results of the round and were offered an opportunity to adjust their scores should they consider appropriate. One letter was returned with the note that the participant has left the company. Of the remaining 11 questionnaires 7 were returned, giving a return rate of 63.6 %. Even though it seems a low sample, this is still within the range specified from Ziglio (1996) if there is sufficient expertise on the discussed matter. It could be argued that the comments provided on the questionnaire and the determination to complete this long questionnaire three times, provide some confidence in the expertise of the panel. However, given the experience with the first two versions of the research strategy, the option used, i.e. a self-selecting panel in Rounds 2 and 3 and no further testing on the association and expertise in IA, was the best available choice. It is also a common practice not to expose participants to any suitability, but judge for their suitability to take part in the panel only by their job title. In this case, the confidence levels are higher, as initial information on the e-business and e-communications practices in the represented organisations to confirm that the informant's knowledge is based on sufficient experience and understanding of IA requirements.

The results prove that in this third round participants were more willing to adjust their scores to converge towards the mean result, which resulted in a change rate much higher than the expected 15 or less % (Linstone 1978). This tendency for divergence rather than convergence could be attributed to several factors, amongst which the greater interval between the second and the third round, i.e. ten months, as opposed to the two months between Round 1 and Round 2. The longer break allowed for further development of personal experience and knowledge, as well as for changes in the situational context. The combination of these factors could have impacted on the individual views, and on the results of the study, respectively. It is not possible to establish whether such changes took place. It could further be hypothesised that only the people who felt strongly about the issues covered by the questionnaire sent it back and those five participants that did not return the Round 3 questionnaire did so as they did not have anything further to express.

In analysing the factors impacting on the stability rate, another aspect of the Delphi study was considered as in need of further investigation, that is whether knowledge of the sample size could have any impact on the rate of change in individual views. It could be hypothesised that in cases where the participants are aware of the size of the sample, there is a negative correlation between the size of the sample and the stability of the results. That is should the participants are aware that the size of the sample is very small, it is likely that they will sustain their original views, whilst they could be willing to converge with results generated by a larger group of people. In this study the participants were not told what was the sample size of each round, and no conclusions could be made on the reason for the change results. Furthermore, it was not possible to compare the pattern of the stability results of this study with other Delphi studies in the IS field referenced in this paper, as the change rate was reported only in few papers, mostly from the social and political studies (Fischhoff & MacGregor 1982; Linstone 1978; Parente *et al.* 1984). These are interesting methodological issues that could be pursued in further studies.

The convergence rate in the last round, the size of the sample and the current practice of most Delphi studies to terminate after the third round (Brancheau &

Wetherbe 1987; Brancheau *et al* 1996; Niederman *et al* 1991; Watson 1989) were considered as sufficient justification for termination of the Delphi study.

A letter expressing researcher's thankfulness was sent to the participants of the last round.

6.1.2. THE ELECTRONIC SURVEY PROCESS

The second evaluation test was conducted using electronic communication.

The decision on the e-mode of the survey was taken on the basis of research on the advantages and disadvantages of e-survey and primary investigation on the preferred model of communication of line managers in organisations that take BISM students on placement. The latter was conducted through a questionnaire with 90 final year students that had completed their placement year (Appendix C2). It comprised of 3 parts, *Organisational work patterns, Information* and *The Line Manager.* It was developed to provide more than the line manager's contact details, but also details on his/her personality with the view of developing the right approach if contacting the line managers for a follow-up interview. Questions were also included to identify the electronic communication channels and the access policy for using these, and manager's preferences on using these. The answers were used in taking the decision on the mode of delivery of the survey (via post, via e-mail, on a web site, or as a combination of any of the three methods). Some subjective opinion was sought on the personality of the manager with the view of approaching them for the interviewing as well.

To increase the external validity of the evaluation the same scenario and questions used in Delphi Round 1 were presented to a group of academics and practitioners that had attended UKAIS[1] and BIT[2] annual conferences in the last two years. Most of the participants in these two annual events are well known academics involved with IS research, delivery, consultancy and publishing. It was considered that the set of people interested in these conferences would comply with the research sample characteristics. In addition, a group of 20 IT consultants working on e-commerce projects, known to the researcher through

1 UK Academy of Information Systems
2 Business Information Technology

previous research and industrial experience, were approached with the request to complete the on-line survey, too.

All participants were e-mailed an invitation to take part in the research that had an HTML forms as an enclosure and provided the URL for a web site that hosted the form, in case the participant preferred to complete the Internet version of the questionnaire.

The form was sent to 162 recipients that had taken part in UKAIS conferences. 34 of them were not reached by the e-mail due to communications error, reallocation, or change of e-mail address. Of the remaining 128 only 9 (7.03% return rate) were returned. This could be attributed to the timing of the survey, i.e. the summer period, as well as to a "survey fatigue" (there are many surveys directed to the UK population nowadays, in any event/ communication media).

It was recognised that there could be overlap in the audiences of these annual UK conferences. After filtering out for duplication of names, the batch of 176 BIT participants was reduced to 100 names. 22 messages were not delivered for the same reasons of communications error, reallocation, or change of e-mail address. Of the remaining 78 people only 3 responses were received giving a total of 3.84% response rate. Of these, two respondents notified the researcher that they do not consider themselves suitable to take part in the survey. The effective return rate of this sample group was 1.28%. The overall return rate for conference participants was 4.85%, i.e. 10 replies from 206 received invitations. This might be considered to be a low response rate, but is not abnormal for surveys approaching participants without any preliminary communication, i.e. 'from cold'. Thus Ranchhod and Zhou (2001) report an earlier e-surveys from Tse et al (1995) with response rates of 6% and 7% and two more recent studies, where the e-mail surveys have achieved response rates of 3 % (Kent and Lee 1999) and 1% (Basi 1999). Another likely explanation of these results is the increased volume of junk, and in general, the growing information overload that e-mail users experience.

Out of the 20 IT consultants invited to take part in the survey 9 completed the on-line questionnaire, presenting a return rate of 45%. There were no delivery problems with the e-mails to these participants.

In total, out of the 282 e-mails sent, 226 were delivered and 19 people, 10 currently employed in the Academia and 9 currently working in the IT industry, completed the survey, giving a total of 8.41% return rate (Table 6.1). Only 3 academics and 3 practitioners agreed to take part in a follow-up discussion. As explained earlier, this is expected given the profile of the sample, i.e. inter-company, the information overload, the (in)ability to associate with IA and the lack of incentives for participation in the study.

Table 6.1: The Electronic survey participation statistics

	Invited (sent e-mails)	**Received (delivered e-mails)**	**Completed survey**	**% (return rate)**
From UKAIS conferences	162	128	9	7.03 %
From BIT conferences (filtered for redundancies with the previous set)	100	78	1	1.28 %
From IT industry	20	20	9	45.00%
Total:	282	226	19	8.41 %

The quantitative data collected in the electronic survey and the Delphi study was processed using computer-based tools. For efficiency considerations the data was entered in MS Excel spreadsheet and then imported and processed in SPSS. The components of the framework were tested through 34 questions, each of which was translated into an ordinal variable (cf. Section 6.2). In addition, for the analysis of the Delphi study two nominal variables were created to represent the number of the Delphi round and the type of the test, i.e. desirability or feasibility. The analysis of the electronic survey included only one additional nominal variable, used to group the responses on the basis of the type of respondent's current employment, i.e. in Academia or in IT/IS industry. This allowed expanding the scope of analysis to include both descriptive statistics and non-parametric tests for exploring relationships and comparing groups. The latter included:

- Friedman test – to test the change in the sets of desirability and feasibility scores in Delphi Round 1, 2 and 3.
- Mann-Whitney U test – to test the difference between the set of scores on desirability produced by Delphi participants with this of the participants in the e-survey. Two Mann-Whitney tests were conducted. The first test (M-W1) compared the results of the Delphi Round 1 with the e-survey, and the second one (M-W2) mapped the results of the Delphi Round 3 against those of the e-survey. The first test, M-W1, was run under the assumption that the Delphi Round 1 and the e-survey could be considered as parts of the same survey delivered using different communication channels, i.e. a paper-

based mail shot and a web-published HTML form. The second Mann-Whitney test, M-W2, examined the results for any differences determined by the changes in opinions of the Delphi participants in Round 3, impacted by seeing the mean results of the first two rounds.

Three more Mann-Whitney tests were conducted, the first of which (M-W3) evaluated whether the median outputs of the Academics participants in the e-survey differ significantly from those of the IT/IS professionals in the e-survey. However, given the size of the sample and the absence of knowledge on employment history, this test is considered as having greater methodological value, rather than being indicative about trends in the views on Information Architecture. The other two Mann-Whitney tests compared the results of the IT participants in the e-survey with those of the Delphi participants in Round 1 (M-W4) and Round 3 (M-W5), respectively. M-W4 informed on the differences between two samples in a cross-sectional study, and M-W5 was conducted as part of an analysis of a longitudinal study. It is recognised that longitudinal tests are usually done using the same test group, but in this case the assumptions were that both test groups represent the same population of IS practitioner in UK, whose participation in the research could be considered as an evidence of their interest in Information Architecture.

Regrettably, due to relatively small sizes of these research samples, i.e. less than 10, the results of all the M-W tests, except of M-W1, are valuable more as adding methodological rigour, rather than as statistically significant confirmation of trends in the views on Information Architecture for e-Business networks.

Spearman's Rank order correlation (rho) test was also considered for exploring the data for any relationships between components of the framework, but was rejected for the reasons referred to above.

The analysis of the results from the quantitative evaluations of the desirability and feasibility of the components of the framework are presented in Section 6.4.

6.1.3. THE EVALUATION INTERVIEWS PROCESS

The third test of the proposed analytical tool encompassed a series of interviews. Its primary goal was to evaluate the framework through an extended qualitative feedback on the framework organisation, coverage and usability. The interviews were viewed as an opportunity to address the limitations of the Delphi study and the electronic survey, that focused solely on the desirability and feasibility of the FEBuS components, but proved to be restricted in their abilities to evaluate the framework in its entirety.

Similarly to the Delphi study and the e-survey, the interview process comprised of three stages, Preparation, Interview, Post-interview.

6.1.3.1. Interview preparation

In this stage potential interviewees were identified through purposive sampling, targeting four groups of IS/IT practitioners:

- those Delphi participants who expressed interest in the results (ten people),
- the IT practitioners who took part in the electronic survey and agreed on a follow-up interview (three people),
- the few Information/Data architects listed in the databank of the Placement office, who opted not to take part in the Delphi study (three people);
- information system architects and e-commerce specialists suggested from academics and professionals familiar with the research objectives (four people).

Twenty invitations for one-hour interview were sent, of which five were accepted (25%) were received. One Delphi participant requested more detailed information on the framework prior taking a decision whether to agree on an interview. Later he wrote a detailed e-mail explaining his view on why his organisation, a financial third party administration company, does not provide a suitable testing field. Regardless of the fact that this was not a true face-to-face interview, the reply was included in the analysis of the results, as it provided valuable information for making judgements on certain implementation issues, including non-applicability of the framework for certain scenarios, presentation format and clarity of the tool (See Chapter 7).

Semi-structured interviews were adopted as best suited for testing a predefined object such as the FEBuS. They ensured that all the components and relationships of the framework are reviewed, whilst at the same time allowing the interviewee to expand on their experiences and suggest any amendments to the framework or raise other framework-related issues. On completion of each interview the framework was reviewed in the light of the comments and the suggested amendments added to the set of issues to be tested at the next interview.

An interview template (Appendix C.7) was developed and tested with one of the participants. The outcomes of the pilot proved that the agreed timeslot of one hour was not sufficient to address all the planned questions. The template was reviewed and a section testing the participant's understanding of the terms Data Architecture, IA, Knowledge Architecture and ISA was taken out to allow more time for testing the framework. The research could still judge on the participant's position on these concepts based on the views expressed when defining the characteristics of the FEBuS, i.e. what type of architecture is presents and what is its value for practice.

Furthermore, to allow more time for in-depth review of the proposal, a section testing the results from the Delphi study and the electronic survey was moved towards the end of the interview. This was to be introduced only if the agreed interview time permitted. In cases where the core objective, i.e. the discussion of the FEBuS, was not completed within the requested hour, extension was requested. In all instances such was granted.

The followed interviews proved that the new interview structure allowed for greater flexibility and for using the one-hour slot most effectively. To improve further the efficiency of the interviews, a few days prior the appointment the interviewees were provided with a summary of the aims of the research, the objectives of the interview and the proposed structure of the interview.

6.1.3.2. The interview sessions

Each interview began with a brief review of the research aims and objectives and the interview structure and objectives. Tape recording and confidentiality were also agreed in this initial part. When requested, the anonymity was confirmed again at the end of the session. Of the five participants two requested that their details and the names of their companies were kept confidential. For uniformity, for the purposes of this paper and in any other publications referring to the results of this study, complete anonymity was provided for all interviewees. This was ensured by replacing their names with a letter corresponding to the order number of the interview. For example, the participant in the pilot interview is referred to as Participant A or Interviewee A, the participant in the second interview - B, and the participant in the last interview - E.

The principal part of the interview followed the "funnel approach" (Bocij *et al.* 2002, Cadle & Yeates 2001) moving from more general to more specific issues to discuss. It started with a general question on the participant's position, working and educational experience, and responsibilities within the company (see Table 6.1). The use of the term 'information architecture' in the company and related information management and information communication practices were discussed to establish a common basis for the interview and develop understanding of interviewee's background and environment that shapes his/her views. Further, the FEBuS framework was presented to the participants for examination. The work was introduced in a plain text format structured in a hierarchically organised bullet list. The reasoning behind each of the framework components was explained to the participants and their views on the organisation of the category and its relationships with other categories were sought. During the discussion of the framework, the participants were encouraged to provide examples on how a particular information category translated to their organisation. Where time permitted the interviewees were invited to provide their views on the components that scored lowest in the Delphi study and the electronic survey. The interviews concluded with exploring how the interviewees classified the framework, e.g. IA or ISA, Data, Information or Knowledge architecture, and discussing other issues related to the implementation of the framework, such as clarity, usability and presentation. Critical views on the importance and the completeness of the framework were also sought. The final part of the sessions included testing two hypotheses on the constituents of Information Architecture for business networks in a networked environment. The interviews concluded with agreeing the confirmation of transcripts and thanking the participant.

6.1.3.3. Post-interview stage

In this stage all interviews were transcribed and analysed with the help of qualitative data analysis tools. The code system used reflected the components of the proposed framework. The data was unitised (Saunders *et al.* 2002) and analysed for any inter-relationships. Initially WinMAX was employed (Fig.6.3), but as the version available proved to be limited for analysing relationships between the codes, the data was transferred to its successor MAXqda. In addition to enhanced analytical and reporting capability, the latter provided user-friendlier interface, adding colour-coding and paragraph-numbering rather than line- numbering (Fig.6.4).

The interview analysis of the interviews also examined the frequencies of each of the codes (Appendix C7). Although these results could not be interpreted as an indicator of the relative importance of each component, they could be treated as a flag designating interviewee's attention to this component as an individual entity, or as a part of a relationship. Only when these results and the supporting comments are correlated with the results of the Delphi study and the e-survey,

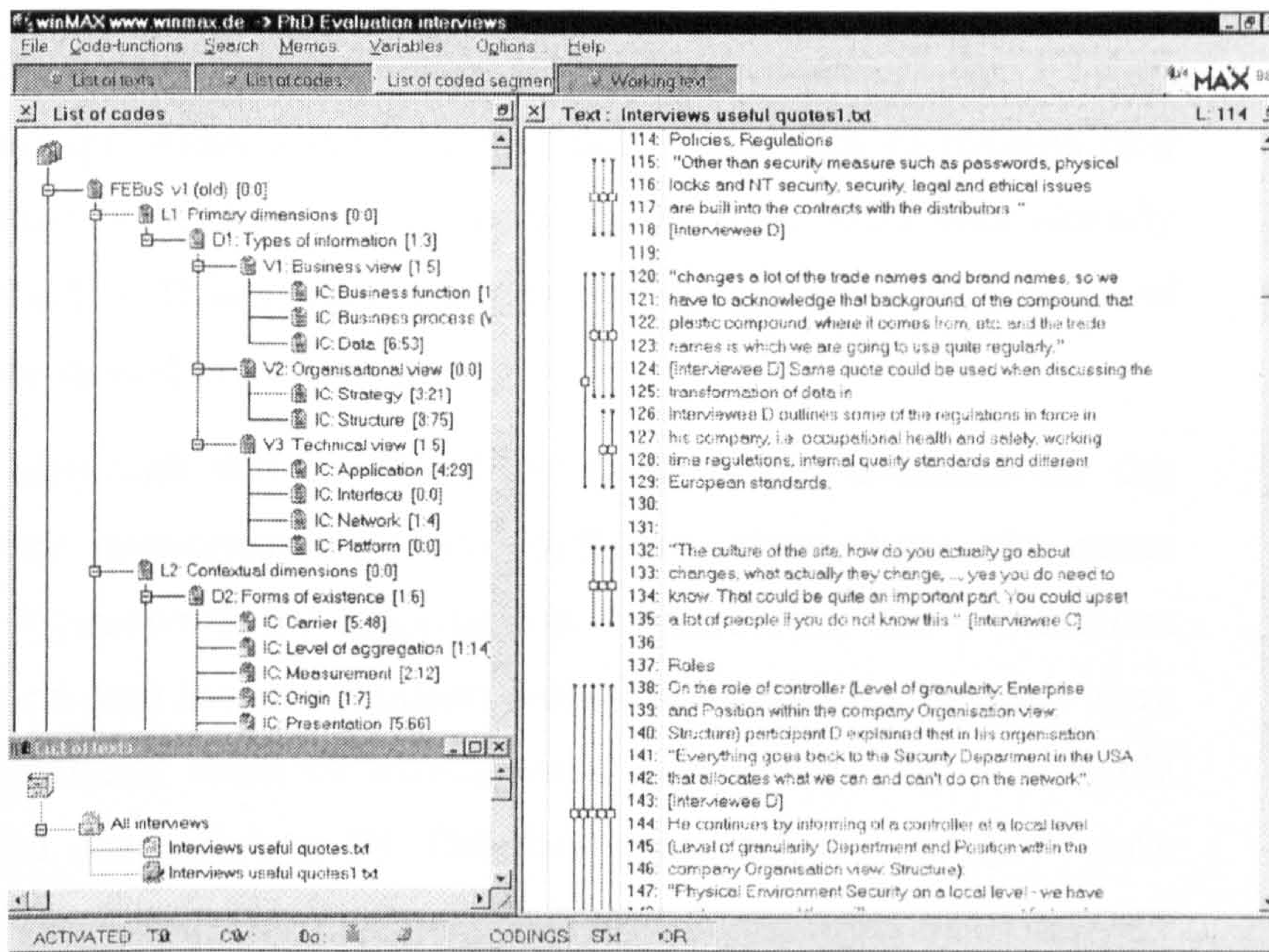


Fig. 6.3: Using WinMAX

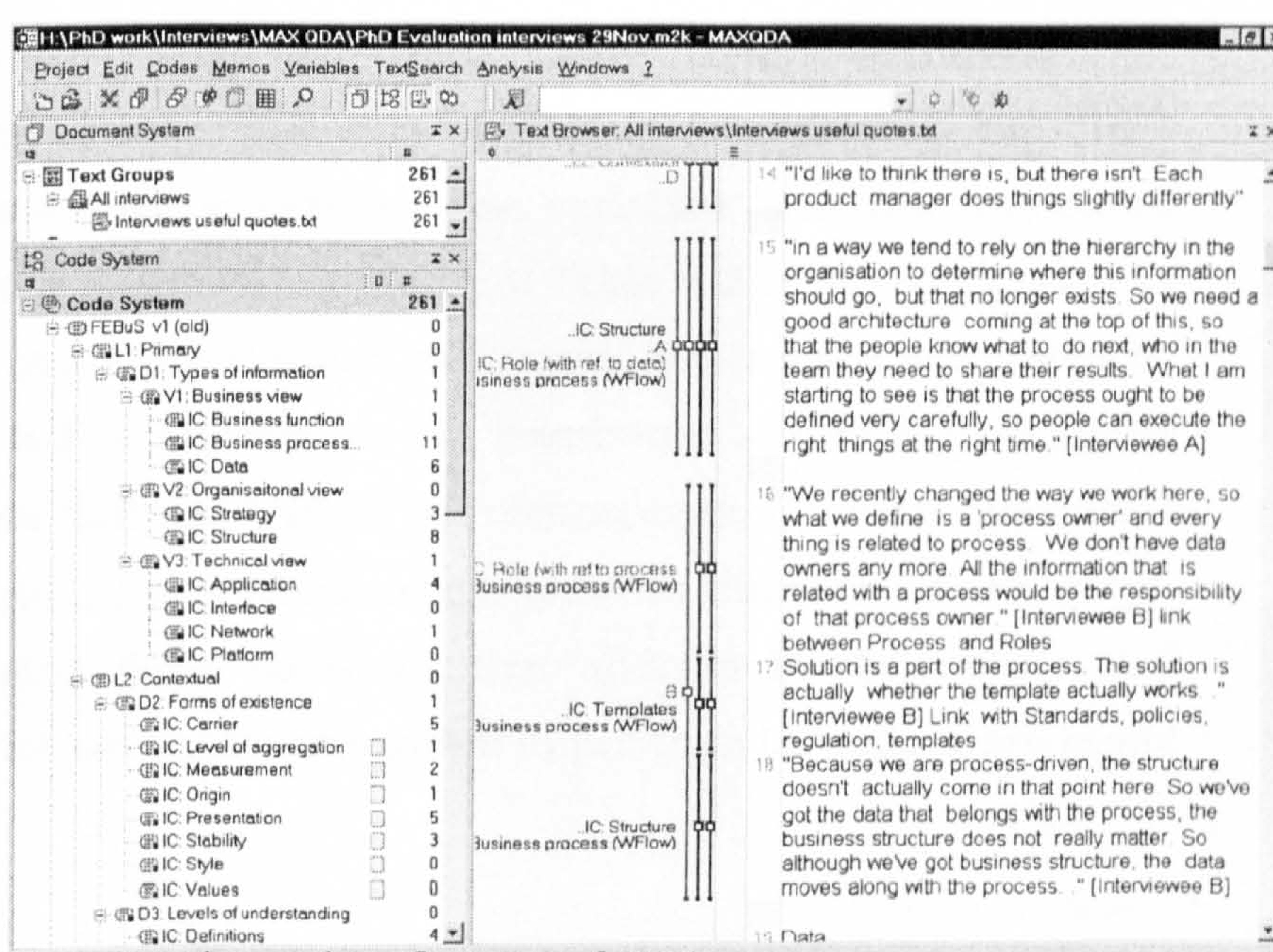


Fig. 6.4: Using MAXqda

conclusions could be drawn about the significance of each component. Still, when analysing a particular code, the frequency is taken into consideration, because it is believed that it could provide some confidence on the reliability of the conclusions made about the framework constituents.

The analysis of the interviews is presented in Sections 6.4.

6.2. THE EVALUATION TOOLS

The set of data collection instruments used in the evaluation of the FEBuS framework includes four questionnaires (one for each of the Delphi rounds and one for the electronic survey) and an interview template. The latter was already discussed in Section 6.1.3.3. This section reviews the design and the content of the electronic and paper-based questionnaires.

As mentioned earlier, although the form and the delivery mechanisms for the Delphi and the e-survey questionnaires were different, they share the same fundamental, i.e. the Framework for Information Architecture for e-Business Systems. The dimensions and the information categories of the framework were translated into 34 questions, each of which wass represented by a variable measured on an ordinal scale of 1 to 10. This has resulted in a complex data collection instrument, but it has been established that there have been studies covering 80 and even 200 test items (Fischer 1978).

For clarity, the name of the variable comprises of a number corresponding to the question number and a term that best describes the dimension/information category that this variable is representing, e.g. "16 – Templates". The cross-reference between the variables and the framework dimensions is illustrated in tables 6.2 and 6.3. Table 6.2 is sorted in order of the survey questions and reflects which framework dimensions are tested by each question. Table 6.3 is focused on the framework structure and shows which are the questions that test each of the components. For each question it outlines which dimension(s) and relationships between dimensions are tested. The table also highlights these questions that address IA dimensions and categories that are either not widely recognised in previous IA work or are newly introduced.

Table 6.2: The Delphi questions and the FEBuS dimensions sorted by question (Page 1 of 2)

The Delphi questions			The Framework
Question		Variable	Dimensions
1	Knowing who the source or recipient of the information is;	1 source/recipient	D6: Roles characteristics (Process perspective)
2	Knowing which team/department/organisation is the source/recipient of the information; Is it internal or external for the organisation;	2 organisation (source/recipient)	D1: Types of org. information (Structure) & D6: Roles characteristics (Process perspective) & D8: Levels of granularity
3	Knowing what is the role of the source/recipient within the project;	3 role (source/recipient)	D1: Types of org. information (Structure) & D6:Roles characteristics (Data perspective)
4	Knowing what processes use this information;	4 processes	D1: Types of business information (Workflow)
5	Knowing what the importance of the information (e.g. strategic/operational/ general; administrative; adding to organisational or personal knowledge) is;	5 importance	D1: Types of organisational information (Strategy)
6	Knowing what risks exist related to this information; What security measures are needed for this information on the sender's/recipient's side;	6 risks	D7: Types of regulations (Policies) & D1: Types of org. information (Strategy)
7	Knowing who the "owner"/originator of this information is;	7 owner/originator	D6: Roles characteristics (Data perspective) & D5: Types of IM processes
8	Knowing who the controller of the quality/performance of the information is;	8 controller	D6: Roles characteristics (Data perspective) & D5: Types of IM processes
9	Knowing whether the information is stable or dynamic; How often it is upgraded;	9 stable/dynamic	D2: Forms of existence (Stability)
10	Knowing what is the format of the information carrier (e.g. text file, diagram, spreadsheet, presentation, document image, image);	10 format	D2: Forms of existence (Presentation)
11	Having access to the information in electronic format, rather than paper or verbally;	11 electronic access	D2: Forms of existence (Carrier)
12	Knowing what is the style of the information (e.g. formal, informal, personal); How structured is it;	12 style	D2: Forms of existence (Style)
13	Knowing the level of aggregation, i.e. how detailed or summarised the information is;	13 aggregation	D2: Forms of existence (Levels of aggregation)
14	Knowing how current/up-to-date the information is;	14 current/up-to-date	D4: Transition (Status), (Version releases)
15	Knowing how the information is described (e.g. what languages, models, tools are used to describe and process the information);	15 languages/tools	D3: Levels of understanding (Models, Templates)
16	Knowing whether templates are available for this information and if so, how to obtain them;	16 templates	D3: Levels of understanding (Models, Templates)
17	Knowing what events affect this information (e.g. year end);	17 events	D1: Types of business information (Business process)

Key to shading:

(no shading) - Questions/Variables for existing IA dimensions and categories

(light gray) - Questions/Variables for emerging IA dimensions and categories

Table 6.2 (cont.): The Delphi questions and the FEBuS dimensions ... (Page 2 of 2)

The Delphi questions			The Framework
	Question	Variable	Dimensions
18	Knowing what is the type of information (e.g. hidden, tacit, explicit, implicit);	18 type	D2: Forms of existence (Nature), (Values)
19	Knowing what is the status before and after any use;	19 – status before/ after use	D4: Transition (Stages of growth), (Version releases)
20	Having measures of the quality of the information; Knowing what the key performance indicators for this information are; Whether best practice is recorded;	20 quality/performace measures	D7: Types of regulations (All categories)
21	Knowing the cost of the information;	21 cost	D1: Types of business information (Business Function) + (Data)
22	Knowing whether there are any ethical considerations arising from the use/dissemination of the information, and if so what are they;	22 ethical issues	D7: Types of regulations (Policies), (Regulations)
23	Knowing whether there are any legal considerations related to the information in any stage of its lifecycle, and what are they;	23 legal issues	D7: Types of regulations (Regulations)
24	Knowing whether there are any organisational considerations (e.g. rules on using this information, strategic importance, confidentiality);	24 organisational issues	D7: Types of regulations (Policies) & D1: Types of org. information (Strategy)
25	Knowing what other information you use is related to/affected by this information;	25 related information	D1: Types of business information (Data)
26	Knowing what software is used to process the information;	26 software	D1: Types of technical information (Software)
27	Knowing what hardware is used to process the information;	27 hardware	D1: Types of technical information (Hardware)
28	Knowing what communication media is used to distribute/receive the information (e.g. protocols, network address, etc.);	28 communications	D1: Types of technical information (Communications)
29	Knowing who is responsible for the design of the system providing the information ;	29 designer	D6: Roles characteristics (Data perspective)
30	Knowing what specific skills and competencies the processing of the information requires;	30 skills/ competencies	D6: Roles characteristics (Levels of competence)
31	Knowing what the permitted values for this information are (e.g. default values, synonyms)	31 domain	D3: Levels of understanding (Definitions)
32	Knowing of any incompatibilities in advance;	32 incompatibilities	D1:Types of business information (Data) & D3: Levels of understanding (Definitions) & D1:Types of tech. information (Interface)
33	Knowing if the information used/changed concurrently, i.e. simultaneously from different parties;	33 concurrent use	D5: Types of IM processes
34	Knowing what happens to this information after completion of the task/ the project	34 next stage	D1:Types of business information (Bus. process)

Key to shading:

(no shading) - Questions/Variables for existing IA dimensions and categories

(light gray) - Questions/Variables for emerging IA dimensions and categories

Table 6.3: The Delphi questions and the FEBuS dimensions – Sorted by dimension

The FEBuS dimensions and information categories	The Delphi/Survey questions	New dimension?
D1: Types of information: Business view		
Business function	21	
Data	21, 25, 31	New aspects*
Work-flow (Business process)	4, 17, 34	
D1: Types of information: Organisational view		
Strategy	5, 6, 24	New aspects
Structure	2, 3	
D1: Types of information: Technical view		
Network	28	
Application	26	
Platform	27	
Interface	26, 27, 28, 32	
D2: Forms of existence		
Based on nature	15	New aspects
Based on values	18	New**
Based on style	12	New
Based on carrier	11	
Based on stability	9	New
Based on level of aggregation	13	New
Based on presentation	10	
D3: Levels of understanding		
Definitions	31, 32	New aspects
Models, templates	15, 16	New aspects
Theories	32	New
D4: Transitions		
Version releases	14,19	New aspects
Stages of capability or growth	19	New aspects
Status (present or historical)	14	New aspects
D5: Types of IM processes		
Types of IM processes	7,8, 33	New
D6: Roles characteristics		
Based on role (data perspective)	3, 7, 8, 29	New aspects
Based on role (process perspective)	1, 2	
Levels of competence, Skills	30	New aspects
D7: Types of regulations		
Standards	20	New
Policies	6, 20, 22, 24	New
Regulations	20, 22, 23	New aspects
D8: Levels of granularity		
Levels of granularity	2	New

* (New aspects)- This component has been addressed partially in previous works

** (New)- This component has not addressed in any previous works

It could be observed that the flow of the questions does not reflect the logical organisation of the framework, i.e. with some dimensions being assigned higher priority than others. The questions were grouped in logical groups, the arrangement of which was determined by the perceived ease of the subject matter of the group, starting with the more straightforward ones. The researcher was aware of the length of the questionnaire and did not want to deter the addressee by starting with questions that could be considered as more complex, potentially sensitive, or referring to concepts that the participants might not find easy to relate to. Personal and contextual questions were included at the end of the questionnaire, preceded by brief statement on their purpose. Agreement for a follow up interview was also sought at the very end of the questionnaire.

6.2.1. THE DELPHI QUESTIONNAIRE FOR ROUND 1

The questionnaire employed in Round 1 of the Delphi study was included the questions listed in Table 6.2. It was supported by a letter introducing the working definitions for IA and for a business network and outlining a common hypothetical scenario that could ensure some consistency in participant's positions when completing the questionnaire. A screenshot of the layout of the questionnaire is presented on Fig.6.5 and the supporting letter and the questionnaire template are included in Appendix C.3.

Two working hypothesis were formulated for each of the questions, the first testing the desirability and the second, the feasibility of the particular component. The respondents were invited to rate these, using a Likert scale of 1 to 10, where 1 indicated the least desirable/feasible constituent and 10 stood for the most desirable/feasible one. Space for comments and/or questions was provided next to each of the issues. The relatively small size of the comments box, did not deter participants from writing in their comments and many comments were received. Where the participant required more space to expand on their views, they provided their comments on the back of the questionnaire.

	Things you want to know/need to know about the information you use	Your view on Please mark ① Least important ⑩ Most important		Your comments
	Brief description	Desirability	Feasibility	*Suggested changes, arguments, questions*
1	Knowing who **the source or recipient** of the information is;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
2	Knowing which **team/ department/ organisation** is the source/recipient of the information; Is it **internal or external** for the organisation;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
3	Knowing what is **the role of the source/recipient** within the project;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
4	Knowing what **processes** use this information;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
5	Knowing what **the importance of the information** (e.g. strategic/operational/ general; administrative; adding to organisational or personal knowledge) is;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
6	Knowing what **risks** exist related to this information; What **security measures** are needed for this information on the sender's/recipient's side;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
7	Knowing who **the "owner"/ originator of this information** is;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
8	Knowing who **the controller of the quality/ performance** of the information is;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
9	Knowing whether the information is **stable or dynamic**; How often it is upgraded;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
10	Knowing what is the **format of the information carrier** (e.g. text file, diagram, spreadsheet, presentation, document image, image);	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
11	Having **access to the information in electronic format**, rather than paper or verbally;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
12	Knowing what is the **style** of the information (e.g. formal, informal, personal); How structured is it;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	

Fig.6.5: Questionnaire layout for Delphi study Round 1

On completion of the core part of the questionnaire, general questions on the methods and scope of information exchange were asked to acquire some idea of the extent to which the participant's organisation was exhibiting any of the characteristics of a participant in an e-business network node. This was done with the intent to find appropriate candidates for the third type of evaluation tests, the interviews. The questionnaire concluded with asking for some personal information such as contact details and preferred method for communication, as well as whether the panellist would be interested in the study results.

6.2.2. THE DELPHI QUESTIONNAIRES FOR ROUND 2 AND ROUND 3

The questionnaires for Delphi Round 2 and 3 shared the same format. They were designed as mail-merge documents (Fig.6.6), presenting the mean results for each question and the answer given by the participant in the first round.

Gazing into the Oracle: A Delphi Study on Information Architecture, Round 2

	«Name» «Family_name», «Placement_Company_Name» Things you want to know/need to know about the information you use	Desirability 1-least desirable; 10-most desirable			Feasibility 1-least feasible; 10-most feasible			Your comments
		Average score	Your score	New score *	Average score	Your score	New score *	
	Brief description	** Enter new figure or tick to agree*			** Enter new figure or tick to agree*			*Suggested changes, questions*
1	Knowing who the source or recipient of the information is;	8.42	«M_1D»		7.89	«M_1F»		
2	Knowing which team/department/organisation is the source/recipient of the information; Is it internal or external for the organisation;	8.74	«M_2_D»		8.05	«M_2_F»		
3	Knowing what the role of the source/recipient within the project is;	7.56	«M_3_D»		7.78	«M_3_F»		
4	Knowing what processes use this information;	7.59	«M_4_D»		6.12	«M_4_F»		
5	Knowing what the importance of the information (e.g. strategic/operational/ general; administrative; adding to organisational or personal knowledge) is;	8.16	«M_5_D»		7.78	«M_5_F»		
6	Knowing what risks exist related to this information; What security measures are needed for this information on the sender's/recipient's side;	8.16	«M_6_D»		7.28	«M_6_F»		
7	Knowing who the "owner"/originator of this information is;	7.42	«M_7_D»		7.61	«M_7_F»		
8	Knowing who the controller of the quality/performance of the information is;	7.00	«M_8_D»		6.58	«M_8_F»		
9	Knowing whether the information is stable or dynamic; How often it is upgraded;	8.89	«M_9_D»		7.32	«M_9_F»		
10	Knowing what the format of the information carrier is (e.g. text file, diagram, spreadsheet, presentation, document image, image);	7.58	«M_10_D»		8.32	«M_10_F»		
11	Having access to the information in electronic format, rather than paper or verbally;	8.16	«M_11_D»		8.05	«M_11_F»		
12	Knowing what the style of the information is (e.g. formal, informal, personal); How structured is it;	6.26	«M_12_D»		7.11	«M_12_F»		
13	Knowing the level of aggregation, i.e. how detailed or summarised the information is;	7.00	«M_13_D»		6.68	«M_13_F»		
14	Knowing how current/up-to-date the information is;	8.79	«M_14_D»		8.26	«M_14_F»		
15	Knowing how the information is described (e.g. what languages, models, tools are used to describe and process the information);	7.06	«M_15_D»		6.65	«M_15_F»		
16	Knowing whether templates are available for this information and if so, how to obtain them;	6.44	«M_16_D»		7.22	«M_16_F»		
17	Knowing what events affect this information (e.g. year end);	8.88	«M_17_D»		7.59	«M_17_F»		

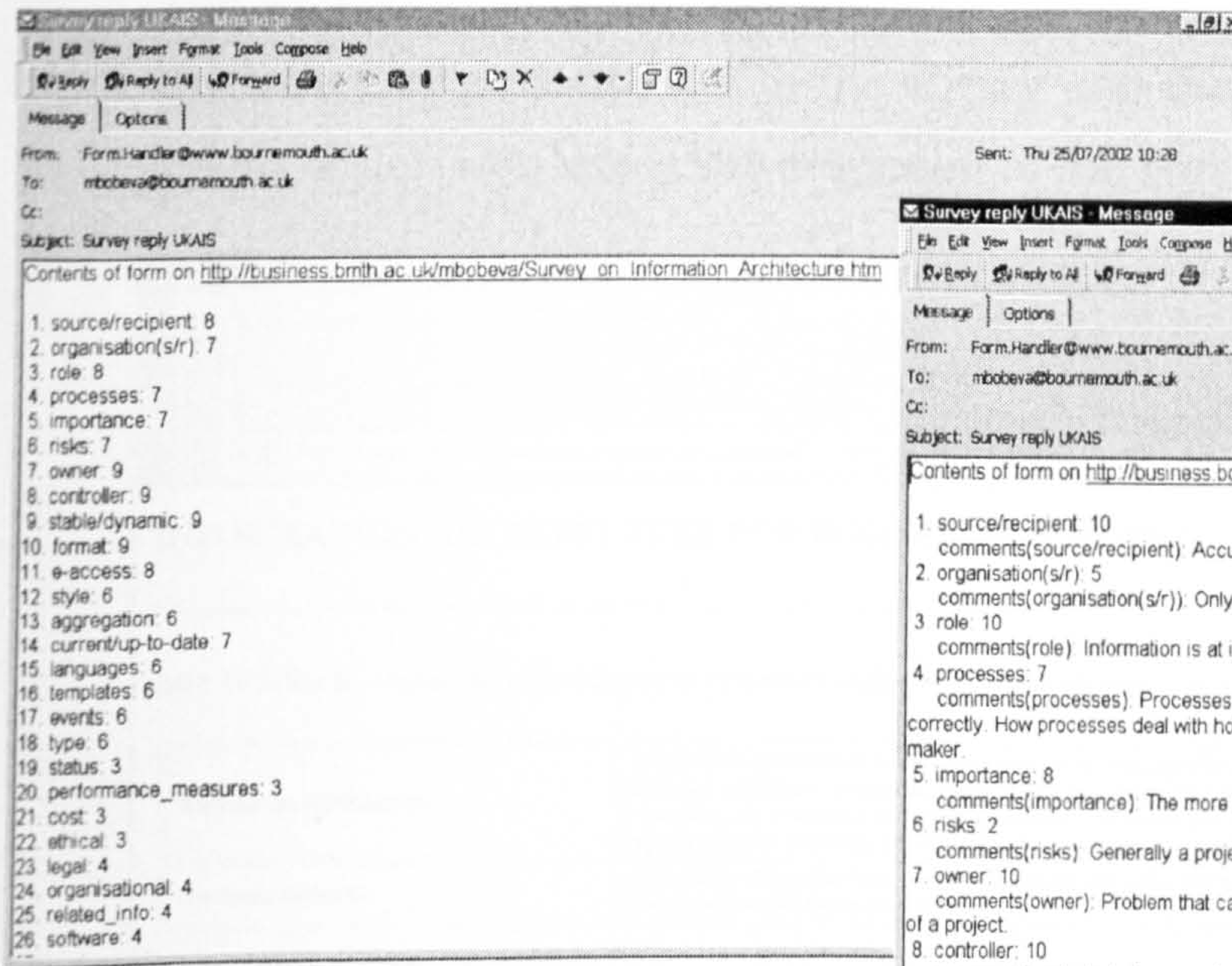
Fig. 6.6: Questionnaire layout for Delphi study Round 2 and Round 3.

Space was provided for recording any changes in the individual's assessment of desirability and feasibility that could be triggered by getting the information on the means of the previous test. As in the previous version, space was provided for recording any comments on each of the questions. Many participants chose to justify their views. In some cases, where people chose not to change any of their scores, they had included a statement either on the questionnaire itself, or on the supporting letter.

Completed samples of the questionnaires in Round 2 and Round 3 are provided in Appendix C.4 and C.5, respectively.

6.2.3. THE ELECTRONIC QUESTIONNAIRE

The electronic survey employed the same questions, but presented these in an HTML form with clickable radio buttons. A form-handling application was used to enable the readability of the respondents' e-mails. This proved to improve readability of the answers, as the scores given by the participant were not listed in a continuous fashion[3], but separated by paragraph marks and any text of designer's choice (Fig. 6.7a and 6.7b).

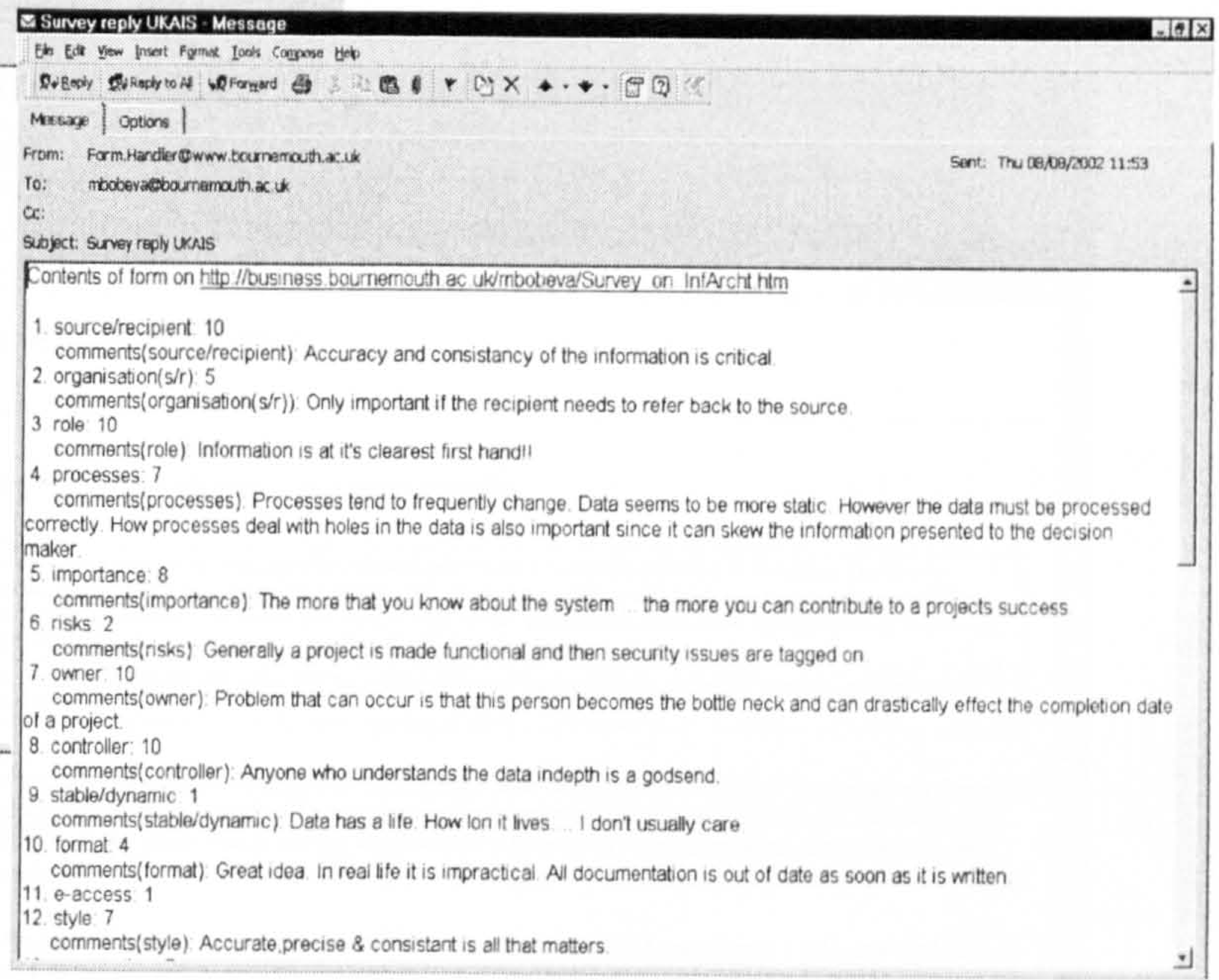


Survey reply UKAIS - Message
File Edit View Insert Format Tools Compose Help
Reply Reply to All Forward
Message | Options
From: Form.Handler@www.bournemouth.ac.uk Sent: Thu 25/07/2002 10:28
To: mbobeva@bournemouth.ac.uk
Cc:
Subject: Survey reply UKAIS

Contents of form on http://business.bmth.ac.uk/mbobeva/Survey_on_Information_Architecture.htm

1. source/recipient: 8
2. organisation(s/r): 7
3. role: 8
4. processes: 7
5. importance: 7
6. risks: 7
7. owner: 9
8. controller: 9
9. stable/dynamic: 9
10. format: 9
11. e-access: 8
12. style: 6
13. aggregation: 6
14. current/up-to-date: 7
15. languages: 6
16. templates: 6
17. events: 6
18. type: 6
19. status: 3
20. performance_measures: 3
21. cost: 3
22. ethical: 3
23. legal: 4
24. organisational: 4
25. related_info: 4
26. software: 4

Fig. 6.7a: Sample reply from the e-survey (response without comments)



Survey reply UKAIS - Message
File Edit View Insert Format Tools Compose Help
Reply Reply to All Forward
Message | Options
From: Form.Handler@www.bournemouth.ac.uk Sent: Thu 08/08/2002 11:53
To: mbobeva@bournemouth.ac.uk
Cc:
Subject: Survey reply UKAIS

Contents of form on http://business.bournemouth.ac.uk/mbobeva/Survey_on_InfArcht.htm

1. source/recipient: 10
comments(source/recipient): Accuracy and consistancy of the information is critical.
2. organisation(s/r): 5
comments(organisation(s/r)): Only important if the recipient needs to refer back to the source.
3. role: 10
comments(role): Information is at it's clearest first hand!!
4. processes: 7
comments(processes): Processes tend to frequently change. Data seems to be more static. However the data must be processed correctly. How processes deal with holes in the data is also important since it can skew the information presented to the decision maker.
5. importance: 8
comments(importance): The more that you know about the system ... the more you can contribute to a projects success
6. risks: 2
comments(risks): Generally a project is made functional and then security issues are tagged on
7. owner: 10
comments(owner): Problem that can occur is that this person becomes the bottle neck and can drastically effect the completion date of a project.
8. controller: 10
comments(controller): Anyone who understands the data indepth is a godsend.
9. stable/dynamic: 1
comments(stable/dynamic): Data has a life. How lon it lives ... I don't usually care
10. format: 4
comments(format): Great idea. In real life it is impractical. All documentation is out of date as soon as it is written.
11. e-access: 1
12. style: 7
comments(style): Accurate,precise & consistant is all that matters.

Fig. 6.7b: Sample reply from the electronic survey (response with comments)

Initially, as specified in Section 3.2.1., it was envisaged that the electronic survey would be sent as an attachment to an e-mail, but this tactics had to be changed as for security reasons some organisations strip off attachments to e-mails, whilst still delivering the message. Consequently the survey was administered through publishing the HTML form on the World Wide Web. The HTML form further provided for some efficiency gains in terms of development time and allowed for examination of whether there are any significant differences in the views of the IS academics (the UKAIS conferences participants) and the people perceived to be more IT-minded (the BIT participants, i.e. either academics of IT professionals, and the IT consultants). This was achieved through hosting the same form (Fig.6.8) on two web different sites, one for the IT consultants and BIT participants (http://business.bournemouth.ac.uk/mbobeva/Survey_on_InfArcht.htm), and another one for the participants in UKAIS conferences

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[3] For example, without form-handling tool the sequence of answers to any ten questions would have been a string of numbers, e.g. 8787779999 (on a scale out of 10).

(http://business.bournemouth.ac.uk/mbobeva/Survey_on_Information_Architecture.htm).

The web address of the relevant form was provided as a hyperlink in the e-mail invitation for participation in the survey and the form handler was designed to report which web site is the originator of the survey response.

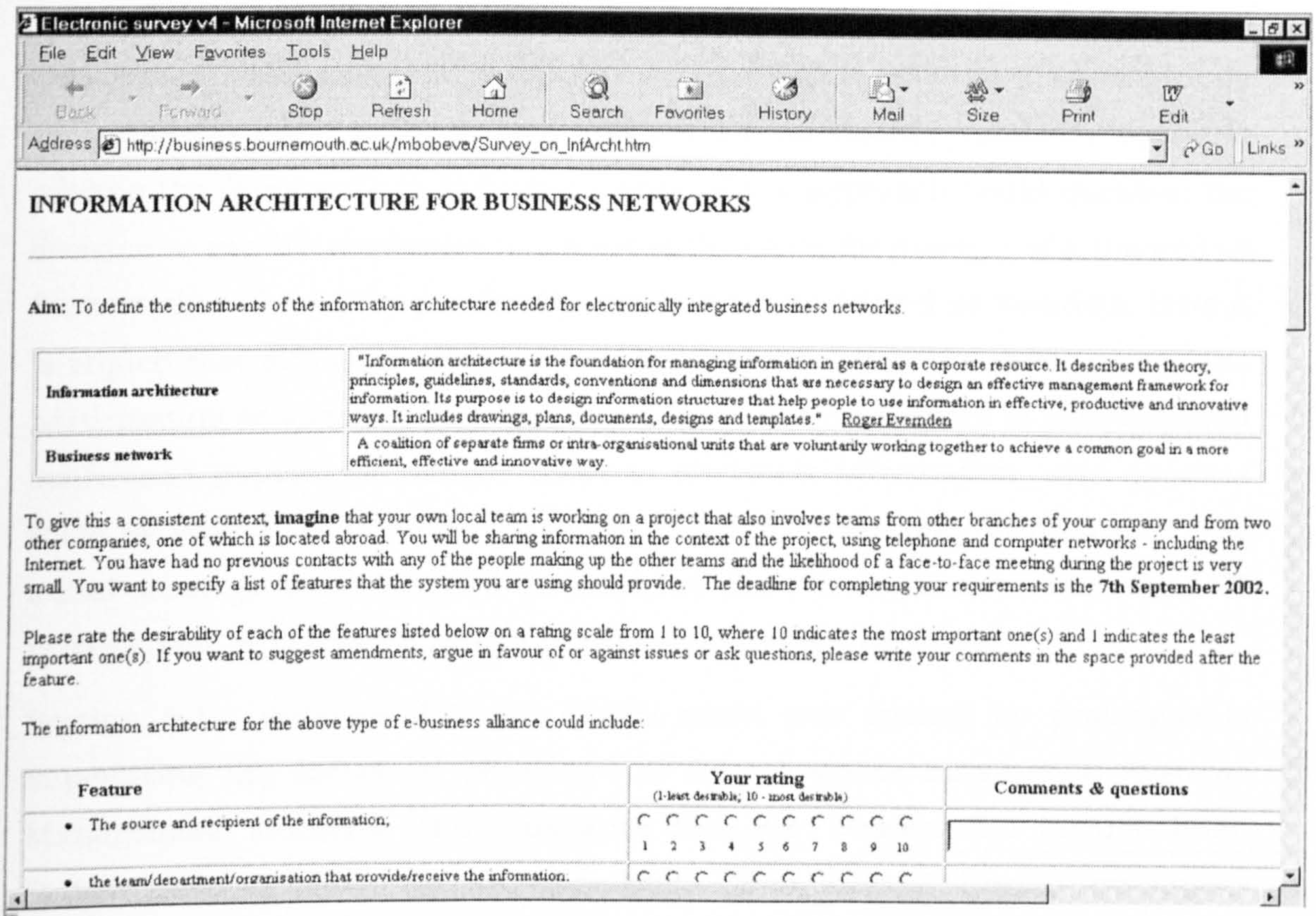


Fig. 6.8: A screenshot of the HTML form used in the electronic survey (web site version).

The form was also attached to the e-mail invitation for participation in the survey, to assist those participants whose organisations do not allow open access to the Internet for all their employees (this issue was established through the survey with the final year students). For this version of the electronic questionnaire the form handler would have left blank the field reporting the originating site. All versions of the form and the form handler reports were tested through a series of tests conducted by three people using different web browsers and different remote locations.

Copy of the e-mail invitations and a sample of completed forms are provided in Appendix C.6.

6.3. THE EVALUATION PANELS

The evaluation of the FEBuS IA was conducted through three tests, each of which targeted a separate evaluation panel. Overall, 33 IS/IT practitioners (19 in the Delphi study, 9 in the e-survey and 5 in interviews) and 10 academics all working in the UK, took part in the primary research. The inclusion of experienced IS/IT people with different occupations is believed to contribute to the generalisability of the results and provide an equally valid alternative to piloting the framework in industry. Critics of the approach could question the decision to involve academics, i.e. what is the value for practice of a theoretical framework evaluated by people who are largely considered as theorists. Here it is argued that although there is no evidence of any industrial experience of the participating academics, their views as educators and authors of peer-reviewed conference papers, as well as users of electronic information, also qualifies them as evaluators participants in the empirical evaluation. Furthermore, the initial strategy was designed to compare the views of academics and IT professional, which could raise interesting points for discussion.

Section 6.1.1 outlined that the Delphi panel was formed by professionals supervising the industrial placement of BSc Business Information Systems Management students. The companies that they represented include Intel, British Airways, Crown Agents, GlaxoSmith-Cline, KODAK, Cogent Investment Operations, Royal Sun Alliance and Portman Building Society. For a full list of the companies represented in the Delphi panel cf. Appendix C.1. More than 50% of the participants, i.e. 10 people, were project managers of different ranks, with another 7 people (36.8 %) being also in managerial or consultants positions dealing with systems analysis, architecture, resourcing and sales. Only two participants (10.5 %), a marketing manager and an assistant to a Chief Executive, were not directly involved with the development and management of information systems, but were considered as key information users. These two participants chose to take part only in the first round of the Delphi study.

The profile of the participants in the electronic survey was outlined by the statistics presented in Section 6.1.2. All 10 participants in annual UK conferences, including the participant in a BIT conference, were academics, and the remaining 9 participants worked in the IT industry.

The five people who took part in the interview evaluation test were all IS/IT practitioners (Table 6.4). Three of them have had more than 15 years industrial experience and the other two have been in their companies for more than 5 years. Two of the represented companies are financial institutions and represent a stable business network, where they dictate the development of any relationships with suppliers and customers.

No	Position	Organisation	Working Experience	Highest Qualification	Sample Sub-group	Interview Duration
A	Datawarehouse architect	One of the largest UK banks; with international presence	More than 20 years in IT	PhD	Placement contacts database	1 hour
B	Management Information Systems Project manager	One of the biggest UK building societies	23 years in system development; 1 year in e-commerce	BSc	E-survey participant	1h 40 min
C	IT consultant, Database support	Medium-sized IT Consulting company	15 years in IT,mainframe interfaces	BSc	E-survey participant	55 min
D	EMEA (Europe, Middle East & Africa) Sales Systems Manager	Large international electronic components company with Head Office in USA	6 years in electronics	MSc	Delphi participant	1 h 20 min
E	Senior software developer	Medium-sized financial software company working for some of the largest UK banks.	5 years on e-commerce projects	BSc Software Engineering	E-survey participant	1h 10 min
F	IS project manager	Financial 3rdParty Administration company	Not known	Not known	Delphi participant	e-mail response

Table 6.4: Participants in the evaluation interviews

The nature of the software consulting and development services that company C provides defines it as a member in a dynamic business network. Company E, which is also a software developer and consultant, could be defined as a node in a stable business network, as it has long term relationships with clients from the financial services sector. The fifth representation is for a global company building and selling electronic components. It was difficult to establish whether this company profile exhibits the characteristics of a dynamic network or of a stable network, as this was a secondary objective of the interview, which could not be fully explored due to limited time for the interview.

The last entry on Table 6.4 is the professional who provided detailed feedback via e-mail on why he considers the framework unsuitable for his company.

6.4. ANALYSIS OF THE RESULTS

"Anyone who understands the data in depth is a godsend."

(A participant in the electronic survey)

The Delphi study and the electronic survey are classified as quantitative evaluation exercises, as the data collection tools they employed were designed to quantify participant's views using a 10-scale Likert scale. However, they also provided some qualitative feedback that is also included in the analysis here. Further qualitative feedback on the framework components and their inter-relationships was collected in the third evaluation test, the face-to-face interviews. Hence, here this test is referred to as a qualitative test.

This section starts with presenting participants' positions regarding IA (Section 6.4.1) and proceeds with the analysis of the quantitative and qualitative results of the evaluation tests, including recommendations for additional framework components (Section 6.4.2). It further discusses how end-users perceive the framework with regards to its scope, consistency, applicability and usability (Section 6.4.3). The fourth part (Section 6.4.4) introduces the results from the testing of two propositions summarising the key differences between the FEBuS and any previous IA frameworks, i.e. H1 on the need of contextual tags in network environment and H2 on information behaviour as part of IA. The last sub-section (Section 6.4.5) discusses interviewees' review and interpretation of the survey results. The impact of the tests onto the initial framework design is discussed in Chapter 7.

6.4.1. UNDERSTANDING OF INFORMATION ARCHITECTURE

The questionnaire-based and the interview-based evaluation tests differ not only in the dominant type of data collected, but also in how they introduced the definition of the concept Information Architecture. The Delphi panellists and the e-survey participants were presented with Evernden's definition of IA (Evernden 2000) that in addition to the hypothetical scenario, described in the supporting letter. This was done with the intention to reduce any misunderstanding or ambiguity that could lead to inconsistent responses and to position the evaluators in a similar contextual mind frame. The interviewees, conversely, were not given a definition of IA, but asked to comment on whether the term IA was recognised in their company. The outcome proved that the term is being used only in two of the five represented organisations, both of these being the organisations from the Financial Services sector. The rest of the participants confirmed only the terms Data Architecture and Network Architecture. Not surprisingly, it was established that even in the organisations where the term IA was more widely recognised, its meaning was often confused with this of other terms, such as Data Architecture and Knowledge Architecture. On identifying this, to eliminate any potential biases onto the results, the interviewees were presented with Evernden's definition (op.cit.), which they unanimously agreed with.

6.4.2. THE FRAMEWORK COMPONENTS

The results of the Delphi study, the electronic survey and the interviews were analysed and a synthesis of the key findings regarding the content and organisation of the FEBuS framework is presented below. Where appropriate, participants' comments and any examples highlighting the specifics of the implementation of the information categories and the impact they could have, are also included. It is assumed that any absence of comments on a certain category could be interpreted as agreement with the proposed component. Any comments from survey participants were interpreted as justification of their scores.

6.4.2.1. Primary dimensions

D1: Types of information (primary dimension)

The design of this dimension was based on existing IA frameworks and models (cf. Chapter 4) and only a few new aspects of the components were introduced. Understandably, its components and structure were generally accepted by the evaluators of the framework organisation, although not necessarily given a high priority.

V1: Business view

The Business view of the information includes three information categories (IC): Business function, Data and Workflow (business process). The new aspect in this dimension refers to the cost of the information item, tested with question 21.

The results of the evaluation of the Business view of D1:Types of information determine the relatively low desirability (Table 6.5) and similarly low feasibility (Table 6.6) of all the three information categories in this view.

Table 6.5: Desirability results for Dimension D1: Types of information (Business view)

Information categories in D1: Business view	**Question(s) testing this dimension**	**Rank of importance in the Delphi rounds** (1-highest, 34-lowest)	**Rank of importance in the e-survey** (1-highest, 34-lowest)	**Frequency in the interviews**
Business function	21 (new aspect)	20, 24, 27	30	1
Data	21 (new aspect)	As above	As above	6
	25	15, 18, 20	14	
	31	27, 26, 24	22	
Work-flow (Business process)	4	12, 11, 12	12	11
	17	3, 3, 5	10	
	34	24, 20, 21	28	
* Ranks are calculated based on the means results			General comments:	1

Table 6.6: Feasibility results for Dimension D1: Types of information (Business view)

Feasibility:	**Median (R1, R2, R3)**			**Rank of the feasibility means in the Delphi rounds 1, 2 & 3** (1-most feasible, 34-least feasible)		
q4 - Processes	7	6	6	29	28	27
q17 - Events	8	8	7	9	14	14
q21 - Cost	7	8	6	19	17	21
q25 - Related information	6	6	6	33	31	30
q31 - Domain	7	8	5	25	19	25
q34 - Next stage	6	6	5	28	32	26

- **Business function**

The Business function category as one of the core 'traditional' categories ,was not explicitly tested in the questionnaire-based evaluations. There was only one question (q.21), referring to the Cost of an information item, that could be partially related to the Finance & Accounting function. It is noticeable to observe that although interview participants talked excessively about the categories Business processes and Data, few of them commented explicitly on the Business function category. Neither of them rejected the need for the latter, only the comments of Interviewee D provided evidence of its existence. Interestingly, his statements also highlight a relationship between this category and another information category, the Standards one:

"The lower the standard levels are [A/N: in terms of organisational hierarchy, but not quality], *the more specific to the respective business function they are."*

[Interviewee D]

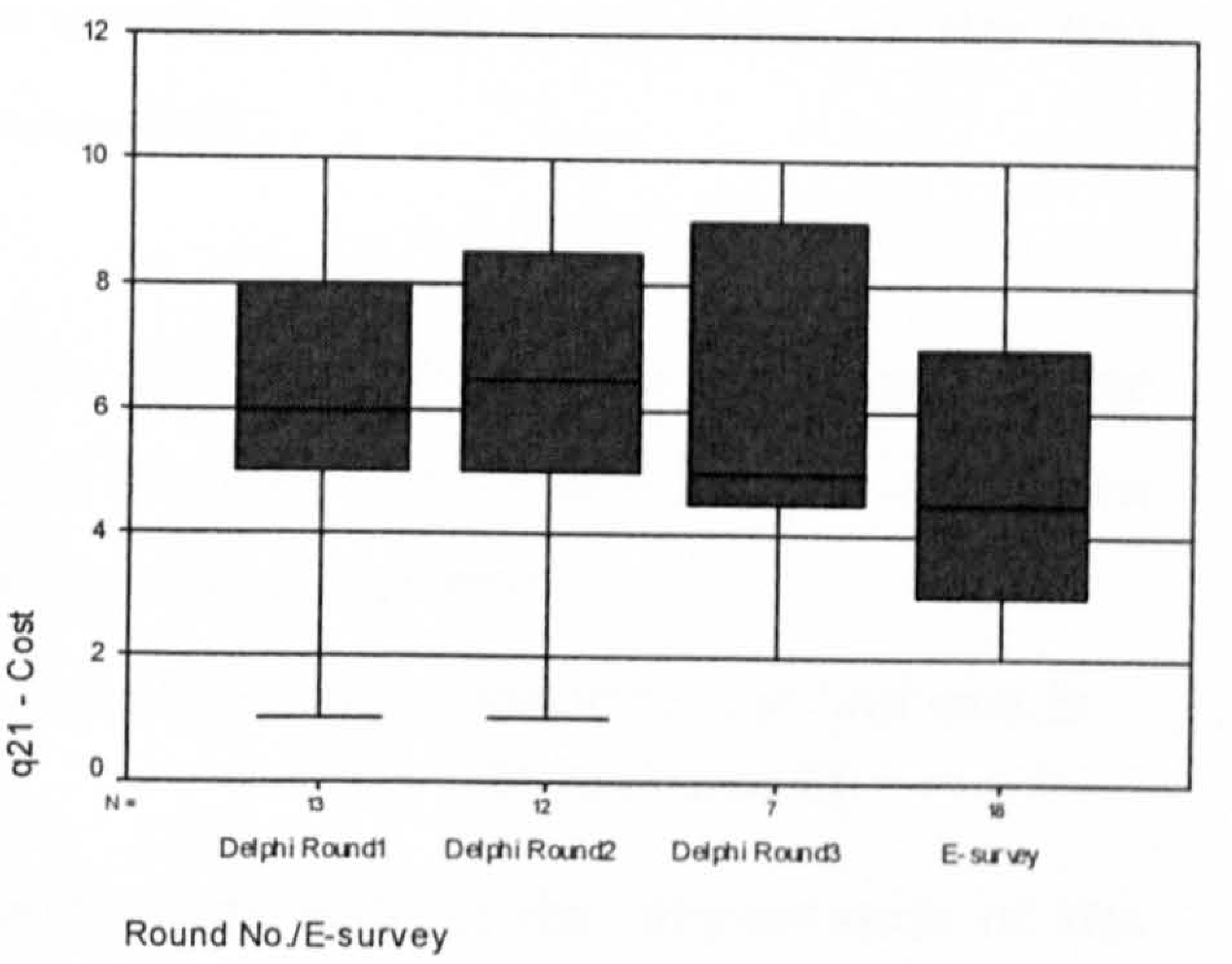
This example provokes the thought that the Business function category could only be meaningful for participants whose role within the company involves liaison with other business functions and managing information that is related/provided by them. For example, this category could be relevant to a Sales Manager who requires timely information from Marketing, Product Design and Finance, but might not be relevant to a software developer whose communication with clients is very restricted and is normally intermediated by a project manager.

- **Data**

The Data IC was tested with three questions, each addressing a specific attribute in this category: Domain (q.31), Related information (q.25) and Cost (q.21). The median results on these attributes (Table 6.6) indicate that the majority of the participants agree that all these attributes are desirable and feasible, i.e. have median higher than 5. However, the means ranking suggests that their relative importance is low (Table 6.5).

The results on the Cost attribute are graphically presented with on Fig.6.9, where the boxplots represent the minimum and maximum scores, as well as the median and the interquartile range of 50% of the results on this component. This approach has been consistently used to illustrate, where appropriate the results from the quantitative tests.

Fig. 6.9: Desirability results for q.21: Cost



The Mann-Whitney test comparing the results from Delphi Round 1 with the e-survey, M-W1, confirmed that there is significant difference in the views on the desirability of knowing the cost of the information. This could also be observed from the variables' ranking positions in Round 3 and the e-survey (Table 6.5). For the Delphi Round 1 participants Cost was the 20th most desirable item, whilst the e-survey respondents positioned it on 30th place in the desirability rank list of 34 variables. However, the results of the second Mann-Whitney test, M-W2, indicate that the results from Delphi Round 3 on this component were no longer statistically different from those of the e-survey. As identified earlier, this convergence of the views could be attributed to the repeated exposure of the Delphi participants to the mean results of the previous rounds and the consideration given to the views of the group.

As mentioned above, despite that the ranking positions within the desirability chart for the particular evaluation test might differ, the evaluation panels agree on the relatively low position of the need for Cost information. This could be attributed to higher importance given to the reliability, accessibility and availability of the information item, or, as the comments provided by one Delphi participant suggest, to the recognition that cost information is needed mostly at the start of a project and its rate of change is low:

"project cost should be agreed before commencement. Changes to original should be costed/agreed before carried out."

Another factor that could have determined the low desirability of the cost information is the high proportion of project managers amongst the evaluators from the industry. It could be hypothesised that as project managers, they recognise that the number of team members who are dealing with information costs is very small and as such do not assign high priority to the information on the information cost. Despite the low scores, the few comments in the two surveys confirm that this information is needed:

"Budget constraints need to be know."

Confirmation of the desirability of the Cost attribute, as well as of the relationship between the Data IC and the Business process IC, came also from Interviewee C in his statements regarding process duration:

"Time is absolutely critical. Because time is really what is related to cost and cost is the biggest thing." [Interviewee C]

Interviewee D outlined another relationship confirming the importance of the Cost attribute within the Data IC, this between the cost of information/product and the type of presentation of the information:

"Catalogues – we don't publish as many as we used to. So, by having it online you've avoided the cost to produce them on paper and having someone to provide that. We use that a lot in terms of justification of a lot of IT projects where it's very difficult to financially justify return back, but you can justify on the cost avoidance, by saying by doing this activity you don't have to do this activity anymore."

[Interviewee D]

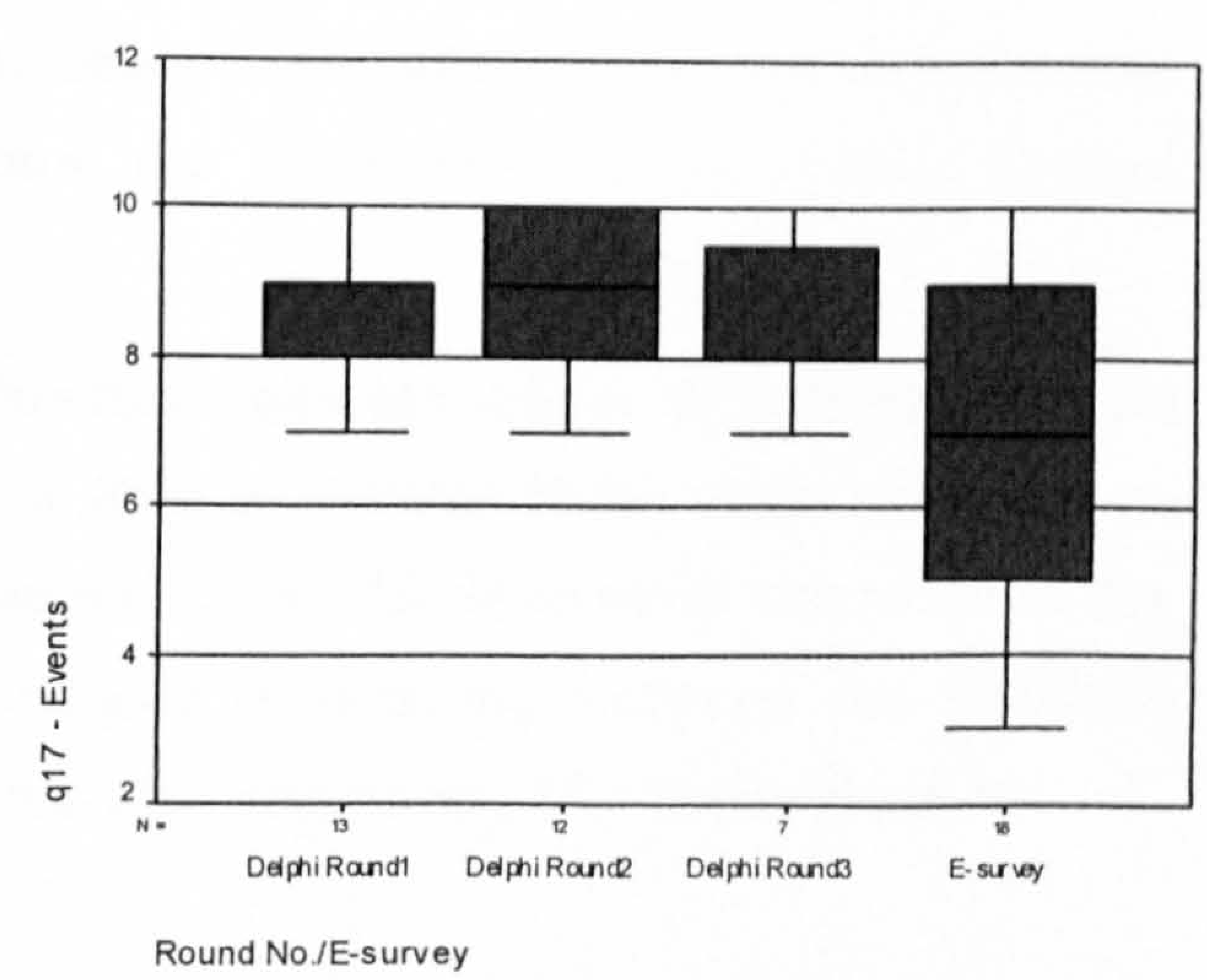
The Data information category, although very specific for the individual context, has been a part of all frameworks for Information Architecture and as such, is considered to be well defined and easy to relate to. The study confirms the existence of relationships between the Data IC and contextual dimensions and affirms that the aspect of Cost that was not well formalised in previous works, is a possible, although not imperative addition to IA frameworks.

- **Business process (Workflow)**

This information category within the Business view of D1:Types of information includes three information clusters (groups of attributes): Process (referring to the description and characteristics of the processes that impact on a particular information item), Event (describing the events that affect the information item), and Next stage (informing of what happens to the information after the current process is completed). Each of these was tested with the Delphi and e-survey participants through a specific question. The statistics prove that they present desirable and feasible features (Table 6.5 and 6.6). Of them, the highest desirability results were scored by the Event cluster, whilst the lowest were for the Next stage cluster, that ranked from 20th to 28th position in the Delphi and e-survey desirability lists.

The Mann-Whitney test comparing the results from Round 1 with the e-survey, M-W1, confirmed that there is significant difference in the views of these two evaluation panels on the desirability of knowing what events affect the information (Fig. 6.10). The Delphi group considered the Events as the 3-rd or 5th most desirable component, whilst on the e-survey desirability list it was at 10th position. Similarly to the case with the Cost attribute, the results of the second Mann-Whitney test, M-W2, indicate that the results from Delphi Round 3 were no longer statistically different from those of the e-survey. This information cluster was further discussed with the interviewees and based on their comments, the proposal to establish it as a separate

Fig. 6.10: Desirability results for q.17: Events

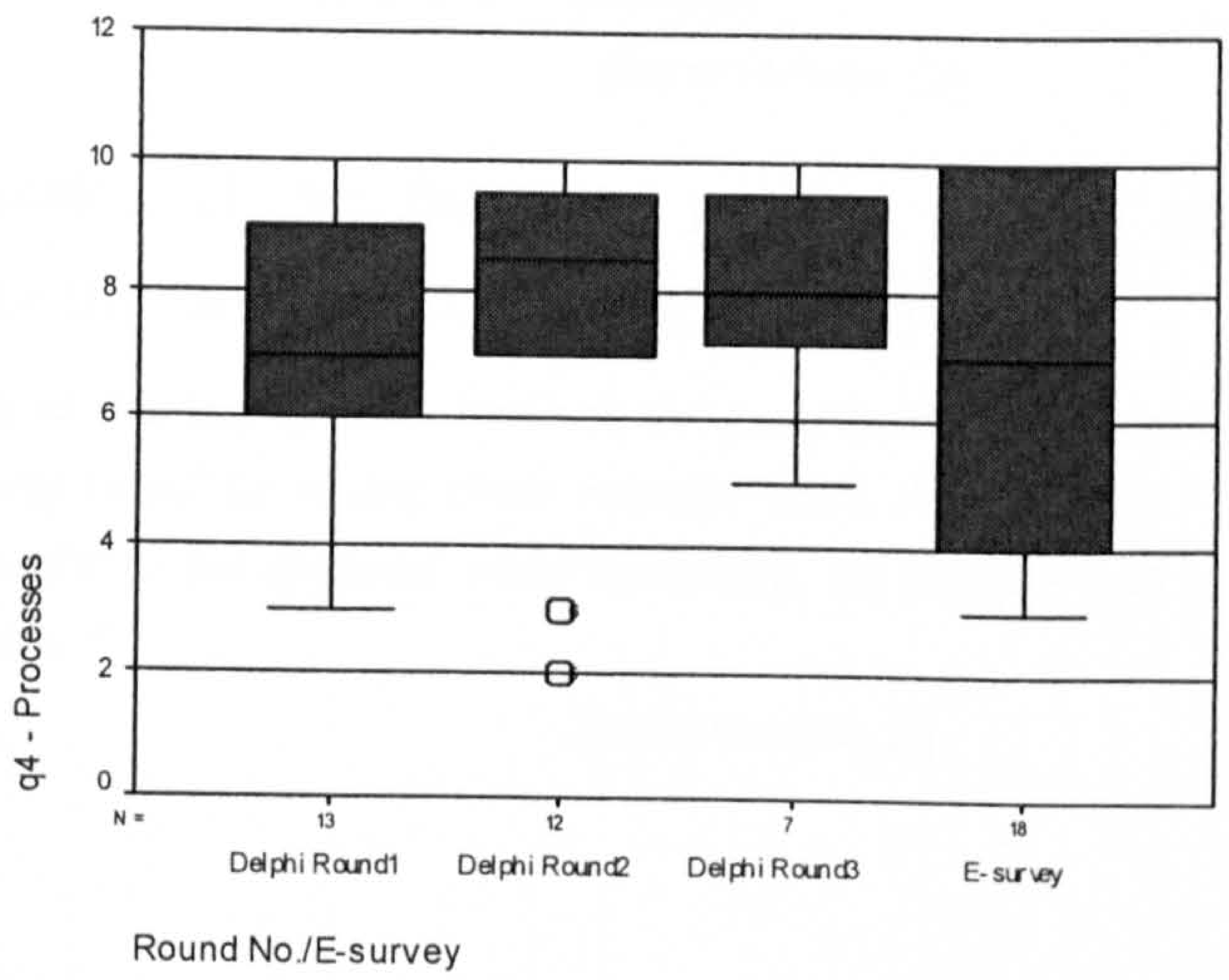


information category was made (See section New proposals below).

The Process information cluster was the only component that scored the same ranking position for (i.e. the 12th most desirable item) for both the Delphi study and the e-survey (Fig.6.11). This component also proved to be the most stable one with regards to feasibility ranking (Table 6.6). It was recognised in all the represented companies, although in each organisational context it was formalised to a different extent:

> *"I'd like to think there is* [A/N: a model of the business processes]*, but there isn't. Each product manager does things slightly differently"*
> [Interviewee D]

Fig. 6.11: Desirability results for q.4: Processes



> *"in a way we tend to rely on the hierarchy in the organisation to determine where this information should go"* [Interviewee A]

> *"Because we are process-driven, the structure doesn't actually come in that point here. So we've got the data that belongs with the process, the business structure does not really matter. And although we've got business structure, the data moves along with the process."* [Interviewee B]

The above statements further confirm that there is a relationship between the Business process IC and the Organisational structure IC (in the Organisaitonal view of D1:Types of information). In process-oriented organisations this translates into the information flow being determined by business processes, whilst in data-oriented organisations, the determinant is the organisational structure.

Participant B implied that any Business process when decomposed to its elementary processes is related to a Role or several Roles (with reference to data), e.g. Analyst, Designer, etc., as well as to the Role (with reference to the process), i.e. Source or Recipient. Similar relationship between the D6:Roles and the Business process category was also emphasised by Interviewee A.

Evidence on other relationships that the IC Business process enters in, was provided by Interviewee B. The example he gave illustrates how the category cross-references with the Data IC (D1:Types of information), as well as with components in D4: Levels of transition and D6: Roles.

> *"We tend to be driven by new product lauch. We have a brief, a product information pack and a product information manager and then we have the responsibility to take that product pack and translate it onto the intranet and the extranet.."*
>
> [Interviewee D]

It is encouraging that the discussion of the Business process IC and its relationships confirmed the need for the new aspects in this category:

> *"We need a good architecture coming at the top of this, so that the people know what to do next, and who in the team they need to share their results with. What I am starting to see is that the process ought to be defined very carefully, so people can execute the right things at the right time."*
>
> [Interviewee A]

- **New proposals**

The interviews raised the issues whether Events, Solutions and Time should be considered as new categories, rather than being clusters or attributes within the Business process information category.

<u>Events</u>

> *"If the company policy changes it has to change the project as well, which is not the most efficient way of managing everyone's time but it's a commercial reality....... They* [A/N: clients] *come back with a long list of priorities when the politics change."*
>
> [Interviewee D]

Interviewee D further expanded that in most cases there are company procedures in place clarifying the sequence of actions to be taken when a change is implemented, thus outlining a relationship between Policies (in D7: Types of regulations) and D4:Transformation. However, he also acknowledged that errors are bound to occur as the implementation of these procedures resides with the individual and his/her level of comprehension and discipline. The same interviewee recognised that much of these responsibilities could be automated through the use of a document management system, which is responsible for any revision control:

> *"A lot of it* [A/N: transformation, version control] *is handled within the system itself, the change control is in there. When you pull a document out to make a change and put it back the system assigns a new version control number. .... We got all revisions self-documented...."* [Interviewee D]

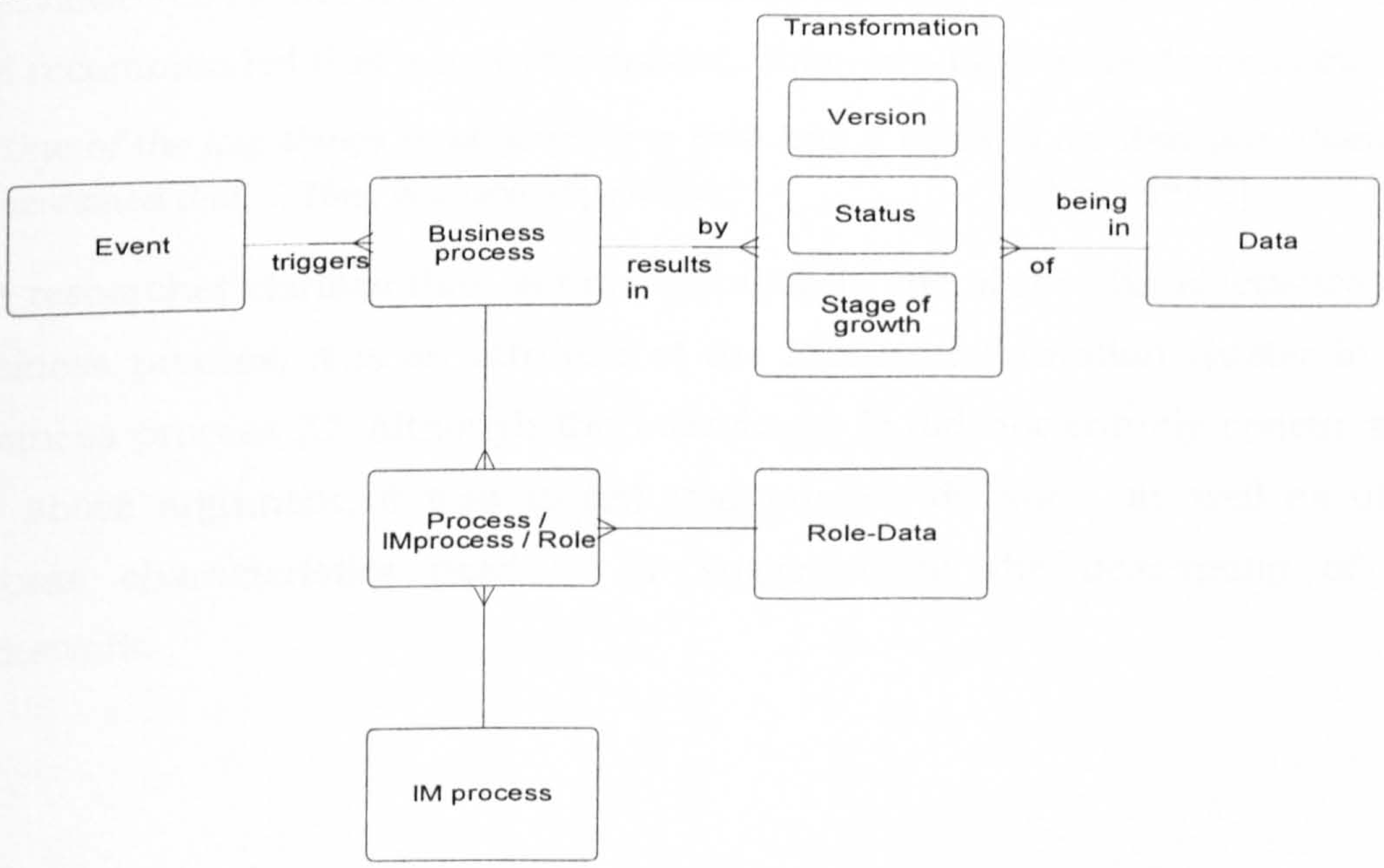
Other interviewees also provided examples outlining key events affecting the work of the system. This, together with the recognition that there could be several events impacting on one process, suggests that a new information category is emerging, this of Events. It is most closely related to the category Process (in the Business view of D1:Type of Information), but also to D4:Transformation. It is considered that the nature of this category, i.e. business-specific, determines its place in the Business view of D1:Types of information.

Table 6.7 illustrates how the categories in D4:Transformation correlate with the rest of the FEBuS components. These relationships are further highlighted in the conceptual model on Fig. 6.12.

Table 6.7: Example of how relationships between FEBuS components are identified.

Example use case	**FEBuS components tied in Relationship**
On the occurrence of an **Event**	D1: Types of information; Business view; Events
a **Business process**	D1: Types of information; Bus.view; Business process
of a **Change IM type** is triggered	D5: Types of IM processes; IM processes
that causes Transformation in the	D4:Transformation – any/all of the categories:
Versions/Status/Stages of growth	Version releases, Status, Stages of growth
of the **Data**. This is carried out by a	D1: Types of information; Business view; Data
specific **Role** (with ref. to Data)	D6: Role characteristics; Role (with ref. to data)

Fig.6.12 Conceptual model of the relationships between D1, D4, D5 and D6



<u>Solution</u>

The Business process IC was mentioned in later stages of the interview with participant B, when it was associated with the category Templates (in D7: Types of regulations). When discussing the latter, this Interviewee B brought in the issue of Solution being an alternative of Template:

> *"Solution is a part of the process. The solution is actually whether the template actually works."* [Interviewee B]

A further review of the above statement leads to considering whether Solution should be a part of the category Business process. It is, however recognised that firstly, there could be several solutions to the same process, and, secondly, that solutions/templates of process could differ based on the physical implementation (incl. Technical view). Therefore, they could be designed as separate categories in different dimensions and a three-way relationship between these two categories and the Model category (D3: Levels of understanding), as is the case in the FEBuS IA.

The discussion with Interviewee B highlighted that alternative terminology is an important point to consider when reflecting on the design of the framework.

<u>Time</u>

The need to improve the documentation of the framework was also raised when discussing the information content of the Business process category with Interviewee C. He observed that there was no reference to duration of a process and recommended that a new component, Time, is added to the framework:

> *"One of the key things in all projects is how long it takes to do. And you haven't mentioned that.... Time is absolutely critical."* [Interviewee C]

The researcher clarified that as time/duration is one of the characteristics of a business process, it is an attribute of the Process information cluster in the Business process IC. Although the Interviewee D did not entirely concur with the above argument, it was agreed that process duration, as well as other process characteristics need to be suggested in the description of the framework.

V2: Organisational view

The Organisational view comprises of two information categories: Strategy and Structure. The questions included in the Delphi and e-survey questionnaires were designed to inform on the need and feasibility of the following descriptives of these categories:

- The attribute Importance of the information (with values strategic, tactical, and operational), and the information cluster Risks, describing the Strategy IC. The desirability of being informed of any Organisational issues related to the use of an information item, was also explored.
- The attributes Role of the source/recipient of the information and the Organisation that is a source/recipient of the information item to define the Structure IC.

The participants in the three evaluation panels confirmed the high desirability of all these attributes (Table 6.8), which was also demonstrated by the ranks they had in the Delphi and e-survey desirability charts, i.e. in the top ten positions.

The feasibility results for these categories, summarised in Table 6.9, and the comments of the interviewees are discussed in the following sections.

Table 6.8: Desirability results for D1: Types of information (Organisational view)

Information categories in D1: Organisational view	**Question(s) testing this dimension**	**Rank of importance in the Delphi rounds** (1-highest, 34-lowest)	**Rank of importance in the e-survey** (1-highest, 34-lowest)	**Frequency in the interviews**
Strategy	5	8, 5, 4	17	3
	6	7, 8, 7	9	
	24	10, 7, 8	6	
Structure	2	5, 4, 6	8	8
	3	14, 15, 23	5	
			General comments:	0

* Ranks are calculated based on the means results

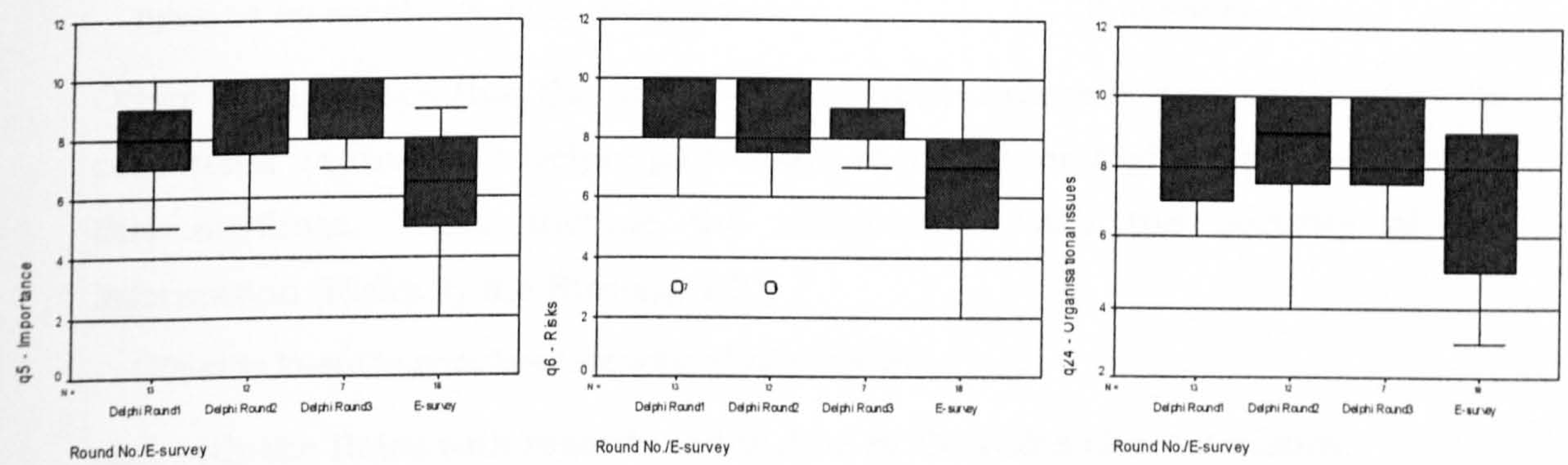
Table 6.9: Feasibility results for Dimension D1: Types of information (Organisational view)

Feasibility:	**Median (R1, R2, R3)**			**Rank of the feasibility means in the Delphi rounds 1, 2 & 3** (1-most feasible, 34-least feasible)		
q2 - Organisation(source/recipient)	9	9	9	3	1	1
q3 - Role (Source/recipient)	9	9	8	6	3	6
q5 - Importance	9	9	8	7	5	3
q6 - Risks	8	7	6	12	15	23
q24 - Organisational issues	7	7	6	16	16	15

- **Strategy**

Although the three questions testing the desirability of this component scored high amongst the majority of both the Delphi and the e-survey participants, the M-W1 test proved that these two evaluation panels differ significantly in their views on how desirable the Importance attribute is. This could also be observed from the different ranks that this category takes, i.e. from the very high 8th position in the Delphi Round 1 to the mid-chart 17th position assigned based on the results of the e-survey participants. Unlike the previous tests, however, this difference was not reconciled with the progression of the Delphi test. In contrast, it was increased, as Delphi participants were giving it higher priority in the subsequent rounds, bringing it to the respectable 4th position in the last round (Fig.6.13).

Fig. 6.13: Desirability results for q.5: Importance, q.6: Risks and q.24: Organisational issues



The Risks information cluster was also a point where the results of the Delphi Round1 and the e–survey panels significantly differed, but as the second Mann-Whitney test confirmed, these differences were overcome in the third Delphi round.

The analysis of the desirability ranking positions in Delphi Rounds 1 and 3 confirm that the components Importance and Organisational issues had raised by four and two positions, respectively. It could be hypothesized that this is related to increase in participants' recognition of the need to understand the role of the information and to provide on-line advise on any organisational considerations and rules related to this information.

The feasibility assessment conducted by the Delphi participants affirms that despite being highly desirable, Organisational issues affecting the information are not as easy to ascertain and implement, as the Importance of the information (Table 6.9). Same observations apply for the Risk attribute.

The qualitative evaluation of this information category was based only on the comments of two participants. Interviewee E suggested that for clarity the Strategy component could be re-labelled and proposed some alternative names including 'Business position', 'Business characteristics', or 'Strategic position'. The written comments provided by Interviewee F address another aspect of the Strategy category, i.e. its relationship with the Structure IC. The case described by this participant informs on the values of the Importance attribute. It illustrates that in the case of business networks any information that is imposed upon the network partners could be considered as being of strategic importance to the organisation-provider, even though it could be of operational value to the organisation-user:

> *we are a 'benign' presence within that infrastructure and have no influence over the architecture of the networks that we use as standards and protocols are imposed upon us by our clients and service providers.* [Interviewee F]

Other relationships that the Importance attribute enters in were outlined in the comments written by a Delphi participant to justify the high scores assigned to this attribute. These include the relationship with the security of the information (Risks in the Strategy IC):

> *"Need to know to prioritise/security of information"*

and with the Roles with regards to the data in D6:Roles characteristics:

> *"should be understood, once roles/responsibilities are understood".*

The comments on the question on information importance (q.5) from a participant in the e-survey surmised a correlation between user understanding and project success, which confirms the need of this attribute.

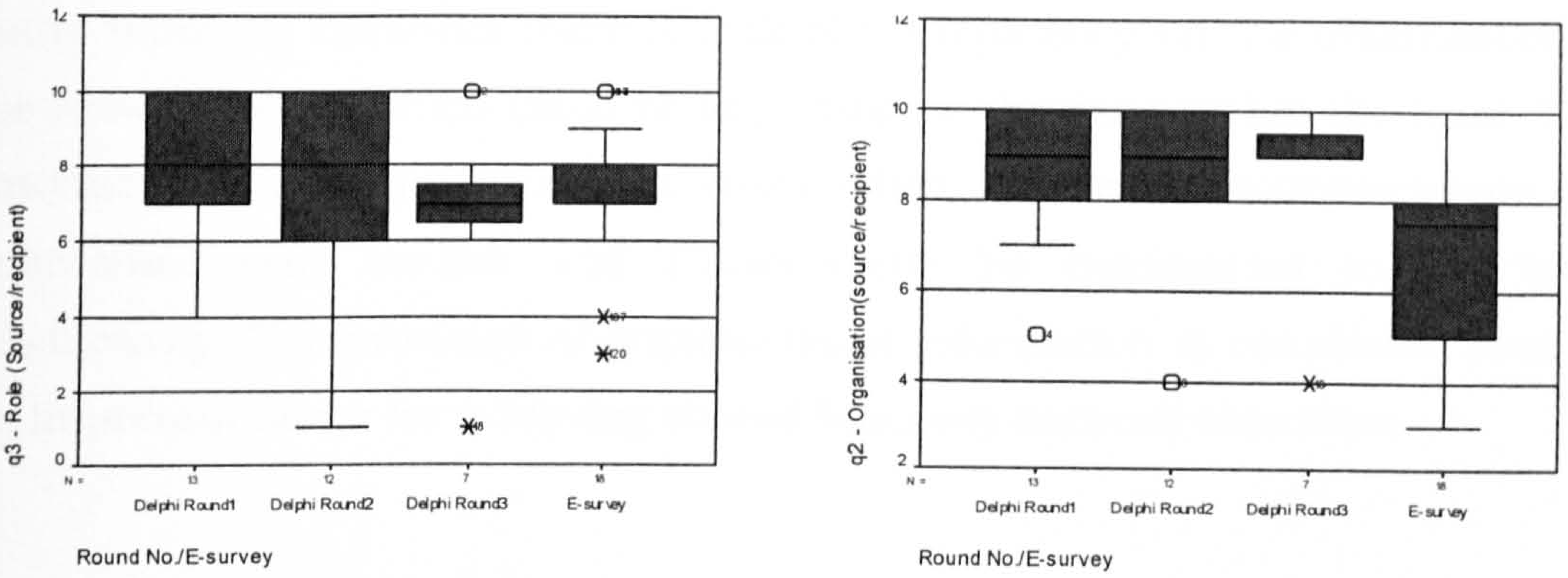
> *"The more you know about the system, the more you can contribute to a project success."*

- **Structure**

The analysis of the results for this information category prove the high feasibility of both the 'Role within the project' and 'Organisation(source/recipient)' attributes, with the second understandably being established as the easiest to implement. Desirability-wise the 'Role within the project' was assessed by the Delphi panel with very high median values, i.e.

9 or 10, whilst the 'Organisation (source/recipient)' scored marginally lower, with medians of 7 and 8. E-survey panellists agree with the results on the latter, but differ significantly with regards to the 'Role within the project' desirability. This difference is maintained throughout the three Delphi rounds (Fig. 6.14).

Fig. 6.14: Desirability results for q.2: Organisaiton (source/recpient) and q.3: Role within the project



Amongst the interviewees the strongest views on this information category were expressed by Interviewee C, who disagreed with the inclusion of the organisational structure as a component in the IA:

But why do you need so? What tends to happen is you are coming in any IT department to say what you will need and you probably have a name of a couple of contacts." [Interviewee C]

When prompted that he will be referred not to specific people, but to people occupying specific positions or taking certain roles within the organisation, he maintained:

"Yes, but that wouldn't be the structure of the organisation, it would be more the function of the people who take part. In the company I am unaware of the structure outside of the IT department of the company that I am working for. And in the previous companies, and in any other companies. I haven't got an overall view of who is in charge and who is where. All I am aware of is who is in charge of each individual job. Who are the people I need to know to get the information I need. In a number of companies that I've been working for, nobody seems to be aware of who does what. ...." [Interviewee C]

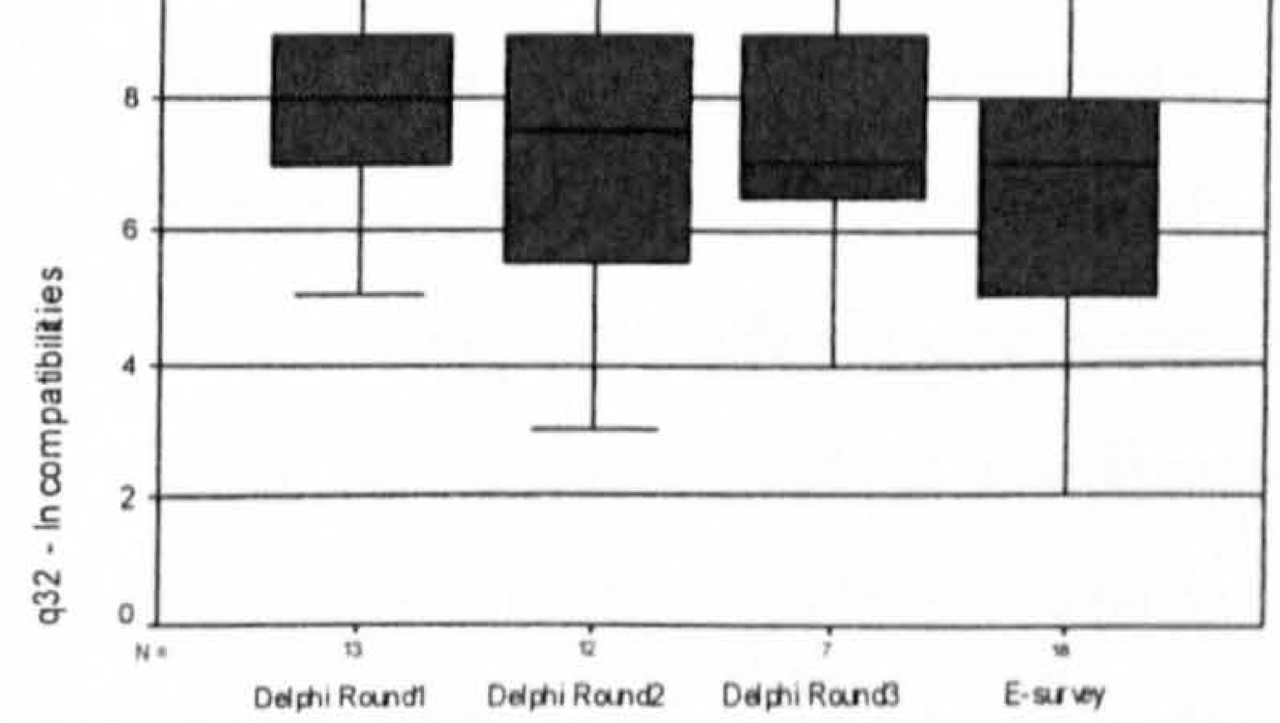
Later, the discussion he acknowledged that his view is reflecting his experience as an IT consultant, a role that implies temporary association with a company, often done in isolation from a remote location. If project documentation is not online, but only the work on the project deliverables is done online, the common scenario is that the contact with the host organisation tends to be done by one or two team members only. This is an interesting view, which despite its determination to limit online information, still confirms the need for IA to include roles (D6: Roles), functions (D1: Types of information), control (D5: Types of IM processes) and reporting mechanisms (D7: Types of regulations).

The views of Interviewee C on the desirability of the Structure IC contradict with the views of the rest of the participants, including these in the quantitative evaluation tests. It could be argued that his comments highlight the fact that in many business networks there is lack of transparency on the organisation of the network team, which could be impacting on the trust within the team. This situation could be intensified in cases when business communications are maintained only on-line and subsequently be detrimental to the team productivity. The provision of organisational information is considered here as an important factor for achieving shared business network objectives.

V3: Technical view

The Network, Application and Platform information categories within this view were represented by one question each. To avoid any confusion in the questionnaire the term 'application' was replaced with 'software' and the term 'platform' with 'hardware'. Evaluating the interface in the quantitative evaluation tests was found to be very difficult due to the absence of knowledge on the technical architecture of the participant's organisation, hence the inability to provide a meaningful example. To represent this category the information given on the above three categories was used, and a question testing participant's views on incompatibilities was included (q.32). The latter provided the highest desirability scores amongst both the Delphi and the e-survey participants, giving it a position within the second ten most desirable issues (Fig. 6. 15).

Fig. 6.15: Desirability results for q.32: Incompatibilities, informing on the Interface IC



The rest of the information categories scored comparatively low on desirability (5 or less than 5) in both the Delphi study and the e-survey. The Network and Platform categories were positioned unanimously in the last places of the desirability rank list, whilst the Application category was perceived as relatively more desirable by the e-survey participants (Table 6.10). The feasibility scores prove the expectations that the information on incompatibilities will be perceived as least feasible for on-line implementation (Table 6.11).

Table 6.10: Desirability results for Dimension D1: Types of information (Technical view)

Information categories in D1: Technical view	**Question(s) testing this dimension**	**Rank of importance in the Delphi rounds** (1-highest, 34-lowest)	**Rank of importance in the e-survey** (1-highest, 34-lowest)	**Frequency in the interviews**
Network	28	32, 33, 32	33	1
Application	26	31, 32, 33	21	4
Platform	27	34, 34, 34	34	0
Interface	26, 27, 28, 32	As above 11, 16, 16	As above 11	As above 0
* Ranks are calculated based on the means results			General comments:	1

Table 6.11: Feasibility results for Dimension D1: Types of information (Technical view)

Feasibility:	**Median (R1, R2, R3)**			**Rank of the feasibility means in the Delphi rounds 1, 2 & 3** (1-most feasible, 34-least feasible)		
q26 - Software	8	7.5	8	15	10	9
q27 - Hardware	7	6	7	17	24	18
q28 - Communications	7	6	7	18	25	19
q32 - Incompatibilities	5	5	4	32	27	32

It is interesting to observe that of the three views within the D1:Types of information dimension, only the Business view and the Organisational view raised comments from participants in all the three evaluation tests. The Technical view triggered only few remarks, but these were fairly superficial and did not address the information categories comprising this view. This could be attributed to the agreement with the design of this view or to participants not being able to question this view due to insufficient confidence in their knowledge on the matter. Based on further analysis of the interviews, it is believed that participants in the evaluation provided in-depth comments only on categories that they felt strongly about, e.g. categories which problems they have to resolve on a day-to-day basis. It could be argued that in medium-size and large organisations, such as the ones represented in this study, the technical architecture is normally standardised and most users are relatively protected from experiencing incompatibility problems with software, hardware and communications systems. The results on this dimensions, however, could have been different, if the evaluation panels consisted mostly of IT professionals responsible for technical support and network management.

6.4.2.2. Contextual dimensions

The discussion in this section addresses the contextual issues of the on-line Information Architecture, or the information about the Information Architecture, i.e. the meta information. As discussed in Chapter 5, some of the dimensions have already been introduced in the later works of Evernden (2000, 2003), but are enhanced in the FEBuS with the addition of new components.

D2: Forms of existence

The Forms of Existence dimension incorporates seven information categories, related to the different forms in which information could exist. As such, they are familiar to information users, but had not been widely recognised as components of the information architecture. The evaluation aspired to confirm the extend to which practitioners and academics support researcher's views on the need of this meta-information for e-business networks.

To test the components in the Delphi study and the e-survey, in the questionnaire each of the information categories, except the Nature one, was represented with one question. The Nature category was informed by the answers provided for the Values category. A summary of the desirability and feasibility result in the questionnaire-based evaluation tests is provided in Tables 6.12 and 6.13, respectively.

Table 6.12: Desirability results for Dimension D2: Forms of existence

Information categories in D2: Forms of existence	**Question(s) testing this dimension**	**Rank of importance in the Delphi rounds** (1-highest, 34-lowest)	**Rank of importance in the e-survey** (1-highest, 34-lowest)	**Frequency in the interviews**
Based on nature	18	28, 27, 28	26	1
Based on values	18	28, 27, 28	26	0
Based on style	12	30, 30, 29	29	0
Based on carrier	11	9, 10, 2	20	5
Based on stability	9	2, 1, 1	7	3
Based on level of aggregation	13	22, 22, 19	25	1
Based on presentation	10	13, 12, 14	18	6
* Ranks are calculated based on the means results			General comments:	1

Table 6.13: Feasibility results for Dimension D2: Forms of existence

Feasibility:	Median (R1, R2, R3)			Rank of the feasibility means in the Delphi rounds 1, 2 & 3 (1-most feasible, 34-least feasible)		
q9 - Stable/dynamic	7	7	7	11	11	34
q10 - Format	9	9	8	1	2	8
q11 - E-access	9	9	9	4	8	2
q12 - Style	7	7	7	14	13	12
q13 - Aggregation	7	7	6	21	21	20
q18 - Type	5	6	5	30	29	24

The information categories in this dimension are also informed by the comments of the participants in the qualitative and quantitative evaluation tests. Table 6.12 includes a column listing how many times during the interviews a component was referred to. Due to the categorical nature of the suggested values, the evaluators' feedback was easy to analyse.

- **Nature**

As explained earlier, the Nature IC and its attributes Soft/Hard and Qualitative/Quantitative, were not explicitly tested in the survey. Although, the term was used in one Delphi participant's comments, the understanding of the term differed from the meaning used here. The participants recognised it as a decomposition of several components, i.e. importance, source, accuracy and current/up-to-date, that are already represented onto the framework.

Amongst the interviewees, only two participants commented on the Nature category. One of them confirmed the expected view that

"When you are working with programmes, hard information is what you want."
[Interviewee C]

whilst another one, Interviewee E, proposed to expand the set of choices by adding another dichotomy, this of Objective/Subjective information.

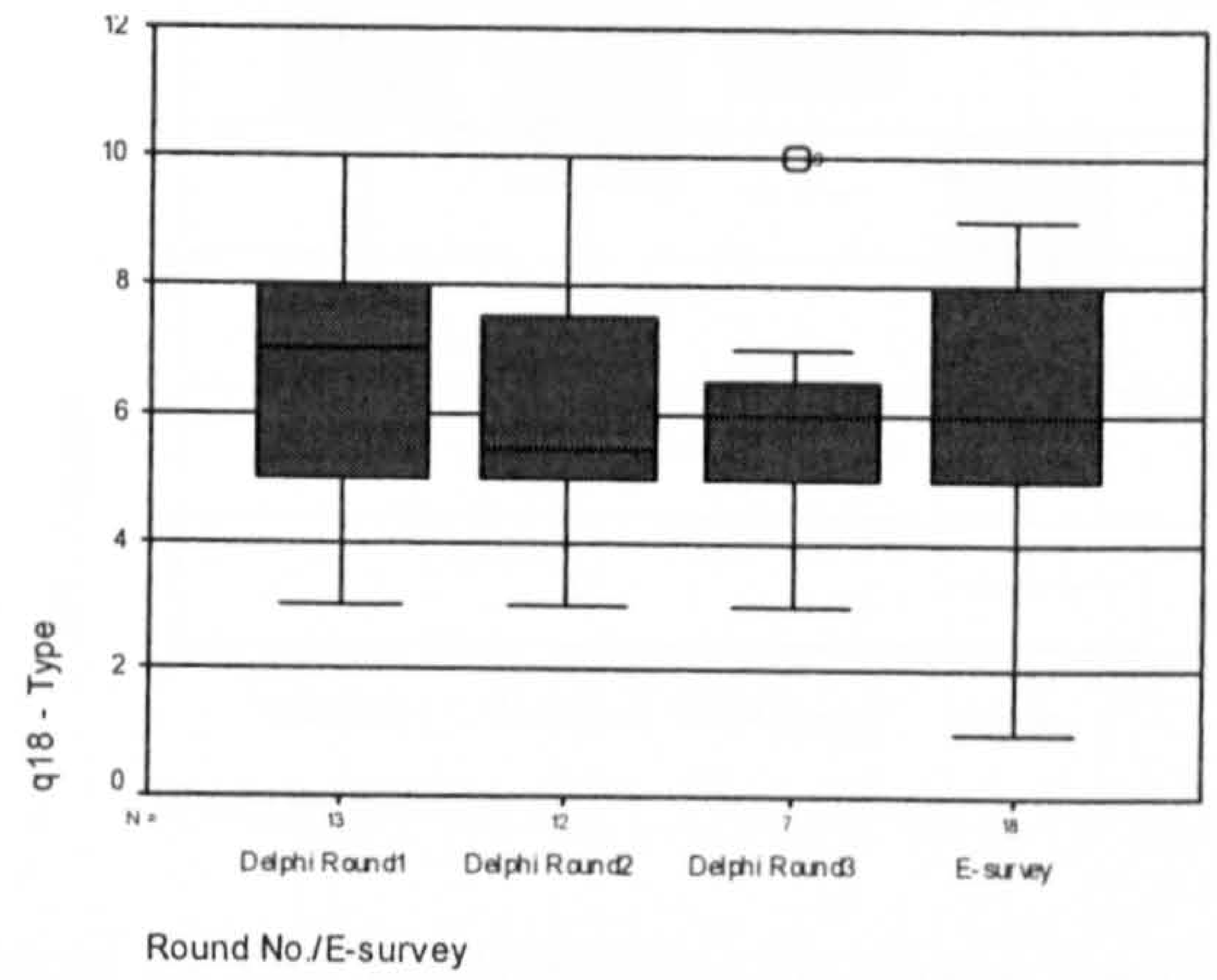
With regards to the first comment, it has to be pointed that Interviewee C recognises that his comment is valid for working context similar to his. As such, his views should not be considered as dismissive for the need of soft or qualitative information on–line. Still, as the evaluation did not provide sufficient evidence for the desirability of this information category, it is recommended that business networks address this component as appropriate to their environment, which could also include creating organisation-specific categories such as the one propposed by Interviewee E.

- **Values**

The Values IC included one attribute with dichotomous domain comprising of the values Explicit and Tacit.

For this variable a score of 6 was assigned by most of the Delphi and e-survey evaluators (Fig.6.16). The low scoring of this information category in the surveys, i.e. positions from 26th to 28th in the different quantitative tests, could be related to the fact that electronic information is always explicit and it is difficult to provide tacit information in electronic form.

Fig.6.16: Desirability results for IC Values in D2: Forms of existence



The interviewees provided no comments on this category either, which could be interpreted as both silent agreement with these categories, or as an indication that they could be needed only in certain cases.

- **Style**

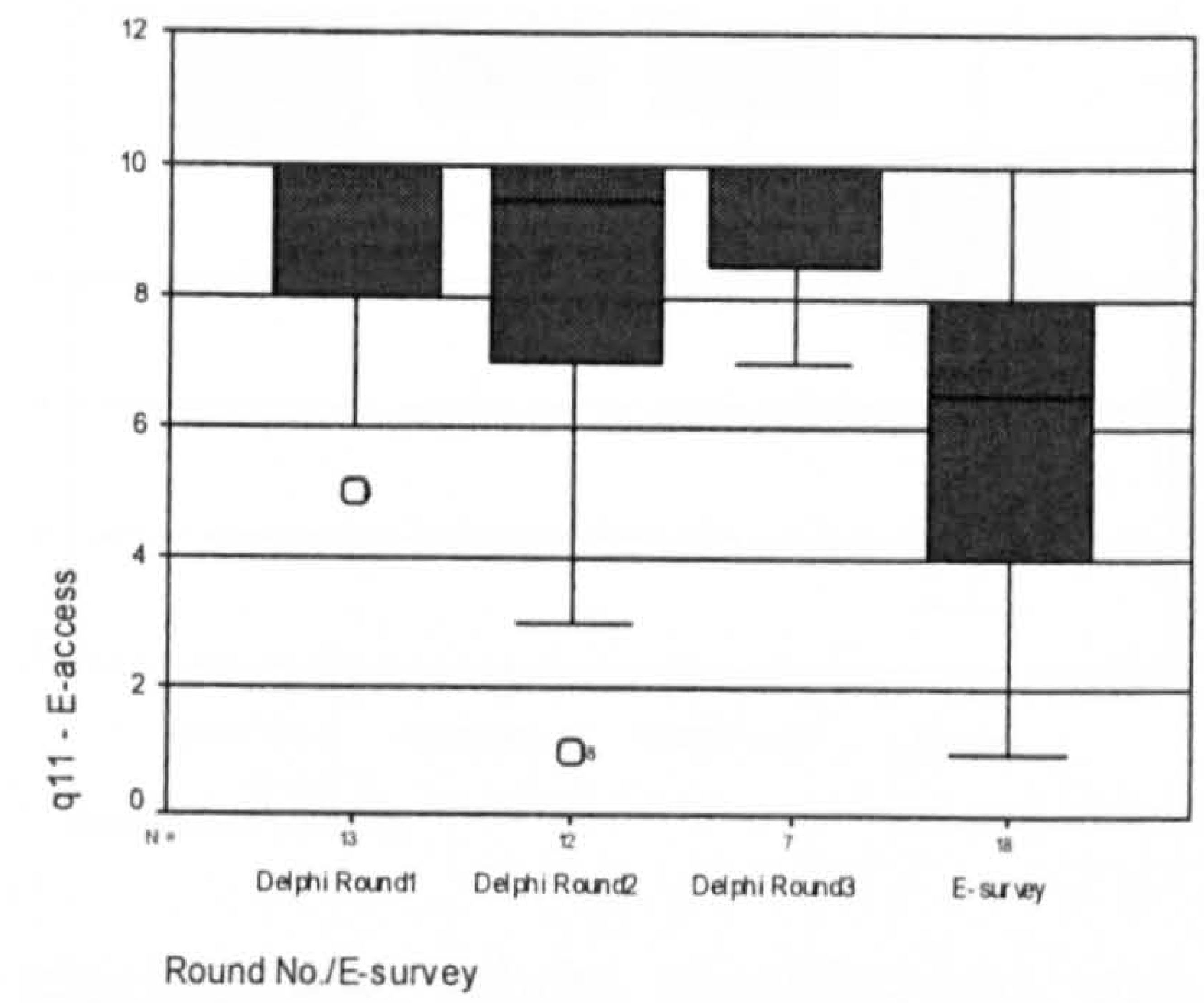
Testing the desirability of the required style for presenting an information item, proved that this meta-information is not of priority to the Delphi and e-survey participants. The median and ranking results of the two groups of evaluators confirm their agreement on the matter (Table 6.12). Similarly to the case with the previous two categories, no comments were provided. A cross-tabulation with the type of business network that the represented organisations are part of, could provide some explanation of this fact. With most of the organisations being in stable networks, it is possible that the participants are not aware of cases that confirm the need for the Style and Value categories.

- **Carrier**

The Carrier information category was introduced to allow for appropriate presentation of the information. The question in the survey testing this component studied the evaluators' preferences regarding information being delivered in electronic format. As it could be observed from the results (Table 6.12), the Delphi participants consider this issue as more desirable than the e-survey panel. The component has the highest median of 10, consistently maintained though the three Delphi rounds.

From the distribution of scores (Fig. 6.17), it can be observed that the e-survey participants did not have uniform views on this category. The spread of scores includes every option of the Likert scale, from 1 to 10 and 50% of the cases lie within the range 4 to 8, indicating the lack of agreement on the issue.

Fig.6.17: Desirability results for IC Carrier in D2: Forms of existence



This has also impacted on the results of the Mann-Whitney tests M-W1 and M-W2 examining the differences in the views of the participants in these two evaluations. Both tests confirm the significant difference in the views of the two groups of evaluators.

There have been several comments from interviewees, confirming the trend to move away from paper-based information carriers, and to provide more information in electronic format. Such a business trend further justifies the need for research on IA for e-business networks.

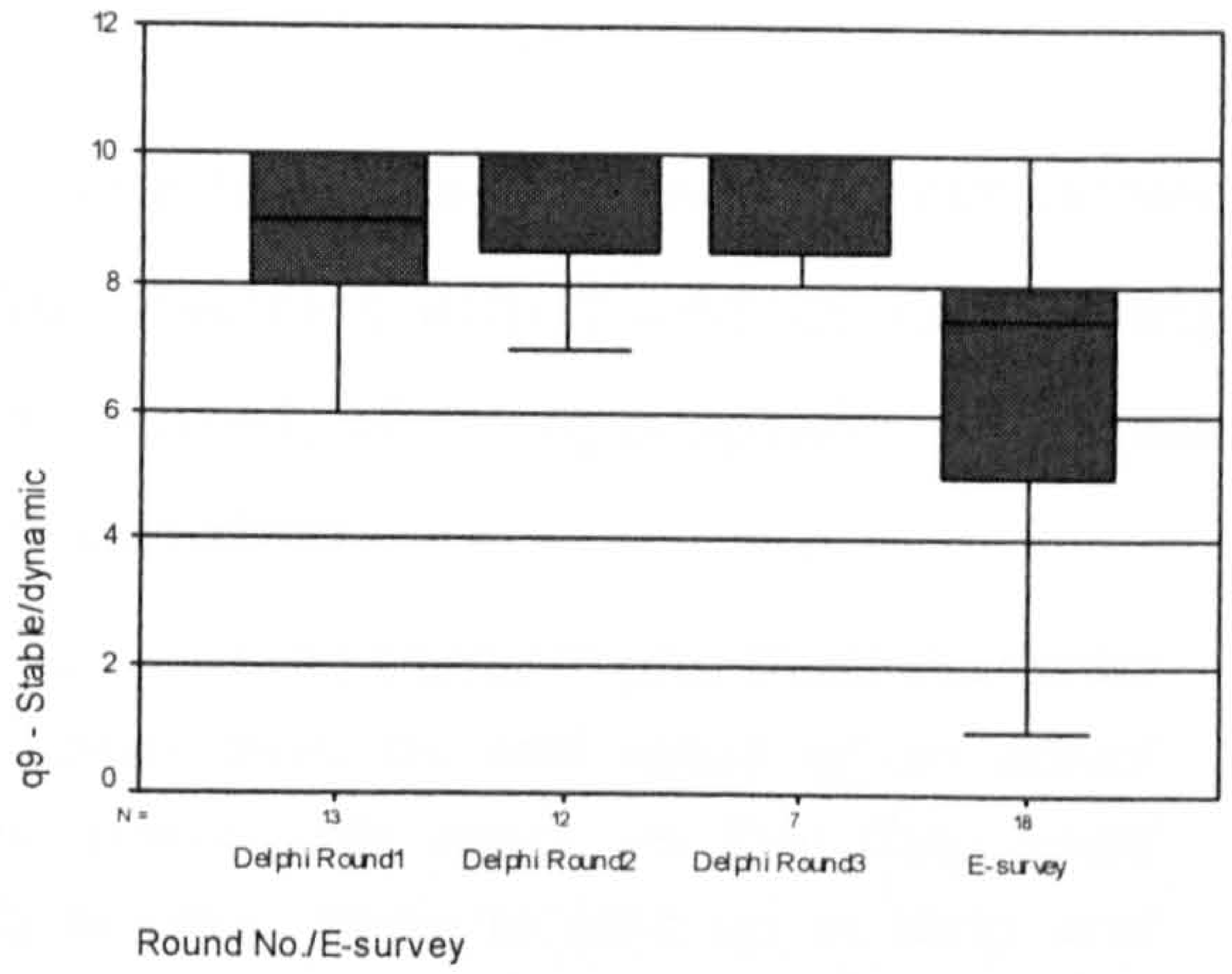
An interesting comment made by Interviewee C acknowledged that the forms of existence discussed here are helpful to know, as they assist users in determining how to treat information most efficiently. The Interviewee F further stated his views that he is not interested in how the information is technically presented to him, as long as it is easy to retrieve. Whilst the FEBuS intends to cover each issue related to the architecture of information in electronic environment, its application demands in-depth knowledge of business and users priorities and as such each instance of the framework is strongly individual.

- **Stability**

Stability of the information, or knowing whether the information is stable or dynamic and being aware of the rate of update is of highest priority to the

Delphi participants. It was ranked as the 1st or 2nd most desirable issue in the different rounds. As it could be confirmed from the results (Fig. 6.18 and Table 6.13), e-survey participants were more reserved in their scores.

Fig.6.18: Desirability results for IC Stability in D2: Forms of existence



Analysis of the qualitative comments revealed that Delphi participants recognise that the stability of the information is related to the level of aggregation of this information, and that both these factors impact on how up-to-date the information is. That is, the more complex its structure is, the more difficult it is to update it. This is known to be a difficult task when dealing with stable information and is even more challenging when working in an environment where information is changed dynamically.

"Need to know if dynamic to keep current",

wrote one of the Delphi panellists, a statement which to a certain summarises the justification of this component.

The interviewees were also agreeable on the need of reflecting information stability. In his statements participant C illustrated the relationship of this category with the categories from D4: Transitions.

"Yes, you have to know whether it is static or dynamic. I am interested in the lifecycle of the information. How information is created, how it is moved, how they use it, how it is validated, and then how it dies and how it can be retrieved. How it dies..." [Interviewee C]

In relation to the changes occurring to the information same participant raised the issue about accuracy of the information:

"You may have an awful lot of information in electronic format. The key to that is finding the information from that information. You may have an awful lot of data that you need to view, you've got people that are causing you a problem because there is an awful lot if different information before you've got the one that is correct. . The other problem with electronic information, I tend to view it sceptically, because unfortunately, it may have been correct at the time of the writing, but electronic information goes out of date very, very quickly.".

[Interviewee C]

It is recognised that an issue such as accuracy is very transient and subjective and could not be presented as a category in the FEBuS. However, the information on the relationship of two other categories, i.e. Stability (D2: Forms of existence) and the frequency of version releases (D4: Transitions) could give users an idea of how much trust should be invested in the respective piece of information.

One way to provide accurate information with this was disclosed by Interviewee B. In his organisation, to avoid any discrepancies introduced by data being represented in several forms, users are presented, where appropriate, with base information that they could manipulate themselves.

> *"Which is why we have one source of data and we are trying to give them data sets that they could manipulate themselves, rather than an end result of an actual report... We are now looking at providing users with tapes, so that they could actually manipulate their own data, tools to allow them to look up in data and convert it to a format that means something to them, i.e. to provide their own information from the data that we are giving them. What we are trying to do is to model a data sets so they end up with a set of data that is useful to them, so that it is more informative to them and they can actually from that data set clean the information that they actually need, rather than providing them with old set of printed documents. Now there are some documents that have to be printed, e.g. control reports, which based on the data in the system that allow us to make sure that we are doing it correctly, checking that the organisation is working correctly and not breaching any controls, so I think that this is actually quite important."*
> [Interviewee B]

This new aspect of information could be considered for inclusion in the framework.

Same interviewee made an interesting proposal on changing some of the categories that reflect the stability of the information. He suggested the dichotomy Stable/Dynamic to be replaced with the following two categories:

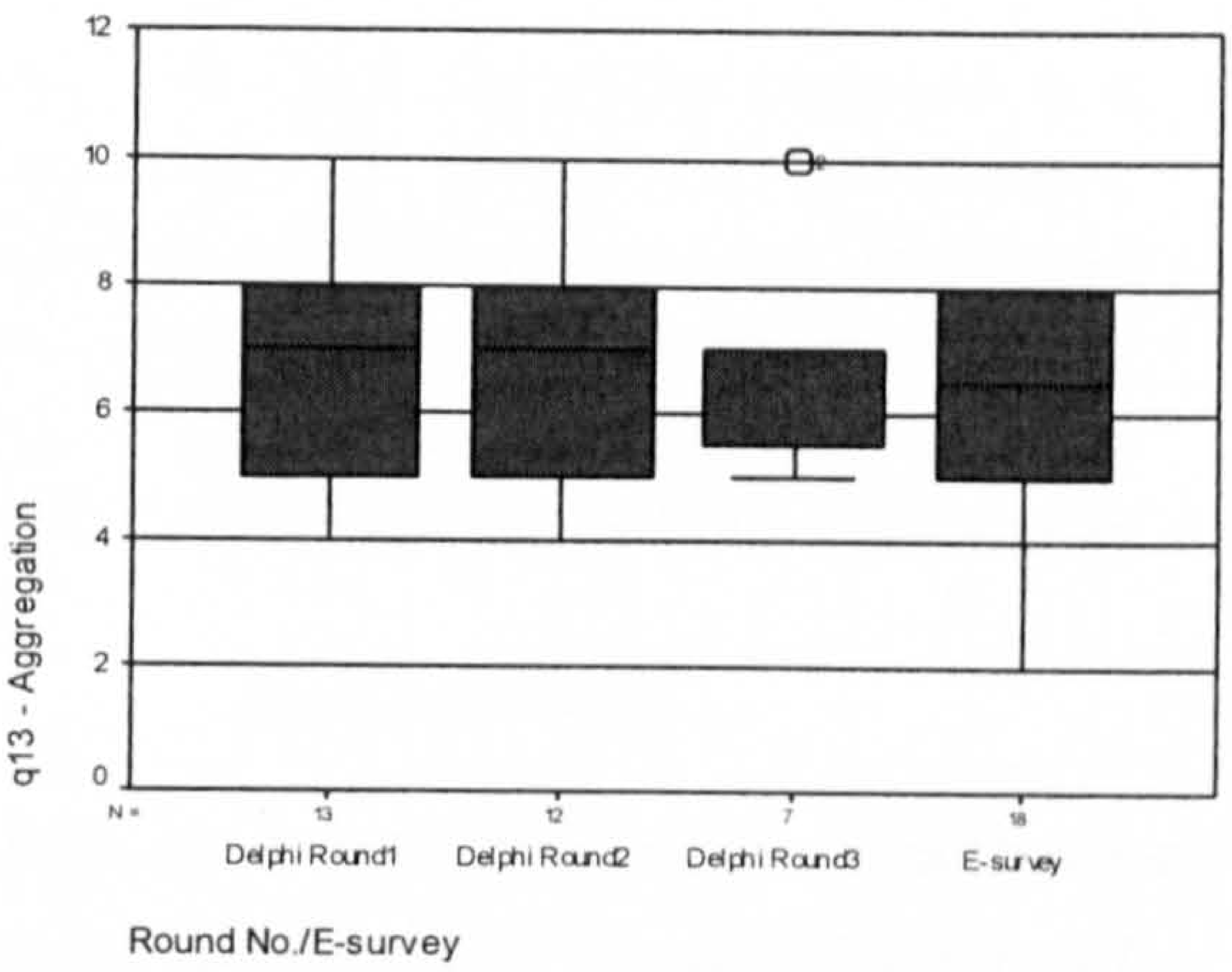
- data that the user cannot change or manipulate in anyway
- data that the user can manipulate and change to gain other information from.

Similar to its predecessors, the FEBuS is a flexible IA framework that allow for customisation, e.g. creating organisation-specific categories such as the one presented above.

- **Level of aggregation**

The Level of aggregation IC currently includes one attribute describing how detailed or summarised the information is. Both Delphi and e-survey participants found this component fairly important (median values of 7 or 6, respectively), but of not high priority, when compared with the rest of the set of components (i.e. ranking 19th, 22nd or 25th in the different runs of the quantitative tests). It has to be pointed that under the impression of the previous results, where participants differed substantially in their views, the results of these four surveys were found surprisingly agreeable (Fig.6.19).

Fig.6.19: Desirability results for IC Aggregation in D2: Forms of existence



The interviews provided several examples on how the Levels of aggregation category is operationalised. The case in organisation B also highlighted the relationship between this category and the Structure one (D1: Organisational view):

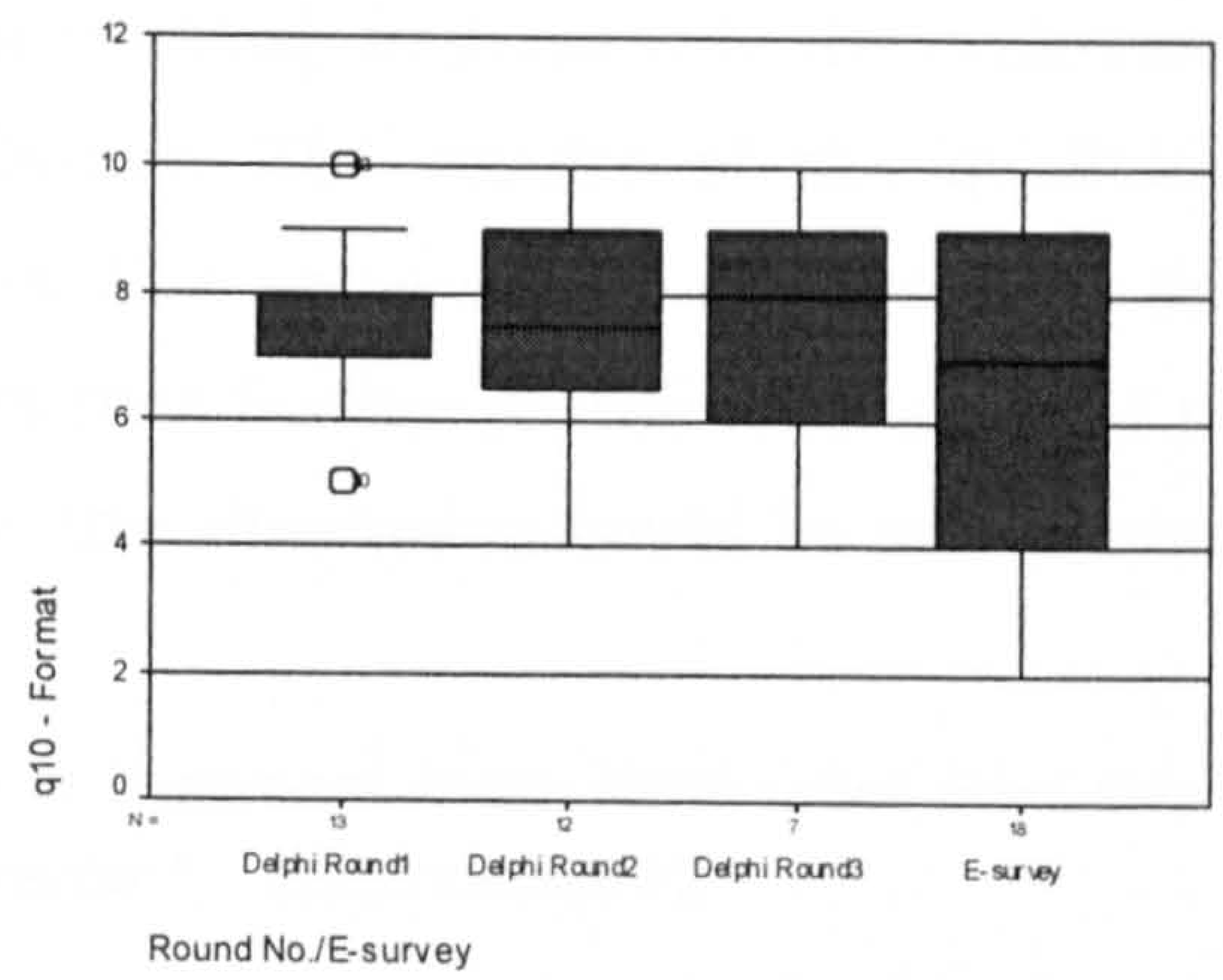
> *"If you are in Head Office you will get your data from only one or two sources and that is – do you need your data immediately, i.e. does it need to be 100% up-to-date. If it does then it comes directly off the systems that produce that data/that information. If you don't use data up-to-date, i.e. if it is a day out of date, then you can take that data from the datawarehouse. So you have two ways of looking at it. So we need something related to the up-to-dateness of the information. Some information can not be out-of-date at all..... And other information it doesn't matter if you are looking at yesterday's data.".*
>
> [Interviewee B]

- **Presentation**

The analysis of the results on the desirability of the last of the categories in D2:Forms of existence, Presentation, proved that knowing the information format, e.g. text, sound, etc., is relatively important to the evaluators (median values of 8 and 7), and the second most desirable category within this dimension with ranks of 12th to 18th. However, as Fig.6.20 illustrates, the e-survey participants differ significantly in their views on the desirability of this component.

The interviewees also confirmed that this is a feature that is not of primary importance. For example, Interviewee B stated that

Fig.6.20: Desirability results for IC Presentation in D2: Forms of existence



"From an informational point of view the final representation is not really relevant to the architecture.

For example, you put this information into an Excel spreadsheet, you could create a printed document, you could create a pie chart, you could e-mail it. So, from that one document you could actually represent the data in all those forms. You input one of the diagrams in a report that somebody else is going to use. Meanwhile, you amend your spreadsheet, so the data changes..... its linked to the data, its linked to how it is used, so the one that is in the report is not changed. So, basically it is not about types of representation, it is about how it is used. – part of Information Management processes; definitions, models, templates. You might need to rename this one to something else. "

[Interviewee B]

Whilst it could be argued that this is true in a process-based organisation where there is a centralised data, these statements need to be tested further for validity in other organisational structures, both process-based and data-oriented.

The discussions with the interviewees provided some very good examples of relationships that this category enters. One of these relationships is the one between the categories in D2:Forms of the presentation and the category Policies (D7: Types of regulations), illustrated with example by Interviewee D:

"We tend to be quite flexible – our preferences are electronic format, which generally means less rework. We do accept some verbal information but we don't like it – we tend to lose the audit trail. Procedures generally prevent you from making changes on the basis of verbal instructions." [Interviewee D]

However, these prove to be informal rules, as when asked whether his organisation has a policy to regulate the format of electronic information, same Interviewee D replied that they do not have a corporate policy as such.

Interviewee D also provided an example certifying a relationship between the type of presentation of information and its cost (See Section D1:Types of information).

In summary, the medians of all categories in this dimension were greater than 6, which could indicative of the desirability of the categories. However, on the ranking list, only three categories proved relatively important to the evaluators, these of Stability, Presentation and Carrier. The results of the qualitative evaluation confirm these findings and outline some of the relationships that D2:Types of information enters in, a fact that further justifies the need of the information categories in it. The need for this dimension could be summarised in the words of Interviewee E:

> *"Yes, forms of existence is very useful. It is important to be clear what level this applies to – product manager, or product director."* [Interviewee E]

D3: Levels of understanding

The Levels of understanding dimension includes three information categories: Definitions, Models & Templates and Theories.

- **Definitions**

The Delphi and e-survey tests confirm that within this dimension participants value most the information on any incompatibilities (q.32) that scored 11th place in desirability (Table 6.14), with median values of 8 and 7 (Table 6.15). Amongst the Delphi panellists this issue proved to raise realistic observations on feasibility:

> *"Not always possible to identify all incompatibilities in advance."*

The comments also confirmed that the categories in D3 could be related to the Software IC in D1: Types of information:

> *"Feasibility (is) affected by compatibility of systems/ software."*

Table 6.14: Desirability results for Dimension D3: Levels of understanding

Information categories in D3: Levels of understanding	Question(s) testing this dimension	Rank of importance in the Delphi rounds (1-highest, 34-lowest)	Rank of importance in the e-survey (1-highest, 34-lowest)	Frequency in the interviews
Definitions	31	27, 26, 24	22	
	32	11, 16, 16	11	
Models, templates	15	19, 25, 22	23	4
	16	29, 29, 31	19	7
Theories	32	As above	As above	2
			General comments:	0

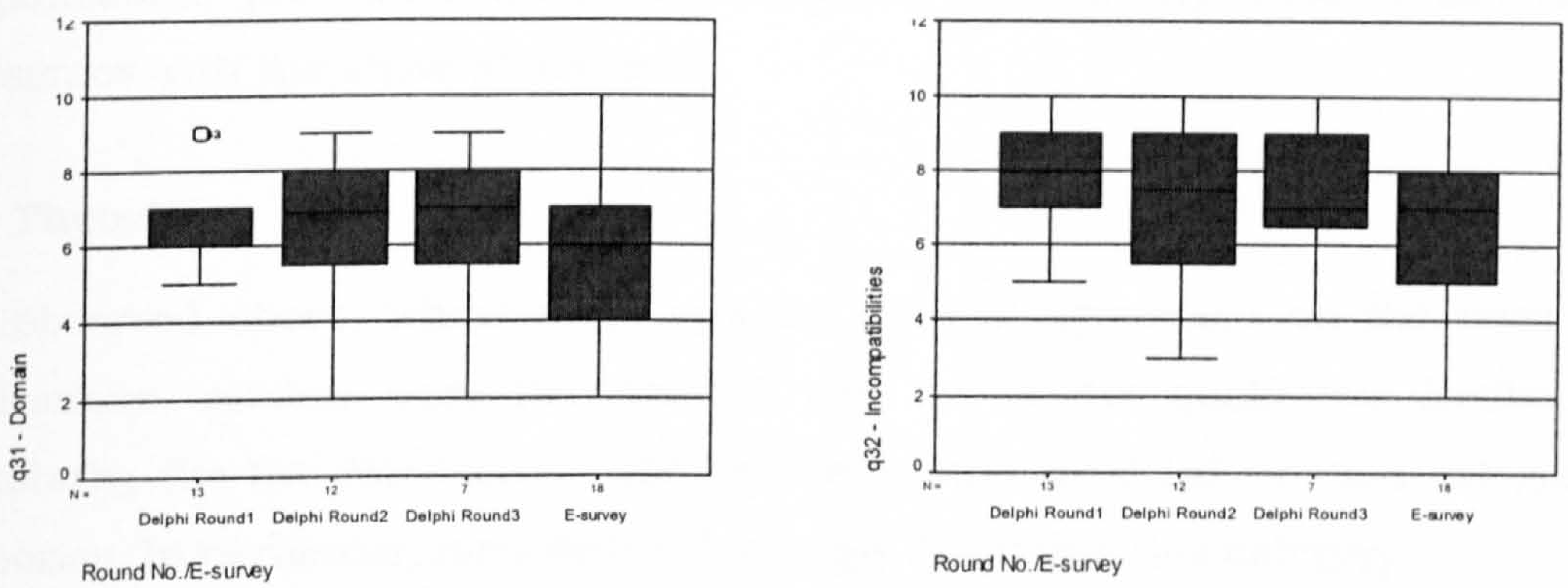
* Ranks are calculated based on the means results

Table 6.15: Feasibility results for Dimension D3: Levels of understanding

Feasibility:	**Median (R1, R2, R3)**			**Rank of the feasibility means in the Delphi rounds 1, 2 & 3** (1-most feasible, 34-least feasible)		
q15 - Languages/tools	7	7	7	22	18	16
q16 - Templates	8	7	8	13	12	4
q31 - Domain	7	8	5	25	19	25
q32 - Incompatibilities	5	6	4	32	27	32

Interestingly, questions related to the IC Levels of understanding such the one on permitted values of the information (q.31), scored more than 10 ranks lower. The Mann-Whitney tests M-W1 and M-W2 confirm that despite the distributions of scores (Fig.6.21) there are no significant differences between the views of the Delphi and the e-survey participants on these IA components. The results could partly be driven by experiential knowledge of how to define the information, i.e. what is allowable, default, etc. and the eagerness to expand this knowledge by more deterministic meta information. Thus the categories Definitions and Theories are considered important only when they add value to participant's knowledge.

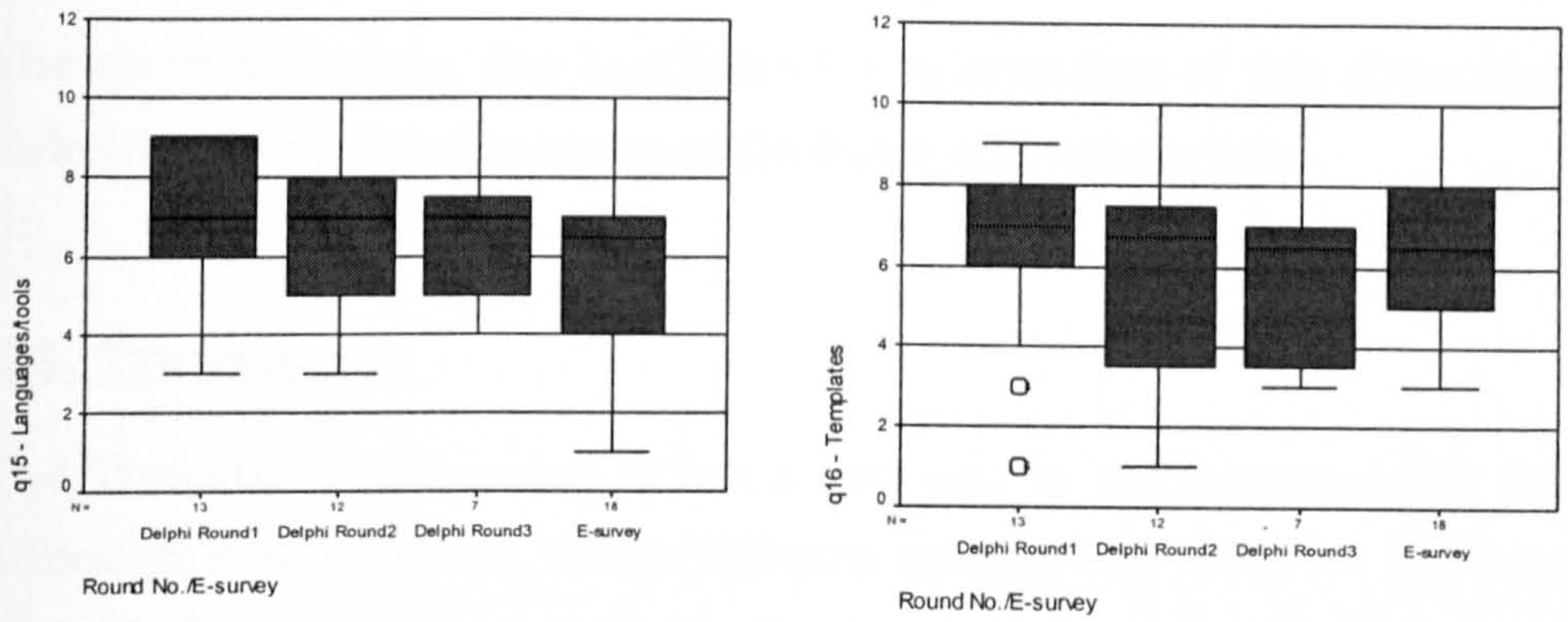
Fig.6.21: Desirability results for IC Definitions in D3: Levels of understanding



- **Models and Templates**

The information category Models & Templates presented one of the highest scores on feasibility (Table 6.15), but it did not score high in terms of desirability. The median results on the desirability of this information category (Fig. 6.22), a unanimous 7 across the Delphi and e-survey evaluation panels confirm that most of the participants agree on the need of this aspect. Since this category was added with the thought of streamlining business operations in virtual networks by standardising the documents templates, decision models, etc., it could be hypothesised that with templates being a standard in most organisations, participants did not consider them as a problem in business networks. This issue could be explored further with some empirical data from investigation of cases of virtual business networks.

Fig.6.22: Desirability results for IC Models & Templates in D3: Levels of understanding



The quality feedback from Delphi participants on the need to know the templates confirm that the existence of a template

"Depends on information, but can be useful."

Interviewee D's reply on the appeal of predefined definitions or models used in his organisation was a brief "*Not really*". However, it was observed that in his organisation, predefined document templates were widely used, a fact that disagrees with the above statement.

- **Theories**

As observed above, whilst there was the general agreement on the need of definitions, models were not covered well on in the qualitative feedback. Similarly, the five interviewees did not favour the third information category, Theories. In particular, Interviewee C strongly dismissed this category.

> *"When somebody writes a computer programme, what they do is to identify a business need and justify it and then determine the cost against the risk of actually doing it. Theories just not come into it."* [Interviewee C]

Similar views were expressed from Interviewee A.

An observation was made during interview B suggesting that the terms 'models', 'templates', and 'theories' could be misinterpreted should the organisational context of the participant does not provide for the use of these terms. Interviewee B initially questioned the need to know any theories related to the information he needs, suggesting that this category could be more desirable to other roles in the project:

"Theories you would link across to analysts and designers, models would be linked to your owners and your builders, and then to your clients and users who are actually doing them, and in which case the theory runs across the board." [Interviewee B]

The above statement also highlights the relationship of this dimension with the Roles (based on data) category in D6:Roles characteristics.

D4: Transitions

The Transitions dimension is not a new one in the history of IA frameworks, although it has existed under different names, e.g. Time or Evolution. In the FEBuS this dimension includes three categories complementing each other: Stages of capability/growth, Status and Version releases. The desirability and feasibility of the first two was tested with questions 19 and 14, respectively. As discussed in Chapter 5, the Version releases category could be considered as an alternative option to the combination of the above two categories. On this basis, the above category would not be discussed separately. Furthermore, Interviewee C pointed that the label 'Version releases' could be misinterpreted by software developers:

"Version of releases that is to do with the control of the programming applications. What we are talking about here is the control of some of the data." (Interviewee C]

This point is to be addressed in the review of the framework.

Table 6.16: Desirability results for Dimension D4: Transitions

Information categories in D4: Transitions	Question(s) testing this dimension	Rank of importance in the Delphi rounds (1-highest, 34-lowest)	Rank of importance in the e-survey (1-highest, 34-lowest)	Frequency in the interviews
Stages of capability/growth	19	23, 23, 26	27	2
Status (present/historical)	14	4, 6, 11	2	3
Version releases	14	As above	As above	7
	19	As above	As above	
			General comments:	3

* Ranks are calculated based on the means results

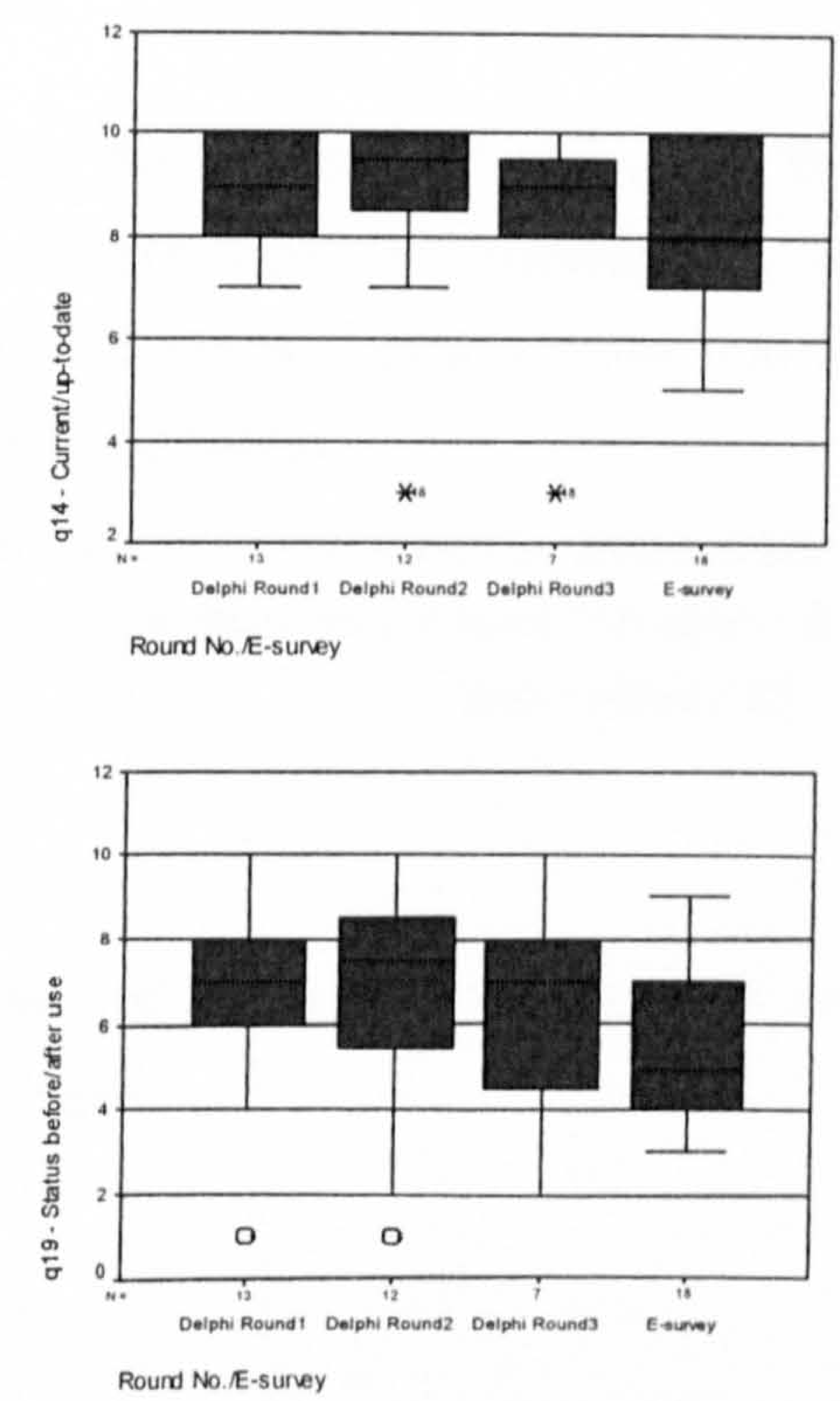
Table 6.17: Feasibility results for Dimension D4: Transitions

Feasibility:	Median (R1, R2, R3)			Rank of the feasibility means in the Delphi rounds 1, 2 & 3 (1-most feasible, 34-least feasible)		
q14 - Current/up-to-date	9	9	7	2	6	11
q19 - Status before/after	6	5	5	31	33	31

"All information should be dated" stated one Delphi participant. Although for others this comment might be considered extreme, it clearly indicates that the Status (current/historical) issue triggered some emotions that made this panellist go beyond the normally expected recording of the level of importance and wrote comments confirming her understanding. This quote corroborates the desirability rank of the Status category (Table 6.16). The feasibility test confirms that this category is also considerably easy to implement (Table 6.17). The desirability of such information was further confirmed in the early stages of the interview with Interviewee B, even before the category Status (D4: Transitions) was discussed. This participant argued that there is the need for a component reflecting how up-to-date the information is. When informed of the nature and scope of dimension D4:Transitions, the interviewee agreed that the provision of the combination of values on the stage of growth and the currentness of the information could inform users of how up-to-date the information is.

The Stages of growth category did not score as high as the Status one (Fig. 6.23), both in terms of feasibility and desirability. This result could have been affected by the inability to provide a detailed explanation of the category, due to limited space on the questionnaire form. It could also be a result of a tight specialisation of the participants, and therefore, lack of interest in the wider aspects of information evolution. Only one Delphi participant commented on this category confirming that it could be useful "*under certain circumstances*".

Fig.6.23: Desirability results for D4:Transitions



The interviews reinforced the results from the Delphi study and the e-survey. Overall, all interviewees agreed that familiarity with the transitions and transformations of the data helps them to adjust correspondingly related information. Whist there is no question on the organisation of this dimension, the discussions reinforced the need that the framework should be accompanied with detailed explanations. This is best illustrated in the example below:

> *"We are contractulally obliged to give them 60 days before any price change. We have 3 layers within the application: historic – what the previous prices were, the current and future prices (if you are within these 60 days you need to know both prices)."* [Interviewee D]

This quote proved that due to the way in which the term 'historic' was used, it was difficult to ascertain whether the examples illustrates the application of the Status or the Stages information categories. That is, was the term 'historic' used to denote the 'pre-contractual' stage in the IC Stages of capability/growth or to define information that was used in the past, i.e. the Status of the information? This example could have been explored further, but it was recognised only when the transcripts of the interview were typed. Its value is recognised as a point of caution when implementing the FEBuS framework, i.e. in cases of unassisted use of the framework, where users are presented just with the skeleton of the framework, concerns could arise whether the Stages and Status components are redundant. This should not be the case when the framework comes with detailed explanations and/or illustrations of each component.

In his comments, Interviewee D inferred the notion of other FEBuS relationships, these between the Data IC in D1:Types of information, the Policies IC in D7:Types of regulations, Roles in D6:Roles characteristics and the Stages of growth and Priority categories in D4:Transitions:

> *"To some extend you can – where a product has failed its qualification, but we are still selling the product, we have to remove that qualification and inform the client. It could be big contractual implications if we don't."* [Interviewee D]

- **New proposals**

The discussion of the transitional nature of the information generated two proposals for new categories, i.e. Priority and Trust.

Priority

A notable point on the organisation of the framework concerns the priority given to an information (needed for a product/service), based on knowing whether changes in this product/service are expected.

> *"It is definitely. If you know that something is to be changed, you'd spend less time on the user interface and on the maintenance."* [Interviewee D]

This statement suggests that a new framework component, this of Priority, is needed.

> *"we are quite restricted on the resources we have – the reality is we don't have a lot of people, that means that somethings don't get done, the things that don't get done might become more urgent than the things that we are working on at the moment."*
> [Interviewee D]

The qualitative data proved that this was an issue also mentioned by Interviewee B, which strengthened the validity of the proposal. Furthermore, Interviewee E, discussed a similar, if not identical issue, using the term 'degree of urgency'. The issue whether this needs to be an information category or an attribute of the IC Data (D1: Types of information; Business view) was extensively discussed with Interviewee D and it was confirmed that priority could be assigned not only to data, but to processes, roles, etc. and as such needs to be specified as a separate information category. Due to its changeable nature of the Priority IC its positon is in D4:Transformations.

Trust

Although at this point the discussion of the initial set of information categories in D4: Transitions should be exhausted, comments raised by interviewees on different occasions confirm that the issue of trust presents a potential candidate category for this dimension.

Initially the issue of trust was mentioned by Interviewee A when discussing the data and the need to know what its importance is in a certain context:

> *"Yes, at the moment that is obvious* [A/N: how important the information is], *because you can get that information only from certain places, and to get the information you must have gone to the right place, but in a more general case, when the information is available completely freely on an intranet it might not be so obvious. You might see all the uniform lines, yes, you would need another source of information. To know what trust to put on it."*

When asked to expand on the issue of trust the interviewee continued:

"Yes, trust in the accuracy and relevance of the intended use of it. Particularly accuracy, because operational data tends not to be very accurate. We tend to tidy up the deficiencies of operational data to come up with strategic results. So, you can trust a strategic result, but can't trust an isolated piece of operational data.

[Interviewee A]

Interestingly, the issue of trust was also brought up in the second interview. On completion of the discussion of the categories in D2:Forms of existence, Interviewee B suggested that:

"Trust is another form of existence: Is the data that you have coming from trusted source of information. The MIS team report is a trusted source. We provide the data that they need If some of the Marketing derive the information from the same source of data, they won't necessarily believe it. Levels of trust is important; "

[Interviewee B]

When the interviewer questioned the idea using the arguments that trust is subjective and context-sensitive issue, Interviewee B agreed and the discussion proceeded to the next of the dimensions. However, during the evaluation of the category Versions in D4:Transitions, Interviewee B raised the issue of trust again. This time he related the issue to the amount of data collected and the number of versions one develops, which could be interpreted as indicative of the experience with this data.

"If you change a version, your level [A/N: of trust] *will change initially when you put a new version on. And then when that version becomes accepted. The trust level increases, so you do have relationship between these two dimensions. The more data you have the stronger the case; the more information, and the more likely it is to be right. For example, we were trying to predict the return on investment on advert. After 3 months we were about 60% accurate, after 6 moths we were 90% accurate, and after 9 months were about 95% accurate. Just from the data we collected. "*

[Interviewee B]

Since the issues of trust was independently raised by two participants, it was decided to explore this issue further with the rest of the interviewees. Therefore, the interview structure was amended to include a question on how trust relates to the components of IA.

Interviewee C initially categorically dismissed the aspect of trust as a dimension of the IA, but clarified his views with the following statement:

"You can trust something more when it is tested but it's a risk, not actually the driving force..... What damage would it cause if it went wrong?"

[Interviewee C]

Interviewee D expanded further on the way trust could be measured:

> "*It is a negative way of measurement – we have a product support groups and you can tell when there is a problem – the number of calls and e-mails rises dramatically.*" [Interviewee D]

Interviewee E also confirmed that trust is an important issue. However, similarly to Interviewee B, to him the quantification of this issue was primarily done through the number of versions of a document and through the frequencies at these changes. Sadly, the researcher missed an opportunity to ask this participant on how the level of trust will be determined for documents that have got only one version. This problem is further amplified should the date when this document is well in the past.

In summary, all the interviewees confirmed the transitional nature of the issues of trust and provided compelling arguments confirming that there should be an information category related to trust. They also identified their views on what are the key measures that could be provided to any user of the information to suggest how much trust they could have in the information provided. As there was no unanimous agreement on the way this category should be labelled, all candidates, i.e. Levels of trust, Degree of risk and Degree of Testing should be considered. The following statement suggests that the dimension that should accommodate this category is D4:Transitions, due to its role as a holder of other time-sensitive categories:

> "*I tend to view it* [A/N: electronic information] *sceptically, because, unfortunately, it may be correct at the time of the writing, but electronic information goes out of date very, very quickly.*" [Interviewee C]

The challenges of providing objective measures for trust, agreed by all users of an information item is an issue that has already been raised in the literature.

D5: Types of IM processes

The only one category in the dimension 'Types of Information Management processes' reflects the stages in the information lifecycle. In the Delphi study and the e-survey it was tested indirectly through questions 7, 8 and 33, where a few IM processes were listed, but the main focus of the questions was on other FEBuS components. Therefore, the results from the quantitative tests (Table 6.18 and Table 6.19) could not be considered as sufficient proof for the need of this dimension.

Table 6.18: Desirability results for Dimension D5: Types of IM processes

Information categories in D5: Types of IM processes	**Question(s) testing this dimension**	**Rank of importance in the Delphi rounds** (1-highest, 34-lowest)	**Rank of importance in the e-survey** (1-highest, 34-lowest)	**Frequency in the interviews**
Types of IM processes	7	17, 17, 18	3	14
	8	21, 19, 25	13	
	33	26, 28, 30	16	
* Ranks are calculated based on the means results			General comments:	0

Table 6.19: Feasibility results for Dimension D5: Types of IM processes

Feasibility:	**Median (R1, R2, R3)**			**Rank of the feasibility means in the Delphi rounds 1, 2 & 3** (1-most feasible, 34-least feasible)		
q7 - Owner/originator	8	8	8	8	7	10
q8 - Controller	6	6	6	23	26	33
q33 - Concurrent use	5	6	5	34	30	29

This dimension was primarily evaluated through the interviews, where it proved to be agreeable with all participants. It was observed that in most of the cases where the interviewees were mentioning IM processes, they also referenced specific roles within their organisations. This proved the notion of a relationship between the category IM processes in D5:Types of IM processes and the IC Roles (both with reference to data and with reference to process) in D6: Role characteristics. Further, it confirmed the suitability of the decision to treat the answers to the questions related to roles as indicative for the desirability of this dimension.

As expected, different synonyms were used to describe the way information is processed, representing the variety of terms that could be used to describe the stages of the information lifecycle. All of these, apart from one, i.e. 'die' introduced by Interviewee C, were covered in the introduction of this information category in the previous chapter (see Section 5.1.4). Table 6.20 introduces the results the above issue generated from the content analysis of the interviews. Although initially the idea was to map these terms to the template list of IM processes (Section 5.1.4.2), this was not done here due to the fact that many of the terms are charged with contextual information. Establishing the domain of values for the process names should be one of the initial activities when using the FEBuS framework. A point to note is that the vocabulary used when referring to IM processes affecting electronic information might differ from this used for describing IM processes for paper-based information, e.g. 'e-mail' and 'publish' stand for 'distribute', whilst 'convert' is only applicable for electronic formats.

Table 6.20: IM process names used by the interviewees.

Interviewee	Variations of IM process names
A	publish, access, get, see, tidy up, come up with, test
B	own, oversee, look after, manage, create, publish, control, clean, model, manipulate, look up, convert, input, amend, change, link, use, distribute, corrupt, view
C	change, retrieve, create, move, use, validate, e-mail, put into [spreadsheet], rename, derive, retrieve, die
D	translate [onto the intranet], publish, change, restrict, pull out, put back, monitor
E	Examine, develop, use, modify, check, validate, summarise, assess

As identified earlier, the interviews confirmed the existence of relationship between this category and IC Structure in the Organisational view of D1:Types of information, as well as with Business process in the Business view of D1:Types of information. This was best expressed in the words of Interviewee B:

> *"They* [A/N: users at lower level] *cannot change – they can only analyse and distribute it further, they can't update the main set of data, the data is incorruptible from that point of view. They might set up some requirements. In our organisation to update data is when actually someone is actually performing a transaction against the customer's record. And the people who effectively update the data, at informational level, we are almost looking at update processes where the individual people are transacting against the customer individual processes...."*
>
> [Interviewee B]

Participants also maintained that the security of the organisational electronic resources could be designed through exploring the relationship between the categories IM process (in D5), Roles (in D6) and Data (in D1). A further, rather interesting point was highlighted by Interviewee A. He recognised the need of IM rights to be built into the IA and suggested that this should also be done not only from security considerations, but also to reduce the information overload experience in e-mail facilitated business communications. His views reinforce the views that a framework for IA could be used as a tool for strategic management of electronic, as well as human resources.

D6: Roles characteristics

Chapter 5 introduced the Roles characteristics dimension and provided details on the three information categories it incorporates, i.e. Roles (data perspective), Roles (process view) and Level of compterencies/Skills. The results indicate that all of these categories are well recognised by the evaluators and considered as being of high desirability for the e-business network. Details on each of the categories and how they cross-reference with each other and with other FEBuS categories are presented below.

- **Roles (data management perspective)**

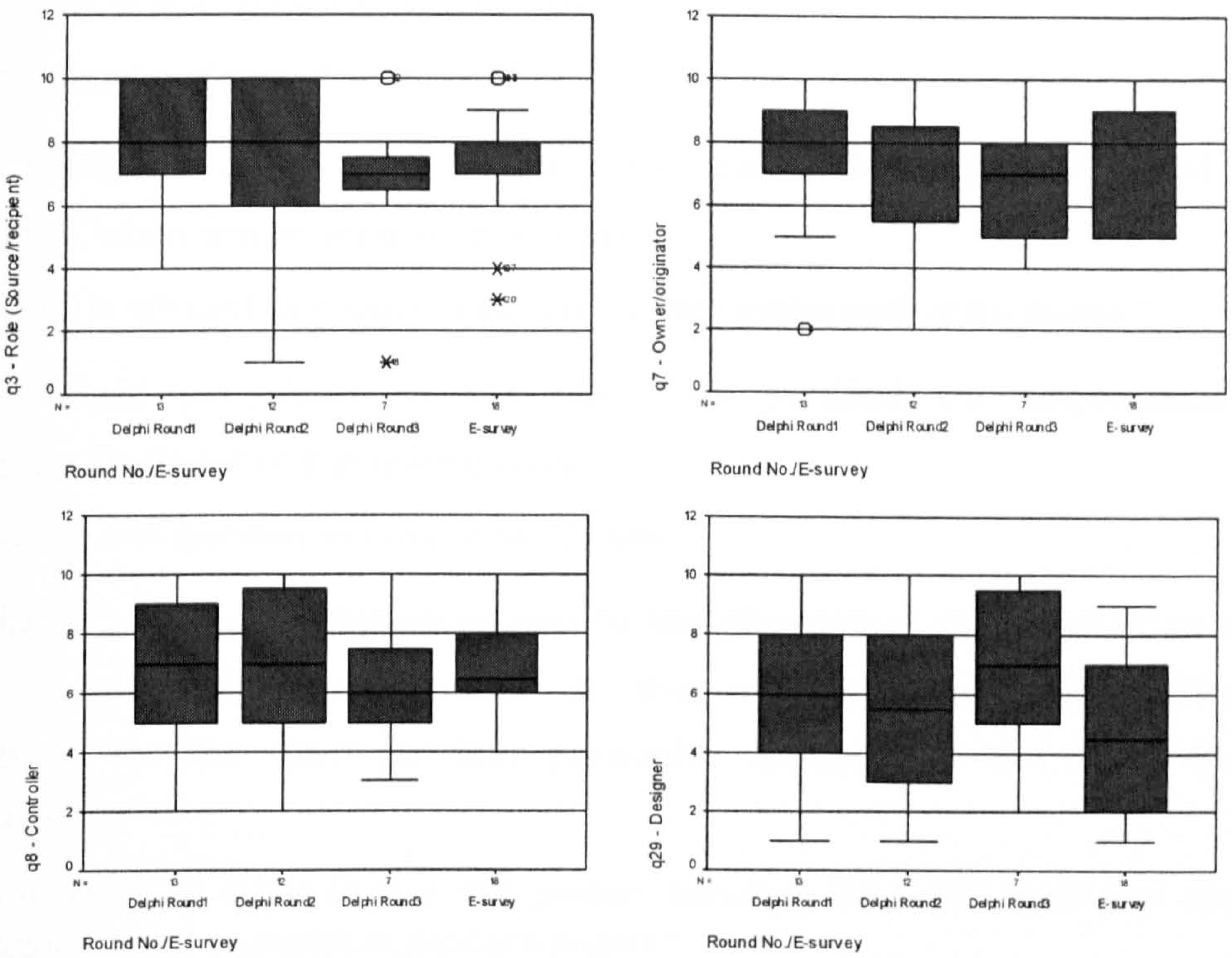
A fundamental part of the D6:Roles characteristics is the IC Roles (data perspective), describing the different roles with regards to the management of the data, e.g. owner, controller, viewer, etc. The domain of allowable roles titles is specific for each business organisation and as specified earlier, needs to be agreed for each business network. To allow for this diversity this category was represented by four questions in the questionnaire, each of them testing particular roles. The interviews further provided a lot of information on the spectrum of roles within the represented organisations.

Table 6.21: Desirability results for Dimension D6: Roles characteristics

Information categories in D6: Roles characteristics	Question(s) testing this dimension	Rank of importance in the Delphi rounds (1-highest, 34-lowest)	Rank of importance in the e-survey (1-highest, 34-lowest)	Frequency in the interviews
Based on role (data perspective)	3	14, 15, 23	5	24
	7	17, 17, 18	3	
	8	21, 19, 25	13	
	29	33, 31, 17	32	
Based on role (process perspective)	1	6, 9, 13	1	7
	2	5, 4, 6	8	
Levels of competence, Skills	30	25, 21, 15	31	3
* Ranks are calculated based on the means results			General comments:	0

The desirability results (Table 6.21) indicated that despite the great variations in their views, the Delphi and e-survey participants consider that of higher importance is to know the Role of the source or the recipient of their information. Of similar importance is to know who the Owner of the information is. The results show that there is less interest in the other tested roles, these of Designer and Controller (Fig.6.24).

Fig 6.24: Desirability results for IC Roles (with regards to data) in D6: Roles



The Mann-Whitney tests prove that with regards to this information category there are no significant differences in their views of these two evaluation panels One explanation of these results could be the focus on core business tasks, rather than on supporting activities, such as control, quality assurance, or design. The feasibility results from the Delphi evaluation of the FEBuS components confirm the trends in desirability results, i.e. it will be easiest to provide information on the role of the source/recipient of the information and on the information ownership, rather than on who is responsible for controlling or designing it (Table 6.22).

Table 6.22: Feasibility results for Dimension D6: Roles characteristics

Feasibility:	**Median (R1, R2, R3)**			**Rank of the feasibility means in the Delphi rounds 1, 2 & 3** (1-most feasible, 34-least feasible)		
q1 - Source/recipient	10	9	10	5	4	5
q2 – Organisation (source/recipient)	9	9	9	3	1	1
q3 - Role (Source/recipient)	9	9	8	6	3	6
q7 - Owner/originator	8	8	8	8	7	10
q8 – Controller	6	6	6	23	26	33
q29 – Designer	7	6	7	20	23	13
q30 - Skills and competencies	6	6	5	26	34	28

The qualitative comments of one Delphi participant confirmed the need for transparency of the roles within the team:

"...Team structured should be shared."

Same participant added details clarifying the difficulties that could be encountered when implementing this online:

"Feasibility is affected by knowing individual's roles within each of the teams."

Another Delphi participant in his comments justified the importance of knowing the Designer of the information:

"To answer and question on process and format."

In anticipation of any problems related to the absence of information on the Owner of information, a member of the e-survey panel put forward justifications for the need for this particular instance of the Roles (data perspective) IC:

"Problem that can occur is that this person becomes the bottle neck and can drastically effect the completion date of a project."

A valuable point was made by another participant in the e-survey, who warned that the "owner" of the information is not always the "originator" of the information and further acknowledged that the definition of these roles depends on the type of business. This comment will be taken into consideration when reviewing the proposed framework.

Similarly valuable comments were made by interviewee A, who identified a further use of this meta-information, i.e. reducing the information overload by using the set of information access rights built into the roles.

"I can publish some results and believe that people in the right roles saw that that information is available and can have access to that. At the same time people who weren't relevant to that piece of work were not interrupted. That is not necessarily the same as preventing access, but in terms of workload, for workload purposes, roles ought to be coded in the IA, so that the right behaviours can be promoted and unnecessary interruptions can be prevented. We send each other too many e-mails now, that's the way we do the work process at the moment and that's more of a burden than not being sent at all."

Same interviewee pointed out that:

"At the moment we certainly rely on knowing something about the person who sent the e-mail, in order to interpret what matters about it. We mustn't lose that contextual information, and so along with the data that we send there needs to come information about the roles and responsibilities of the person who sends it."

(Interviewee A)

The rest of the interviews confirmed the expectation that the set of roles tested in the questionnaire might not be representative of the particular organisational cases, as the set of roles comprising the Roles IC could differ from one organisation to another. Here is a small set of quotes from interviewees B and D, highlighting some similarities and differences with the role names used in the descriptions of the FEBuS:

- Controller Alternative titles: Master user, Overseer

"[A/N: when discussing security of the physical environment on a local level] *we have master users and they will prove any access at first*"

(Interviewee D)

"*There is an overseer, which is our communications manager from the point of view of content and style.*" [Interviewee B]

- Manager Alternative titles: Data manager, Knowledge manager

"*We are just putting in place a Data Manager who is to ensure that important users run consistent data.*" [Interviewee B]

- Owner Alternative titles: Data owner, Process owner

"*Each department has an owner or two who actually look after their department needs.*" [Interviewee B]

"*We recently changed the way we work here, so what we define is a 'process owner' and every thing is related to process. We don't have data owners any more. All the information that is related with a process would be the responsibility of that process owner.*" [Interviewee B]

- User Alternative titles: Master user, Key user

"*Every application has been assigned master users. Every master user then nominates key users that will be contacted if the master user is not available.*"

[Interviewee D]

Whether there is a relationship between these roles or not, depends on the organisational structure (D1:Types of information; Organisational view). Thus Interviewee B clarified that for his company, a matrix organisation, there was no relationship between the overseer and each department owner.

Furthermore, a common perception, confirmed by all interviewees, was that the list of roles provided for illustrative purposes in the FEBuS framework is far more detailed than its version in a real business situation, where some of the roles are combined. Interviewee C explained that what tends to happen is that the planner, the owner, the analyst, designer and the builder are the same person. This view was further confirmed by Interviewee D:

"A lot of the guys who deal with applications do a lot of these roles - they will be the analyst, the planner, the owner, possibly the manager, very rarely – the user – they do see it from the drawing board through to production.".

[Interviewee D]

For a process-based organisation, however, Interviewee B argues that this is not entirely true.

"You might have people in more than one role. In our method of working you won't have people occupying more than one role. This process has these tasks. A role is responsible for a task. And an individual might perform two roles. ."

[Interviewee B]

Due to the limited information on the matter, this case could not be examined further.

- **Roles (process perspective)**

The second Roles category reflects the process view of a role, i.e. the source or recipient aspect (the process perspective) of the actor in the virtual business network. The desirability and feasibility results on the two questions testing this category, q.1 and q.2, proved that it is considered as one of the most needed ones. This is understandable, as Source/Recipient has been one of the fundamental attributes in the Process component of any IA framework. Similarly, there was an unanimous agreement amongst the interviewee on how to recognise the roles of source and recipient.

"Typically in the information that we deal with our primary source is the product manager, The recipient could be inside salaes, distributor, customer,etc."

[Interviewee D]

When asked whether the Roles (process perspective) category is needed, Interviewee B explained:

"That's very important. The recipients and the source of data are often miles apart. The recipient often is considered as more important that the source. It's the wrong way round. But in an organisation something that goes to the Board would have more respect paid to it. That something that is input to make that way to the Board. So, the person doing the input for a high level source high level recipient, actually, is given more importance [recipient-role-position within the hierarchy]"

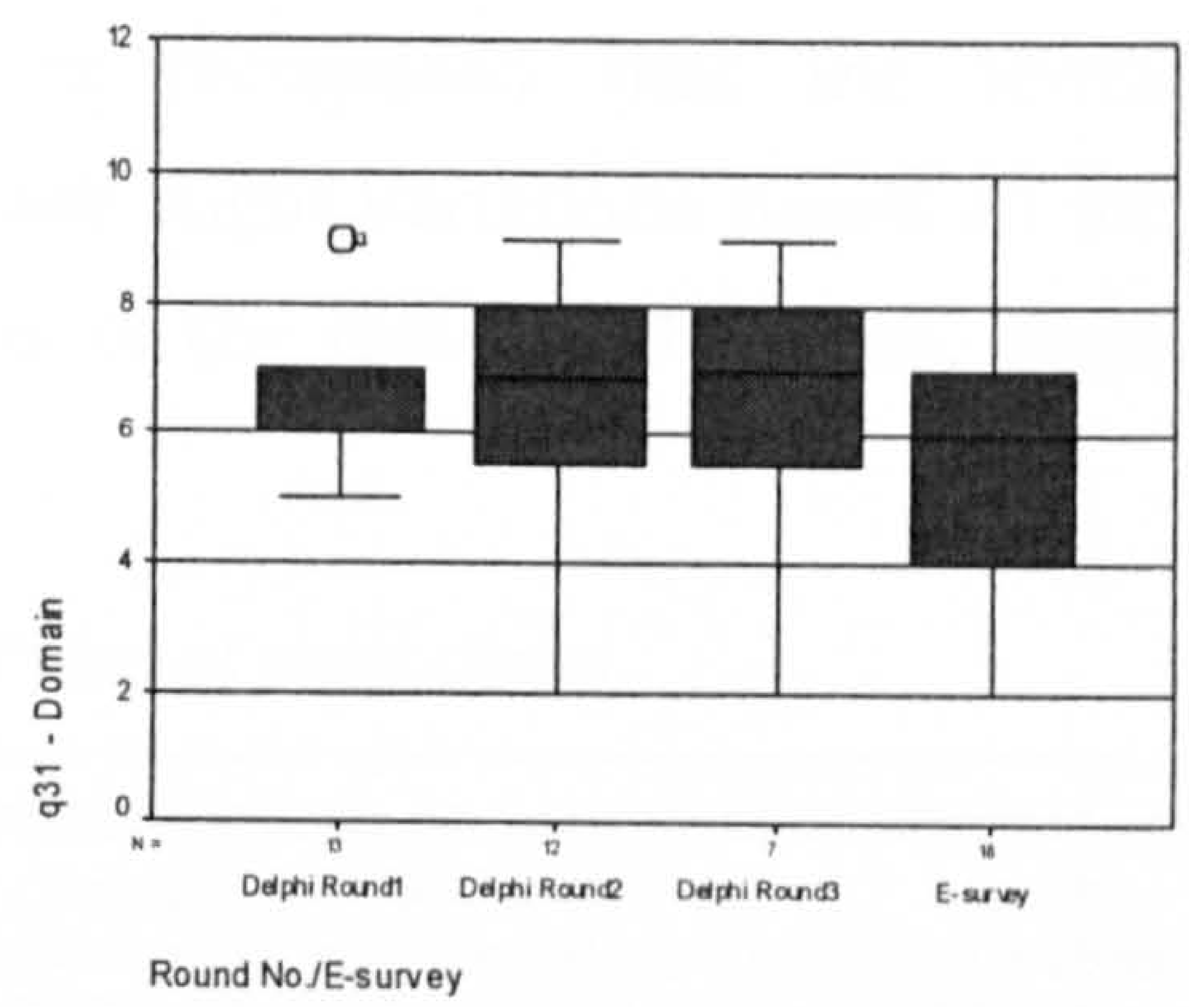
[Interviewee B]

The above quote confirms the need of a new category on priority, as suggested in the description of D4: Transitions. It further highlights that this new category cross-references with the IC Structure (in D1). Whilst the latter relationship might not be supported when the business network is formed by/within a hierarchical organisation, it certainly could be of values in defining power levels in the rest of the cases.

- **Levels of competence, Skills**

The last of the information categories in this dimension, the Levels of competence, describes the required skills and competencies for the particular role. It was tested with a single question, q.31. The quantitative results indicate that initially there are significant differences in the views of the Delphi and e-survey panels on the desirability of this component, that were not resolved with the progression of the Delphi study (Fig.6.25).

Fig 6.25: Desirability results for IC Levels of competence in D6: Roles characteristics



This category proved to raise conflicting views amongst the interviewees, too. Interviewee C recognised the need for business information on data, process and skills to be included in the IA, but was very sceptical on its real value. He argued that matching people to projects based on their skills is

> *"a very sensible way that you could go about it, but the problem is that it is cost. If you've try to the get the right person to the right job then you either have to let people go on a very regular basis or you've got to expand your business very dramatically. .. Generally they look to see who is not working (on a project) and try to make him to pick up the skills needed to complete the job that is required."*
>
> (Interviewee C)

His statement further confirmed the need of the attribute Cost in the IC Data (D1:Types of information).

The relationship between this category and the IC category Definitions in D3:Levels of understanding was recognised by Interviewee B:

> *"I think the definitions are effectively defining the competence of the users. I was thinking of them refining their power or their responsibilities.....These are just examples of responsibilities but they could also be the skills and competencies."*
>
> [Interviewee B]

D7: Types of regulations

The penultimate dimension incorporated three information categories: Standards, Policies and Regulations. Five questions were construed and included in the Delphi study and the e-survey to test the need for the above components. Of these, one was related to security issues and the other four were reflecting the quality, ethical, legal and organisational-specific issues that any regulatory framework deals with. It is recognised that the terms 'standards', 'policies' and 'regulations' could have slight variations based on the specific context, which could affect the validity of the results. Therefore, these categories will be discussed jointly.

Table 6.23: Desirability results for Dimension D7: Types of regulations

Information categories in D7: Types of regulations	**Question(s) testing this dimension**	**Rank of importance in the Delphi rounds** (1-highest, 34-lowest)	**Rank of importance in the e-survey** (1-highest, 34-lowest)	**Frequency in the interviews**
Standards	20	16, 13, 9	24	7
Policies	6	7, 8, 7	9	9
	20	As above	As above	
	22	18, 14, 10	15	
	24	10, 7, 8	6	
Regulations	20	As above	As above	3
	22	As above	As above	
	23	1, 2, 3	4	
			General comments:	0

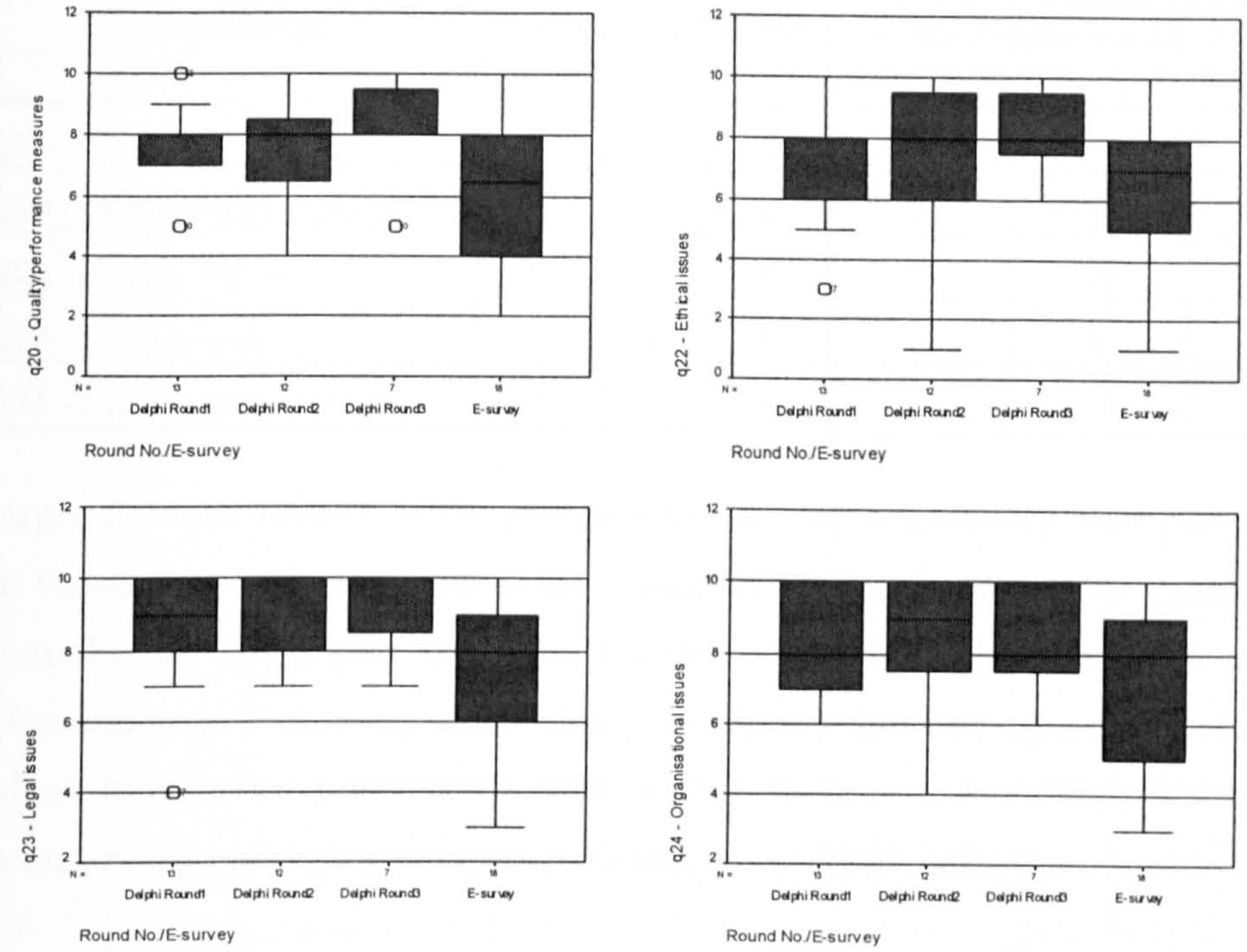
* Ranks are calculated based on the means results

The desirability results (Table 6.23) indicate that regulatory documents addressing legal issues are of highest importance, followed by those dealing with organisational issues, security issues and ethical issues. The findings on organisational issues (Fig.6.26) indicate wide variations in the views of the participants, a result that could be attributed to their different occupational scenarios. Nevertheless, despite these differences, the results from the Delphi study and the e-survey are agreeable.

The comments of two Delphi participants confirm the priorities assigned to the ethical, legal and organisational issues:

> *"Equal opportunities, racial equality, data protection, so many ethical considerations these days - it is essential! "*
>
> *"Team leaders/members would need to know how to decide if there are any ethical/legal/organisation issues".*

Fig 6.26: Desirability results for Quality, Ethical, Legal and Organisational issues in D7: Types of regulations



It is interesting to observe that Risks and Legal issues initially proved to be objects of significant disagreement between the Delphi study and e-survey participants, which was proved not to be an issue, when comparing the responses of the Round 3 participants with these of the e-survey participants (Mann-Whitney test 2). This, however, was not the case with the Quality issues where the differences remained significant (Fig.6.26), with the e-survey results showing much lower means result. Despite that the quality variable was not recognised to be of primary importance, one of the e-survey participants observed that it is of unique value as far as customers are concerned.

The feasibility results from the Delphi evaluation confirm that the panellists from the three rounds maintained their views only with regards to the implementation of organisational views, ranking 15th or 16th position. It could be observed that with each following round the rest of the issues, with the exception of the Risks one, were climbing up the feasibility-ranking table (Table 6.24).

Table 6.24: Feasibility results for Dimension D7: Types of regulations

Feasibility:	**Median (R1, R2, R3)**			**Rank of the feasibility means in the Delphi rounds 1, 2 & 3** (1-most feasible, 34-least feasible)		
q6 - Risks	8	7	6	12	15	23
q20 - Quality/performance	7	7	6	24	22	17
q22 - Ethical issues	6	6	5	27	20	22
q23 - Legal issues	8	8	7	10	9	7
q24 - Organisational issues	7	7	6	16	16	15

Although Ethical issues were recognised as the regulatory component with lowest feasibility, a participant in the e-survey on the feasibility of incorporating them in the IA, suggested that this feature could be implemented a part of a security schema. However, since this participant did not agree on a follow up interview, it was not possible to explore this further to establish whether this was a comment reflecting current practice, or an ideal situation.

It is believed that because the interviewees were presented with the framework itself, rather than with questions reflecting components of this framework, and could clarify their understanding with the researcher, their input into the evaluation of the components of the FEBuS is more reliable.

In the case of the Regulations dimension the interviewees' statements confirmed that in an online environment having information about the policies, regulations and standards that the information object complies with would be of extreme value.

> *"The culture of the site, how do you actually go about changes, what actually they change, ..., yes you do need to know. That could be quite an important part. You could upset a lot of people if you do not know this."* [Interviewee C]

Interviewee D commented that

> *"Other than security measure such as passwords, physical locks and NT security, security, legal and ethical issues are built into the contracts with the distributors."*
> [Interviewee D]

In cases like this, the meta-information could be in the form of a hyperlink to the relevant part of the contract, or to the contract itself. Same interviewee provided an example of a case confirming that the separation of this dimension could be useful, i.e. when one of the parties changes trade names and this has to be reflected on the information on all products received/supplied by this business partner. Similar case also included internal quality standards and different European standards (Interviewee D).

The standards issue is even more demanding in cases where the collaborating parties are using different applications:

> *"more software vendors are attempting to standardise data formats and most support generic document and message standards such as XML. Although message formats and standards are being standardised, there is no standard mechanism for exchanging that data."* [Interviewee F]

With reference to the operationalization of this dimension, and the relationship it maintains, with the rest of the dimensions, Interviewee E suggested that:

> *"It is a good idea to examine developments in software development, where things are well established and standardised and see how applicable they are for the information architecture in business and other business areas."* [Interviewee E]

The interviewee made references to CORBA and ISO9002, suggesting that these are consulted when reviewing the FEBuS framework.

D8: Levels of granularity

The Levels of granularity dimension comprises of only one information category, baring the same name. This proved to be the IA component that was most difficult to evaluate with the chosen evaluation tests. In the Delphi and e-survey questionnaires there was only one question measuring participants' agreement on desirability of knowing the organisation that is a source/recipient of the information. The answers to this question were already discussed in the discussion of the Structure IC in the Organisational view of D1:Types if information (Table 6.7 and Table 6.8). It is considered that as there was no separate question dedicated to this dimension, the quantitative evaluation tests did not provide sufficient evidence on the desirability and feasibility of the Levels of granularity IC.

Furthermore, the data from the evaluation interviews presented only fractional evidences of the need for this dimension. These were gained from the description of the examples of working practices that some of the participants provided. For example, Interviewee B defined his organisation as a matrix organisation, where the levels of granularity are dependent on the particular task/object.

"...we have information that is provided to the Board at certain level for them to make decisions of where the company is going and you have information that is provided to an underwriter to determine whether he could actually process a mortgage or not." [Interviewee B]

The above example further illustrates how this component is complemented by the Structure IC (in D1).

Interviewee D further observed another relationship that the hierarchy of the focal business unit enters in, this with the IC Standards (D7:Types of regulations). He explained that their quality standards have five levels of hierarchy, the top one being the mission statement, followed by general work practice standards, e.g. Health and Safety. The lower standard levels are more specific to the respective business function or department. This hierarchy, he agreed, evidences of the existence of the Levels of granularity dimesion in the type of business network that his organisaiton represents[4].

The e-mail response of participant F is another confirmation of how the above category relates to the rest of the framework components, in the context of stable business network:

"[we] have no influence over the architecture of the networks that we use as standards and protocols are imposed upon us by our clients and service providers." [Interviewee F]

Due to time limitations for the interviews it was not possible to explore fully which of the other seven dimensions are related to D8:Levels of granularity. The researcher's observations from the qualitative evaluations prove that this contextual information needs to be discussed at the very beginning to set firmly the focus of the IA. This could provide another level of hierarchy amongst the FEBuS dimensions, but will prove beneficial for the users of the framework. Knowing the boundary of the discussion (or the project) on the constituents of the IA, will prove the work with the framework a less arduous task.

6.4.3. CHARACTERISTICS OF THE FEBUS FRAMEWORK

In the final part of the interview all participants, but one, were asked to characterise the framework in terms of its focus, scope and clarity, as well as to

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4 As specified in Section 6.3 it was difficult to establish whether company D represents a stable or dynamic business network.

comment on the usability, accuracy and completeness of the tool. There was only interviewee that due to time limitations could not give his views on the above characteristics.

6.4.3.1. Focus

This part of the interview tested interviewees' perception of the focus of the framework, i.e. whether it is a Data Architecture, Information Architecture or Knowledge Architecture. Three of the participants unanimously agreed that this is an Information Architecture, whilst participant D believed the framework is addressing Knowledge Architectures and justified his views with the complexity of the information provided and the potential the framework offers to develop knowledge. The latter was also recognised by another participant, Interviewee B:

> *"The basis for it is certainly data. It certainly is information architecture, as it is giving you the context, but I don't think it is knowledge architecture..... It could be used to develop knowledge "* (Interviewee B)

It is reassuring that after the thorough examinations of the work, the participants' comments confirm that the FEBuS framework could be defined as a framework for Information Architecture. The comments could also be used as a supporting evidence certifying that the second of the research objectives, i.e. to build an extended framework for IA, has been met.

6.4.3.2. Scope

In search of further confirmation whether the IA-building objective was met, the participants were also asked to define the framework in terms of scope, i.e. Information Architecture or Information Systems Architecture. Only participant defined the architecture as Information Systems Architecture and, coincidentally or not, this was the same person who defined the framework as a tool focused on Knowledge Management. He further clarified that his views are of

> *"information system in a wider context, but not simply a computer-based application."* (Interviewee D)

The rest of the evaluators classified the analytical tool as Information Architecture. Their views are best summarised in the words of participant E, *"It's definitely Information Architecture. It is not systems-based. ... It could be used as an IS Architecture, but I think it is more than just a systems architecture, but if you are limiting it by the word 'system', you are limiting it down you could use this on any set of data that you have."*

6.4.3.3. Accuracy and completeness

The interview comments were largely confirmatory of the accuracy and completeness of the framework. The provided examples further validate the components and relationships within the tool. A few recommendations were made for new components, e.g. Time, Priority, Trust, or for changing the status of a component, e.g. to promote the information cluster Events into an information category. These were discussed extensively with the interviewees to establish any redundancy and relationships with existing structures. Decision on incorporation also considered their fitness with the purpose and scope of the framework. The final version of the FEBuS (Chapter 7) addresses each of these proposals. Where a candidate component was rejected, clarifications are given on the set of relationships that provide the required information.

Other improvements that were suggested were attributed to presentational and methodological, rather than structural concerns. These were largely due to the decision the researcher took on presenting the interviews candidates with a summary of the framework, rather than with the full documentation of the work. It was feared that non-assisted familiarisation with the lengthy description of a complex architectural framework, such FEBuS could deter any potential participants in the evaluation and jeopardise the completion of the study.

With regards to the completeness of the work, the views of the interviewees are best summarised in the following quote:

"it does capture everything that you tend to go through" (Interviewee D)

6.4.3.4. Clarity

Clarity was highlighted as the most desirable improvement to the framework. Two interviewees emphasised on the importance of supporting documentation with definitions, detailed explanations and examples support, where necessary, whilst another interviewee deemed face-to-face contact as best suited for any initial familiarisation with the framework. His major point was that individual interpretations of the definitions could differ and that the help of a framework consultant will facilitate user's understanding of a complex object like the FEBuS.

> *"If you weren't here explaining it, I probably would have struggled more."*
> (Interviewee D)

These comments, as explained earlier, were due to a decision on how much of the framework documentation to be presented to the interviewees beforehand and how much to be introduced during the course of the interview. This, of course, would not be an issue when implementing the framework. Any adopters of the tool will be provided with the full set of documentation, as well as assisted throughout the implementation.

Despite the challenges brought in by the above methodological decision, the researcher observed that all participants could relate to the organisation of the framework, and support these with examples from their experience. Another way to explore the clarity of the work was through the tests of how interviewees understand of the focus, scope and purpose of the framework. The findings confirm that their views confirm that researcher's goals were met:

> *"Your idea, as I understand it, is to develop a fundamental structure for development of specifications and implementing processes on the basis of this specification, which could be used in other businesses but not only the software ones."*
> (Interviewee E)

On a point made by the researcher that is it difficult to explain the multi-dimensional structure, where there are many relationships between different dimensions, one of the interviewees suggested that the principles of inheritance, abstraction and encapsulation introduced in object-orientation might be helpful for the framework presentation.

The issue of clarity was addressed through another question investigating what presentation form the participants consider as most appropriate for the framework. The general view was that both paper-based forms and electronic form employing indexes and hyperlinks should be provided. During the discussion recommendations were given on the characteristics of the electronic version, mainly that it should be based on a standard application and clear of circular navigation.

6.4.3.5. Usability

Anecdotally, information managers that are pressured by time and cost constraints do not favour introducing new tools that do not bring along any tangible benefits. This has been confirmed in the discussions of the FEBuS framework. Whilst all participants agree on the role of the proposed framework, they are more doubtful on its usability.

Interviewee B referred to the framework as a "strategic tool", but further pointed that management recognition of the role of the tool and commitment to its use are key factors in for the framework adoption.

Interviewee C defined the framework as an *"ideal model"* and was a little sceptic on the usability of the tool, as it is not immediately generating profit. His understanding was that the framework should be considered as a toolkit used only when these is a demand,

> *"Otherwise the overhead of actually doing it doesn't justify its cost."*

The following excerpt from the e-mail of Interviewee F gives further insights on cases where the framework is considered as inapplicable:

> *"For companies that are using either proprietary/bespoke (and point to point) or privately managed secure networks it is not obvious that the framework is applicable to their scenarios, too. "* (Interviewee F)

This lack of recognition of how the framework could be employed could be related to the ability of the users to comprehend the complex construct when examining it without the assistance of a person familiar with the tool (as it was the case with Interviewee F). Interviewee B reinforced this observation:

> *"The hardest I see in getting people to accept and use it, is going to be that these 8-9 dimensions are going to be difficult for people to conceive. "*

To resolve this concern many of the participants suggested a case-study approach. These views were best summarised below:

> *"As this is a framework for developing architectures, it has to have a very good overview with specific example, i.e. how it is applied to a certain case, so that the users of this framework could relate their specific case to the case described in the example. This could be the selling point of the framework, a promotion."*
>
> (Interviewee E)

The discussion of the usability of the tool instigated an association with another analytical tool, a simple model for decision making, introduced by Interviewee D. This is a decision triangle that, similarly to the project management triangle (Cadle & Yeates 2001) consists of three criteria: Time, Cost and Quality (Specification). The basic principles of this model could be summarised as follows:

- To achieve something in shorter time you will need more money and good specification.
- To save money you will need to invest more time. (No comments about specification).
- To improve the specification, you will need to invest time or money, or both.

As the proposed framework clearly fits in the Specification part of this model, its implementation will require investment of time and money. This confirms the views that to be implemented, the importance of the framework being recognised, promoted and supported by management. Whilst with an internal network only one organisation is concerned, in the cases of a dynamic business network, this has to be done by the managerial bodies of all the nodes in the alliance, which could further affect the ability to apply the framework.

6.4.4. PROPOSITIONS TESTING

As mentioned earlier (Section 4.1.3), the interviews also involved testing two propositions:

P1: In a networked environment the data needs to carry some **contextual tags** (based on the role of the information user), e.g. ethical and organisational issues, to inform the user of the **physical and situational context.**

P2: IA needs to cater of information behaviour (events, transformation, next stage, current/up-to-date).

These were designed to provide the last part of the evidence on whether the theory building research objective has been met. The cross-referencing of these results with the ones on the framework focus and scope would inform on drawing the conclusion on the achievement of the initial goals.

Four of the five interviewees provided their views on the above propositions. Unanimously all of them agreed that in a network environment data should carry contextual tags (Proposition 1).

> *"At the moment we certainly rely on knowing something about the person who sent the e-mail, in order to interpret what matters about it. We mustn't lose that contextual information, and so along with the data that we send there needs to come information about the roles and responsibilities of the person who sends it."*
>
> (Interviewee A)

Interviewee B further observed that currently in most cases this is not the case, which raises concerns about the risks of using such context-weak data for decision making.

Further issue relating to the names of the categories that provide contextual information was raised by Interviewee C. He argued that the labels need to be very clear to foster unambiguous understanding of what the data represents.

Proposition 2 was also confirmed as true by all the four participants. The replies recognise the importance of knowing the life history of the information (Interviewee A) and that IA is event-driven (Interviewee C). It is interesting to observe that all the four comments on this question were much briefer in comparison to the previous answers. This could be attributed to the impact of two factors, i.e. participants being exhausted from the long interview and/or the categorical agreement with the propositions, e.g. the reply of Interviewee D "*Absolutely*".

6.4.5. REVIEWING THE SURVEY RESULTS WITH INTERVIEWEES

It is recognised that the agenda for the interviews was too ambitious and in most cases the one-hour slot was sufficient only for discussing the framework components and the characteristics of the framework. Only one participant, Interviewee B, agreed to review the results from the Delphi study and the electronic survey. His views confirm that knowing the status of the information prior and after its use is not of major interest, as opposed to the version release. In his words:

> "*We are not interested in the state, we are interested in the version.*"

The reflections on the low score of the role of the Designer brought up again the issue of trust.

> "*Do you trust that person who's done that work for you, or not? In an ideal work people would argue that it doesn't matter who does it, because it will all go right, but in reality you get people who are better than others, and you are looking for those who are better at doing it.*" (Interviewee B)

These comments will be taken into consideration in the design of the final version of the FEBuS framework in Chapter 7.

6.3. SUMMARY

"When a theory is evaluated, the boundary between theory construction and theory testing often becomes blurred." Bacharach (1989, p.504)

Toub (2000) in his white paper on evaluating information architecture (for web sites) argues that like blueprints for physical structures IAs are abstract models, and as such you can't see, smell, taste, or touch them, you could only 'experience' them. This evaluation exercise has proved Toub's observations that measuring the IA as a whole involves a multitude of interrelated aspects. To shed some light on these, the evaluation process and the constituent of the research samples were documented in detail. Furthermore, the study concentrated on examining the proposed IA components and the relationships between these. The approach undertaken in first two evaluation tests, the Delphi study and the e-survey, align with Toub's assertion that the examination should focus on comparing the relative scoring of the IA aspect to another IA aspect or to established benchmark. In addition to the quantitative results, the qualitative feedback provided by the first two evaluation panels was analysed and established to be of confirmatory character. Whilst the Delphi study did not introduce any new variables, the e-survey put forward two proposals for integration in the framework, i.e. "Standards" and "Time for delivery". Noticeably, the new variables are containers for hard information, which is understandable, as the sources of the recommendations were IT consultants. It could be speculated that this is symptomatic of the IT considerations dominating in IS. These were included in the agenda of the 3rd evaluation test, the interviews, which primary objective was to test the organisation of the framework. The results of this last evaluation reflected the scope, accuracy and applicability of the framework and informed on potential improvements to the tool. A summary of the key recommendations for change could be found in Table 6.25. It is an extension of Table 5.3 and allows for tracking which the new proposals were accepted.

Table 6.25: Recommendations for changes in the FEBuS

The FEBuS dimensions and information categories	New dimension?	Recommendation	Rec. No./Type
D1: Types of information			
D1: Types of information: Business view		Promote the information cluster Events to an IC in the Business view in D1:Types of information	1 / S
Business function			
Data	New aspects (cost, permitted values)		
Work-flow (Business process)		Clarify the structure and information content of the IC Business process in D1:Types of information with consideration to the information clusters Events, Solutions and Time.	2 / S
D1: Types of information: Organisational view			
Strategy	New aspects (rules, values, risks)	Consider alternative labels for the IC Strategy in the Organisational view in D1:Types of information, e.g. 'Business position', 'Business characteristics', or 'Strategic position'	3 / N
Structure			
D1: Types of information: Technical view			
Network			
Application			
Platform			
Interface			
D2: Forms of existence		Add a new information category, Origin, to represent whether the information used is derived or base . Establish whether a detailed explanation is needed for the relationships informing on how to establish how up-to-date information is.	4 / D 5 / D
Based on nature	New aspects (descriptors)	Consider including another classification in the IC Nature in D2:Forms of existence, i.e. Objective/Subjective.	6 / S
Based on values		Review the need for IC Values with attribute values explicit/tacit in D2:Forms of existence.	7 / S
Based on style	New (formal/informal)	Review the need for IC Style with attribute values formal/informal in D2:Forms of existence.	8 / S
Based on carrier	New (paper/verbal)	Remove the attribute value 'verbal' from IC Carrier in D2:Forms of presentation	9 / D
Based on stability		Consider changing the attribute values in the category Stability (D2:Forms of existence) from Stable/Dynamic to 'Data that users cannot change or manipulate in anyway' and 'Data that users can manipulate and change to gain other information from'. Clarify that Accuracy could not be an IC, but could be illustrated through the relationship between IC Stability (D2: Forms of existence) and the frequency of Version releases (D4: Transitions).	10 / D
Based on level of aggregation			
Based on presentation			
D3: Levels of understanding		Review the need for IC Theory in D3:Levels of understanding.	11 / S
Definitions	New aspects (incompatibilities)		
Models, templates	New aspects (Models, templates)	Consider alternative terminology for IC Templates in D3:Levels of understanding, e.g. Solutions. Examine the need for information category Templates in D3:Levels of understanding.	12 / N 13 / S
Theories	New aspects (Theories)		
D4: Transitions		Introduce Priority as a new IC in D4:Transitions. Confirm how it compares to 'degree of urgency'. Consider including another category in D4:Transitions related to trust in the provided information. It could act as a placeholder for any business specific criteria for trust. Determine the most appropriate name for this category. Alternative candidates include Levels of trust, Degree of risk and Degree of training.	14 / S 15 / S 16 / N
Version releases	New aspects: (currency)	Change the title of IC Version releases (D4:Transformations) to Versions	17 / N
Stages of capability or growth	New aspects (status before/after use)	Examine the IC Status and Stages of capability/growth (D4:Transitions) with emphasis on the difference/overlap between 'pre-contractual' and 'historic'.	18 / D
Status (present or historical)	New aspects (currency)	Ditto	18 / D
D5: Types of IM processes		Present alternative names for the processes in D5:Types of IM processes. Include 'die' and any other names describing how information ceases to exist.	19 / D
Types of IM processes	New (Info lifecycle)		
D6: Roles characteristics			
Based on role (data perspective)	New aspects (owner, controller)		
Based on role (process perspective)	New aspects (source, recip.nt)		
Levels of competence, Skills		Review the name of the category to allow information to be given on acquitted Qualifications.	20 / N
D7: Types of regulations			
Standards	New		
Policies	New		
Regulations	New aspects		
D8: Levels of granularity		Redesign the structure of the framework to set up D8:Levels of granularity as a focal dimension, i.e. one to be decided upon first.	21 / S
Levels of granularity	New		

*Key to recommendations types: D - Description; N - Naming/labelling; S - Structural

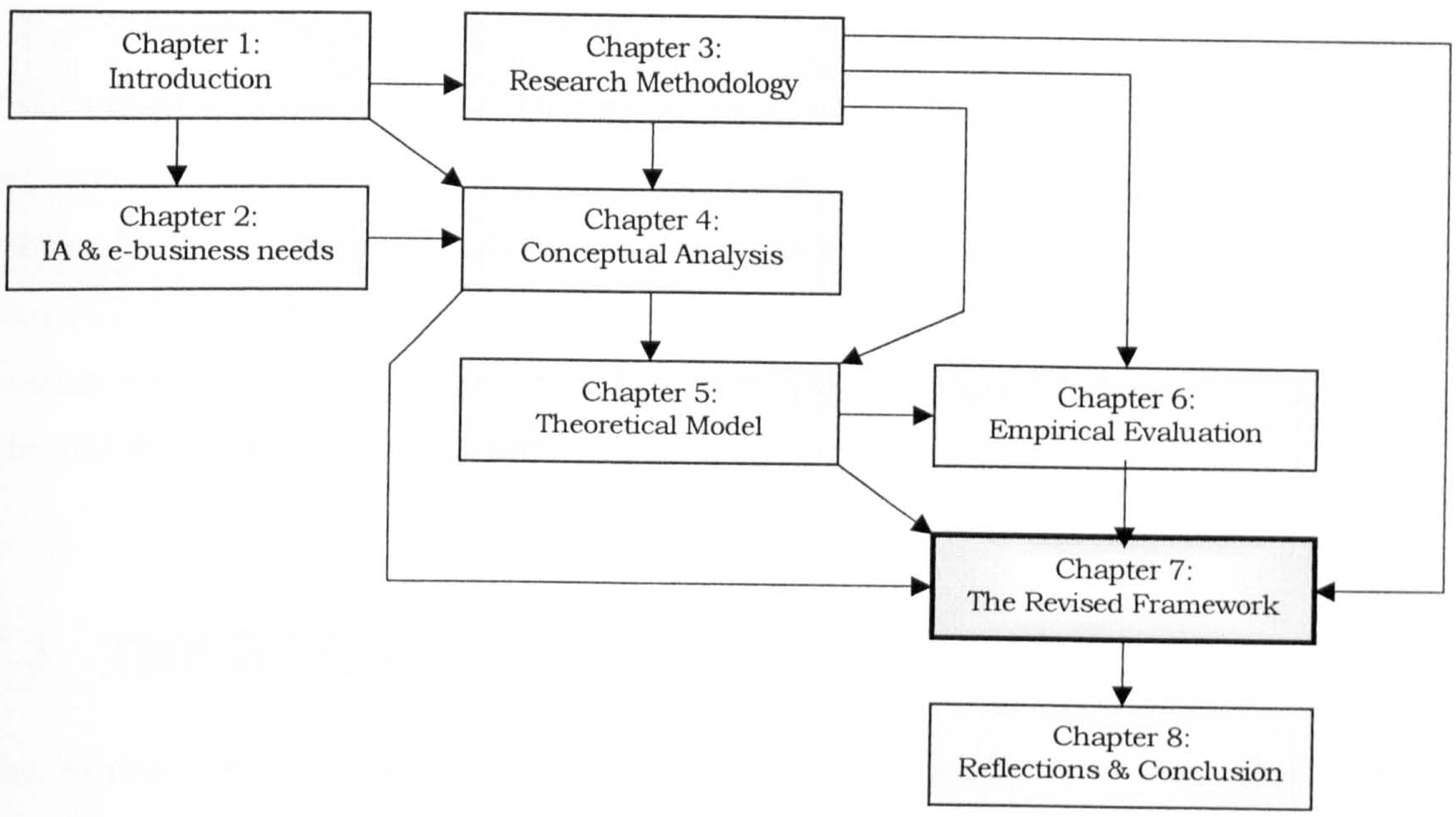
The analysis of the recommendations proves that four of the new components are well accepted and for another eight, there are only minor recommendations, i.e. name changes and framework descriptions. There are eleven recommendations for structural changes, of which five are suggestions for new components (Table 6.26).

Table 6.26: Analysis of the actions required to address the evaluation recommendations

Action required	**Counts**	**Recommendation No.**
No action required on new proposals	8	
Name change (N)	5	3, 12, 16, 17, 20
Framework description (D)	5	5, 7, 8, 18, 19
Structural changes (S)	11	1, 2, 4, 6, 9, 10, 11, 13, 14, 15, 21

The resulting conceptual model and the reflections on the study are discussed in the following chapter.

Chapter 7:
The Revised Framework



> *" Every information architecture is different and should be. .... And all those things – users, content, and organisational context – all are highly variable in each situation. So there can be no 'Correct Information Architecture'. Nor is there a single obvious template to use and reuse. "*
>
> Rosenfeld (Hill 1998)

This chapter presents the modifications of the Framework for Information Architecture for Electronically mediated Business Systems (FEBuS) conducted on the basis of the empirical evaluation of the work (Chapter 6). The resulting framework is tested further using models and checklists for framework evaluation identified in the secondary research and conclusions are made on the quality of the analytical tool.

7.1. THE REVISED FRAMEWORK

The amendments done to the theoretical framework reflect the results of the triangulation of the findings of the qualitative evaluation, the Delphi study and the electronic survey. This section has a similar organisation to the section that introduces the framework in Chapter 5, i.e. it reviews the changes required to the terminology of the framework (Section 7.1.1), the rules regulating the application of the framework (Section 7.1.2) and the finalised set of components (Section 7.1.3).

7.1.1. STRUCTURAL ORGANISATION OF THE FRAMEWORK

The principal concepts, the system of rules and the organisation of the framework were tested through the qualitative evaluation test, the interviews. To evaluate the terminology, the terms 'dimension', 'information category', 'attribute' and 'domain' were introduced to the participants at the very beginning of each interview. The findings proved that the interviewees did not have any problems with the descriptors of the analytical tool and had used them without any difficulty throughout the interview sessions. As there were no recommendations on changes, or suggestions for alternative terminology, the structural organisation did not undergo any modifications and remains as described initially in Section 5.1.2.

The evaluation of the relationships between the framework components was successfully achieved through discussing examples from the IS practice. The cross-references between information categories were recognised and understood by the participants, even in cases where more than two dimensions were linked.

The only recommendation with regards to the foundations of the framework was related to the provision of detailed documentation of the tool up-front. This was recognised as an important measure to build user confidence and acceptance.

7.1.2. RULES IN THE FRAMEWORK

The rules of the proposed framework were introduced gradually throughout the discussion of the work with the interviewees. The observations from the qualitative evaluation confirmed that it is very easy to shift the level of analysis to a higher or lower hierarchical level, e.g. from business network to a business network node, an experience that could complicate the application of the framework and result in user's frustration with the amount of work required and the complexity of the tool. This signifies that the starting point when using the framework should be the work on a dimension establishing the boundaries of the Information Architecture as per Recommendation 21 (Table 6.25). This information should be made visible to the user, if possible on a permanent basis. Consequently, the dimension D8:Levels of granularity was assigned a higher priority than the rest of the contextual dimensions. Furthermore, it was determined that the level of analysis needs to be formalised before the work on any other dimension, including the primary dimensions, commences. This has led to the review of the hierarchical organisation of the framework and to the introduction of a third type of dimensions, the "focal" one, that specifies the level of analysis.

The redesigned theoretical framework is based upon the following three types of dimensions:

- **Focal dimension**, determining the unit of analysis, e.g. a business network, a business sector, a corporation, department et al. The dimension that establishes this working perspective is 'Levels of granularity'. To assure that no change is needed in the numbering of the rest of the dimensions this dimension was relabelled from Dimension 8 to Dimension 0 (Table 7.1).

- **Primary dimensions**, related to the nature and characteristics of the business, i.e. the object of the analysis. The set of primary dimensions in the framework includes the three different views in D1:Types of information.
- **Contextual dimensions** - These are the remaining six dimensions that were introduced to compensate for the context-weak electronic information with details that assist users in judging and managing more efficiently and effectively the information they work with.

The introduction of the new hierarchical level required a review of the framework rules for consistency. In fact, only one rule needed to be amended to reflect the priority of the new type of dimensions, i.e. Rule 4. It now reads as follows:

> **Rule 4:** The order into which the dimensions are reviewed depends on the type of the dimension. The focal dimension is set first, followed by the primary dimensions, and lastly by the contextual dimensions.

The rationale for this rule is founded in the methods used for business or systems analysis; the majority recommend setting the boundaries of the study as the very first step of any analytical exercise. In the context of this research this means that, to be able to develop or analyse information architecture, the boundary of the work needs to be clearly defined through establishing the respective level of granularity. Similarly, no analysis of contextual issues could be conducted if the object whose context is discussed is not unambiguously defined though its organisational, business and technological characteristics.

7.1.3. THE FRAMEWORK COMPONENTS

Based on the feedback from the evaluation tests, a few changes were made to the organisation and content of the framework. The resulting framework and how it maps onto its previous version are presented in Table 7.1. Due to limitations of the printed form, the table presents mainly structural (S) and naming (N) recommendations. The improvements to the descriptions (D) are described separately below. They are unique for each occurrence of the framework and have to be agreed by the participants in the business network implementing the FEBuS.

Table 7.1: The FEBuS - evaluation impact at a glance (The changes in italics labelled 'new')

The FEBuS (pre-evaluation version)	Rationale	The FEBuS (post-evaluation version)
	Recc. No.	**Focal dimension:** **[new]**
	21	**Dimension 0: Levels of granularity**
		Inf. category: Levels of granularity
Primary dimension:		**Primary dimension:**
Dimension 1: Types of information		**Dimension 1: Types of information**
Business view		**Business view**
Inf. category: Business function		Inf. category: Business function
Inf. category: Data		Inf. category: Data
Inf. category: Business process	2	Inf. category: Business process
	2	Inf. category: Event *[new]*
Organisation view		**Organisation view**
Inf. category: Strategy	3	Inf. category: Strategy/Strategic business position
Inf. category: Structure		Inf. category: Structure
Technical view		**Technical view**
Inf. category: Network		Inf. category: Network
Inf. category: Application		Inf. category: Application
Inf. category: Platform		Inf. category: Platform
Inf. category: Interface		Inf. category: Interface
Contextual dimensions:		**Contextual dimensions:**
Dimension 2: Forms of existence	~~(5)~~	**Dimension 2: Forms of existence**
Inf. category: Nature	6	Inf. category: Nature
Inf. category: Values	~~(7)~~	Inf. category: Values
Inf. category: Style	~~(8)~~	Inf. category: Style
Inf. category: Carrier	9	Inf. category: Carrier
Inf. category: Stability	~~(10)~~	Inf. category: Stability
Inf. category: Level of aggregation		Inf. category: Level of aggregation
Inf. category: Presentation		Inf. category: Presentation
	4	Inf. category: Origin *[new]*
Dimension 3: Levels of understanding		**Dimension 3: Levels of understanding**
Inf. category: Definitions		Inf. category: Definitions
Inf. category: Models, Templates	12,13	Inf. category: Models, Templates, Solutions *[new)*
Inf. category: Theories	11	Inf. category: Theories *[optional]*
Dimension 4: Transitions		**Dimension 4: Transitions**
Inf. category: Version releases	17	Inf. category: Versions/Configuration *[name amendment]*
Inf. category: Stages of capability/ growth	~~(18)~~	Inf. category: Stages of capability/ growth
Inf. category: Status	~~(18)~~	Inf. category: Status
	15, 16	Inf. category: Level of trust/ Degree of risk/testing *[new]*
	14	Inf. category: Priority/Degree of urgency *[new]*
Dimension 5: Types of IM processes	19	**Dimension 5: Types of IM processes**
Inf. category: IM processes		Inf. category: IM processes
Dimension 6: Roles Characteristics		**Dimension 6: Roles Characteristics**
Inf. category: Roles (data perspective)		Inf. category: Roles (data perspective)
Inf. category: Roles (process perspective)		Inf. category: Roles (process perspective)
Inf. category: Skills/Level of competence	20	Inf. category: Skills/Level of competence/ Qualifications *[new aspect)*
Dimension 7: Types of Regulations		**Dimension 7: Types of Regulations**
Inf. category: Standards		Inf. category: Standards
Inf. category: Policies		Inf. category: Policies
Inf. category: Regulations		Inf. category: Regulations
Dimension 8: Levels of granularity		*[Converted into a focal dimension]*
Inf. category: Levels of granularity		

As identified in the previous section, the major structural change affected the hierarchy of types of dimensions by adding a new one, type, the Focal type, which hosts dimensions that need to be considered prior to any further analysis of the information in the business system is conducted. This dimension currently includes the dimension Levels of granularity, previously known as Dimension 8. There are no changes in the attribute set in this dimension nor in their value domains.

The changes in the content affect all the remaining dimensions, apart from D5: Types of IM processes and D7:Types of regulations. Some of these changes address minor amendments, such as name change or adding a new attribute, others are considered as major changes, as they either add or remove information categories.

Dimension 1: Types of information

Within the primary dimension D1:Types of information there is only one major change affecting the Business view of the dimension, the promotion of the information cluster Events into an information category (Recommendation 1 in Table 6.25). It is considered as the missing link in the relationship between Business process, IM processes and Transformations, determining the impact that a particular event could have on the data. The minimum set of attributes with in this category and their domains include Event ID, Event type (internal, external), Event date/time, Automation (automatically-triggered or human-triggered), Event duration and Event frequency (annual, monthly, weekly, daily, etc.).

The minor changes in D1:Types of information involve:

- In the Business view: Based on Recommendation 2 (Table 6.25) the information cluster Event was promoted into an information category. The Solutions cluster is noted to be optional as it could be an alternative to a relationship between the Business process and relevant information categories in the Technical view. Finally, the definition of the set of attributes for the Business process information category was expanded to include an attribute Process duration to reflect further temporal aspects of a process. Thus, the Business process IC includes the attributes Process ID, Process type (internal, external), Process automation (automatically-triggered or human-triggered), Process duration and Process frequency (annual, monthly, weekly, daily, etc.).

- In the Organisation view: renaming the Strategy IC to Strategy/Strategic business position (Recommendation 3, Table 6.25). This change is also in agreement with the terminology used in some of the foundational works for the FEBuS framework.
- In the Technical view: providing flexibility for alternative taxonomies based on the different definitions of 'application' and 'platform'. For example, in some cases, the term 'application' could be considered as a synonym of the term 'software', whilst many IT professionals could argue that 'application' covers only application software such as word processing, databases, etc., and does not represent systems software, such as operating systems, compilers, system utilities. Similarly, to some practitioners, the term 'platform' could be associated with 'hardware', e.g. a processor, to others, with 'system software' such as an operating system. This differentiation is outlined in computing dictionaries, but might be omitted when applying the framework. Providing a great level of detail is beneficial when using the framework as a checklist, but could be very restrictive when trying to populate it with real data. Hence, the set of information categories in this view needs to be tailored to the requirements of the specific business system and consistent terminology agreed amongst the participants in the alliance.

Dimension 2: Forms of existence

The major change in this dimension was triggered by Recommendation 4 (Table 6.25) and included the addition of a new information category, Origin, to represent whether the information used is derived or base. Knowing the origin of the information could aid the judgement of the quality of this data. Mainly, if the information is derived, the quality of the parent information needs to be confirmed as well.

Recommendations 7 and 8 for reviewing the need of information categories Style and Values did not have sufficient empirical backup and need to be research in the future work on the framework.

One minor change was implemented in the Nature IC, i.e. in response to Recommendation 6 an attribute was added to represent the dichotomy

Objective/Subjective. Based on the specific scenario the set of attributes in this category could be condensed to represent only the required type of data. Consideration has to be paid also to how the richness of the contextual information could be affected if the combinations of attributes is reduced due to the elimination of some of them.

Another minor amendment based on Recommendation 9 included defining the Value attribute 'verbal' as 'optional'. The justification for this change came from the understanding that in an electronically mediated environment verbal information is a rare commodity and for simplicity could be removed from the Information Architectures of some systems.

No action was taken on Recommendations 5 and 10, as it was considered that the proposed changes need further empirical clarification. Decision was taken to explore the rationale for these two recommendations in future developments of the FEBuS.

Dimension 3: Levels of understanding

The changes in this dimension include the addition of a new aspect, Solutions, in the category Models and Templates (based on Recommendation 12) and to reflect on Recommendation 11 to define the information category Theories as optional. The impact of these changes on the framework is considered as minor, as the flexibility of the FEBuS allows for customisation of the presented structure, i.e. the existence and content of these categories will be agreed for each occurrence of the framework. This is the rationale for making any changes to address Recommendation 13 (on the optionality of the Templates part of IC Models, Templates, Solutions).

Dimension 4: Levels of transition

The Levels of Transformation dimension was the one most affected by the evaluation tests. Two new information categories were added, Level of trust (Recommendation 14) and Priority (Recommendations 15 and 16). It is understandable that the extent to which one trusts, is specific for the individual and varies with time. To prevent such subjectivism, measures of trust were such as Degree of risk or Degree of testing should be considered, and if appropriate, the name of the category should be alternated to reflect the specific measure in use. The Priority information category could also be labelled Degree of urgency, should this provide better alignment with the terminology in place.

There is only one minor change here, i.e. the re-labelling of the Version Releases IC into Versions/Configuration (Recommendation 17). This was postulated by the understanding that 'version release' could be understood as version of software that is being released, thus shifting the focus away from the version of the information object itself.

Recommendation 18 requires further empirical data and could not be addressed immediately as there is no secondary work supportive of the proposed changes. This will be included in the Recommendations for future work.

Dimension 5: Types of Information Management (IM) processes

As specified earlier, no changes were made to the content of this dimension. The point on tailoring the value domains to the requirements of the specific business system is equally valid for leaving this dimension intact. Recommendation 19 is going to be addressed by providing FEBuS users with the sample values given in Table 6.20. The latter is going to be revisited with every implementation of the framework.

Dimension 6: Roles Characteristics

Within the dimension there is only one minor amendment, concerning the scope of the information category Skills/Levels of competence (Recommendation 20). This could be been expanded to incorporate Qualifications required, where appropriate. To include this option, the category is to be renamed to Skill/Levels of Competence/Qualifications, with three core information clusters representing the required information as suggested in the name of the category.

Dimension 7: Types of Regulations

Similarly to D5:Types of IM processes, this dimension was not affected by the evaluation.

The review of the amendments made to the framework addressed most of the points raised by the evaluators. Where recommendations were not addressed, rationale for the decision was provided and action points were noted. The revisions reflect the principle agreement of the evaluators with the proposed IA tool and confirm the need for the proposed extensions.

Additional improvements to the documentation are planned through provision of a worked example or graphical presentation of the framework and further evaluation of the work through a dedicated web site.

7.2. EVALUATING THE REVISED FRAMEWORK

The theoretical framework proposed here is evaluated using two sets of criteria, the checklist for IA frameworks, developed by Evernden (2002) (cf. Table 2.2 in Section 2.1.2) and the Metamodel criteria proposed by Andersen and Opdahl (1995).

7.2.1. THE RESULTS USING EVERNDEN'S CHECKLIST

The FEBuS presents most of the desirable characteristics for IA frameworks identified by Evernden (2002) (Table 2.2). It has clearly defined (1) multi-dimensional structure and (2) governing principles that direct users in their application of the framework, without restraining their freedom of choice. As already pointed out before, the application of the tool is determined by the specific business organisation and context. Customisation of the tool (3) is possible through redesigning the attribute set and redefining the attribute domains. Each evaluator had interpreted it in their own scenario.

The participants in the interviews confirmed that the tool is addressing Information Architecture (4), but also acknowledged that it could successfully be used as an Information System Architecture analytical tool. The potential of the framework as Knowledge Architecture was also recognised by one of the evaluators. His views could have been effected by the ability of the framework to handle both explicit and tacit information, with the latter being represented through a series of components and relationships between them, that inform on and build up user's implicit understanding of the information.

The documentation of the framework (5), presented in Chapter 5 and Section 7.1 in this chapter, is the foundation of a detailed user guide that will include vocabulary, regulatory framework, description of the components, their attributes and value domains, and will provide examples to highlight the application of the tool. It is recognised that the framework documentation is an evolving document that could benefit from more worked examples or a case study approach illustrating the use of the tool.

The only limitation of the work is the lack of software support (6) and methodological guidelines on implementing the framework. For the development of such, a pilot e-business network is needed to provide the required real-world case study material and be available for a testing the software application.

The FEBuS framework tests positively on the Evernden's checklist, providing five of the six requirements for an IA framework.

7.2.2. THE RESULTS USING THE METAMODEL TEST

Andersen and Opdahl (1995) suggest a set of criteria for a meta-model including:

- simplicity (1),
- multiple enterprise domains (2),
- integration capacity (3)
- extensibility (4) and
- ability to address both explicit and tacit information (5).

The previous section already argued the case for the multi-dimensional structure of the framework (2), able to adjust its structure as demanded by the particular business scenario (4) and proved that it also provides different kind of information (5). Further, the framework satisfies the requirement to integrate descriptions of IT infrastructures, IS architectures, organisation structures and business objectives (3), although not necessarily tied in to specific diagrams or diagramming notations.

The only criterion that is only partially met by the FEBuS is the Simplicity one. However, complexity is a prerequisite to any IA framework, especially if it is an N-dimensional structure:

> *"IS architectures are complex.... Hence, only the most important concepts and relations should be included."* Andersen and Opdahl (1995)

Finding the balance between oversimplifying and confusing the user with the complexity of the analytical tool has been recognised as a difficult task. Under the circumstances the best available compromise was achieved. .

The two simple tests directed at the desirable features of the FEBuS as IA architecture, employing features of a metamodel, confirmed the strengths and limitations of this analytical tool. These are going to be discussed further in the following Chapter 8, addressing the quality of the product and the process of this research.

7.3. SUMMARY

The proposed framework for e-business systems is a generic analytical tool for information architecture for electronically mediated business networks and is intended to be applicable to all organisations, regardless of their type, size and market sector. The complexity of the information architecture of the individual business unit could differ from one business unit to another, due to

(a) the size of the organisation and the type of activities

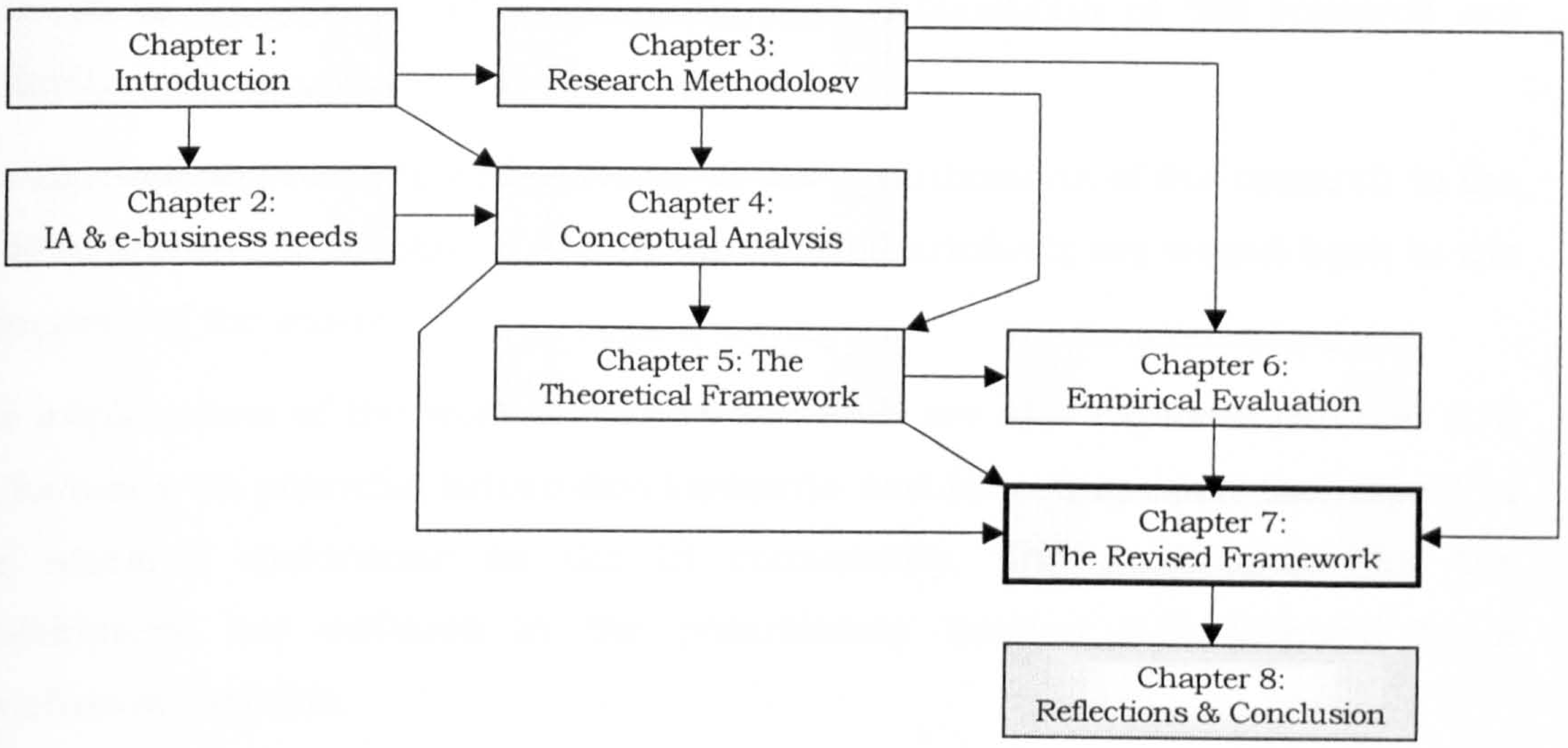
(b) the complexity of its processes

(c) the participation (or not) in a business network and the interactions within the business network.

Successful implementation requires that attention is paid to establishing a library of terms, definitions and examples clarifying the understanding of the components. This provides for easier communication within the business network and for the ability to support organisational changes more easily, thus enabling resources to be scaled up or down to the mission needs. Any customisation of the tool is user-driven and should be carried out in accordance with the rules of the framework and with recognition of the vertical and horizontal integration with other information components. Other desirable features include improving the documentation of the framework with a series of worked examples, or a case study, and automating its use through the provision of a dedicated software application. There two improvements should be both driven from usability criteria such as effectiveness, efficiency and satisfaction.

The discussion of the quality of the research and the contributions to knowledge and practice are made in the following chapter 8.

Chapter 8: Reflections and Conclusion



This chapter presents the reflections on the process and the product of this research. It starts with a recap on the research objectives and how they were met. Reflections on the 'lessons learned' from this research experience permeate the whole chapter.

The second part explores quality issues, using the criteria of construct validity, internal and external validity and reliability and their qualitative analogues, as outlined in Chapter 3. The limitations and implications of the research are critically evaluated at the end of this section.

The discussion proceeds with a review of the contributions of the research to the body of knowledge (Section 8.3) and the original artefacts are traced back to the objectives of the study.

The implications of the work for future research are also explored (Section 8.4) by focusing on potential future developments and reflecting upon the impact of the research experience on the IS community. The implications for the practitioners are outlined in the penultimate Section 8.5, followed by a Conclusions section.

8.1. THE RESEARCH OBJECTIVES REVISITED

This section examines the artefacts produced as a result of meeting the research objectives. Each objective is discussed below in the order they were originally presented in Section 1.2.

(1) *To investigate frameworks and models of information architecture and information systems architecture and establish their status within the IS knowledge domain.*

The bibliography of I(S)A and IM analytical tools at the end of this thesis evidences of the scope of the secondary research underpinning the investigation of I(S)A frameworks. The set of analytical tools relevant to this study is analysed in terms of their content, originality, methodological robustness and documentation and the most comprehensive and useful members of the set were subjected to more detailed investigation. The analysis and categorisation of these frameworks informs of their status within the IS knowledge domain (Sections 2.1 and 4.1).

(2) *To conduct a conceptual analysis on the frameworks and models identified as part of Objective 1 and then to establish fundamental IA components and desirable extensions to existing IA frameworks.*

The achievement of the above objective resulted in the provision of an anthology of frameworks and models of information architecture and information systems architecture (Section 2.1).

(3) *To investigate requirements for IA for electronically mediated business networks and explore the extent to which they are met by the reviewed analytical tools.*

The artefact of this objective is the synopsis of the requirements for e-business IA (Section 2.3). It synthesises prevalent IA dimensions, with ideas from related subject domains such as Systems Theory and Systems Modelling, Web design and virtual team working and is used to establish whether existing IA tools in their current state are viable to meet the needs of electronically mediated business alliances.

(4) *To propose a framework, based on the outcomes of Objective 2 and Objective 3, for e-business network information architecture that addresses the above problems, through utilisation and integration of best practice.*

The Framework for Information Architecture for Electronically-mediated Business Networks, FEBuS, (Chapter 5) emerged as a result of the critical evaluation of the IA needs of e-business networks and the tools provided to meet these needs.

(5) *To empirically evaluate the proposed theoretical framework and its status as an analytical tool.*

FEBuS was subjected to a multi-method evaluation test (Chapter 6) that proved, in principle, that information users and architects could easily relate to the work. The evaluators unanimously agreed with most of the proposed changes and also suggested further improvements, related to the naming conventions, the descriptions of the tool and its structure, which are synthesised in Section 6.3.

(6) *To refine, based on the findings of the empirical evaluation, the initially proposed IA framework.*

The recommendations from the evaluation were reviewed and acted upon, to produce a revisited version of the framework was generated (Chapter 7).

8.2. QUALITY OF THE RESEARCH

Section 3.1 introduced the frameworks for assessing the quality of research used by positivist and non-positivist researchers and presented the key quality criteria for this study, that are complementing the positivist quality criteria of construct validity, internal validity, external validity and reliability with their respective non-positivist counterparts, i.e. confirmability, credibility, transferability and dependability (Shaw 1999, Reinhardt 2000; Stake 1995).

The following discussion of how this research performs on each of the tests allows the readers to discern the scope of quality measures ruling this endeavour and to judge for themselves on the quality of the claims made in this paper.

8.2.1. CONSTRUCT VALIDITY AND CONFIRMABILITY

As Lee (1999) stated, construct validity subsumes content validity, criterion-related validity and convergent and discriminant validity. To satisfy the requirements for quality of the construct, the formulation of the components of the framework was based on existing models and theories. Evidence was accumulated to confirm which are the most common components across existing I(S)A works (Table 2.8) and how they were represented in the proposed framework (Section 5.1). Further, different samples were drawn from the research population and three empirical evaluations of the analytical tool were conducted, one of which, the Delphi study, was also viewed as a longitudinal evaluation, examining the stability of the views on the panel over time.

One critic from the e-survey sample suggested that what is claimed to be an IA component is not related to IA, but to some other information-related construct. Possibly this comment could be attributed to the lack of agreement about what constitutes an IA.

Inevitably objections could be raised about the use of a convenience research sample. However, as Dietz (1987) points out

> *"Delphi panels are usually a convenience sample of knowledgeable persons rather than a random sample of experts."*

Although it is debatable what Dietz's understanding of 'random' is, the above statement confirms that the sample selection approach used here fits within the norm of Delphi studies.

Further criticism is expected on the low return rate and the possibility of it being related to a disagreement with the content of the questionnaire, and respectively, the proposed IA framework. In neither the Delphi study, nor the electronic survey, any conclusions could be drawn on the potential for non-response bias. Further, a return rate of 8.15% (for the e-survey) when approaching participants from 'cold' is not a rare phenomenon (Ranchhod & Zhou 2001). The small panel in Delphi Round 3 is not a rare phenomenon and has been justified by Delphi theorists (Ziglio 1996). However, it is recognised that these numbers could have been higher should the third round targeted all the informants, rather than only those who took part in Round 3.

Dietz (1987) confirms the findings of other studies that indicate that

> *"panellists who offer reasons for their views are better able to assess forecast accuracy than panellists who are not required to provide reasons."*

To exploit this option for improving accuracy of the results and to allow for understanding participants' stands, a field for comments and justifications was provided within the questionnaire. This was extensively utilised by the e-survey respondents, but was used only by a small number of Delphi panellists. It could be speculated that the absence of comments on some of the questionnaires could be related to the limited space provided on the list and/or participant's busy schedule, rather than to respondent's unwillingness or lack of understanding. Conversely, there were a few participants who consistently provided their views, either by very small writing in the comment boxes, or in a free-format style on the back of the questionnaire.

Further, Yin's three tactics for improving construct validity (Yin 1994, pp.32-48) were used to evaluate the work. Firstly, multiple choices of evidence, i.e. interviews, survey and Delphi results were accessed. Secondly, "a chain of evidence" was established, certifying the steps in the process of data gathering and analysis, to strengthen the rigour of the study. This also included the development of documents illustrating how the proposed tool is represented in the questionnaires and by inviting the interviewees to review the outcomes of the exercise.

8.2.2. INTERNAL VALIDITY AND CREDIBILITY

Lee (1999, p.155) correctly observes that the use of multiple informants that Yin (1994) recommends, implies internal consistency and potential stability over time. This tactic, at its core, is analogous to the substitution strategy (Reichardt 2000, p.92) for ensuring credible results in the social psychology studies. The latter operates by replacement of the comparison that is subject to the threat with a comparison that is not subject to a threat. In the case of this research this was simplified by replacing one sample of the research population with another, i.e. the Delphi panellists with the on-line participants. Ultimately, the results within and amongst the samples confirm the quality of the research. The minor variations in the results could be attributed both to the different contextual settings of each respondent, as well as to the individual's incapability to grasp the complex reality.

In addition, Yin's tactic based on pattern matching and time series has delivered positive results by reducing the impact of differences in individual knowledge and experience. Yin's explanation building solution was examined and complemented by the elaboration and comparison strategy proposed by Reichardt (2000, p.94). Both the positivist and the interpretivist recommendations are based on iterations and validation by comparison of the outcome with the original. However, minor modifications were needed in both cases. As Reichardt's typology of strategies for eliminating threats to validity originates in the social studies, the concepts of threat and treatment he uses, are translatable into the social aspects of IS research, but not directly applicable to the scientific aspects of the domain. Likewise, Yin's reference to explanation building was not considered suitable, as the nature of this study is not explanatory, but exploratory and predictive; hence the label "elaboration and comparison" was adopted. Bearing this minor modification in mind, the core of the above two proposals was successfully employed throughout the evaluation, including correlation of the empirical results from both questionnaire-based tests and modifying the framework prior the last interview testing.

It could also be argued that elaboration and comparison was also conducted at an internal test level. In the Delphi study internal validity was achieved through the reporting of the average scoring for each of the constructs, whilst in the interviews, this quality criterion was maintained by introducing the interviewees to the results from the previous evaluation studies. In the electronic survey credibility was affirmed through analysis of the professional allegiance of the participants to one of the two groups, IT professionals and academics.

Another threat to validity was the effect of the participant's understanding of the questions. The strategy for reducing this threat included clarifying the definitions underpinning the research and by providing the researcher's contact details for some further explanation/discussion, if required.

Whilst the above observations concern the design and implementation of the empirical research, it should be noted that the internal integrity of the literature review was managed by using the 'tables audit trail' tool. This is a graphical representation of relationships between the summary tables used in the study (Fig. 8.1), which proved to be a very useful tool for outlining the key areas of the literary research and steering the development of the argument.

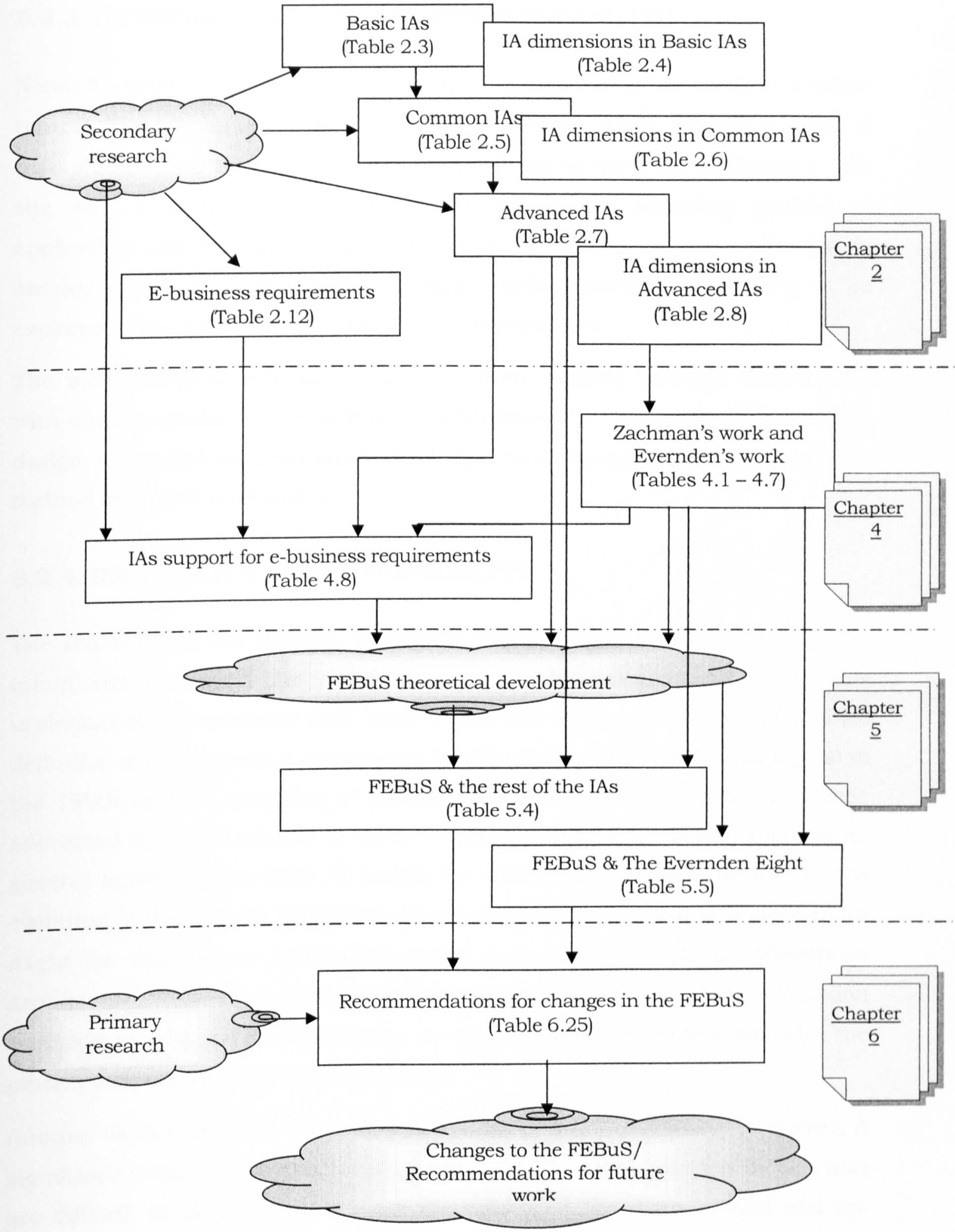


Fig.8.1: An audit trail through summary tables

8.2.3. EXTERNAL VALIDITY AND TRANSFERABILITY

Normally, external validity is best confirmed by replicating the study in another context. The results on the IA framework will be best tested through a series of case studies (See Section 8.4 *Implications for future research*). Building a web site with a detailed description of the framework, including method of application and worked examples to illustrate aspects of its application is another option to further test the validity with experts that is going to be explored in the future work on the FEBuS (Section 8.4).

The methodological external validity has been justified through comparisons with similar studies. To enable anyone interested in the study to repeat the design, a detailed documentation of all aspects of the application of the multi-method approach is provided.

8.2.4. RELIABILITY AND DEPENDABILITY

The reliability of the findings is mainly founded upon on the ability of the informants to relate to the IA definition used in this research and sustain this understanding throughout their involvement with the work. The lack of a single definition of IA has been a major issue for this study. Although IA was topical in the 1990s and the provision of a single all encompassing definition has been addressed by ASIS summit in 2000 (Denn & Maglaughlin 2000), there is no general agreement on what IA stands for. This could partially be due to the evolution of the term IA within the emerging context of the World Wide Web, or might be due to its reinvention under new names, such as 'Enterprise Architecture'. Measures have been incorporated in all the three evaluation methods to address this ambiguity, so as to ensure consensus amongst the participants on what the term IA means.

Another challenge to the research was the use of a non-administered survey. A significant problem with this research method is that psychological factors that are difficult to measure can impact the validity of the study results and are difficult to anticipate. As Mitchell (1996) acknowledges, any attempt to assess these factors could involve random and systematic errors, whose distribution is unlikely to be random. These errors could be attributed to pressure at work and time of the day when the survey was completed, or to individual characteristics such as prejudice, bias, mood, fatigue or information overload. The characteristics of the measurement instrument itself can also be a potential sources, e.g. unclear instructions or ambiguous questions. Yin's tactics for dealing with such threats (Yin, 1994) had to be tailored to the specifics of this research, as they are primarily applicable to case study research. This determined the employment of protocols for the interviews only. Furthermore, the approach adopted here meets the three tests of reliability suggested by Mitchell (1996), i.e. test/re-test (through the rounds in the Delphi study), internal consistency (as confirmed by the range and median values) and alternative form (complementing the Delphi study with e-survey and interviews). This last test corresponds to what corresponds Lincoln and Guba (1985) refer to as the triangulation of data collection.

The application of the Delphi method in this study aligns with the classic design based on three Delphi rounds and as such, meets the tests for the effectiveness of the result and the quality of the generated solution (Erffmeyer *et al* 1986). Although there are views about the correlation between the number of the participants and the quality of the results (Linstone 1978), the number of participants in the third round forced the decision to terminate the Delphi evaluation. This choice was further informed by the findings of Dietz (1987) who provides a statistical evidence that error is reduced through iterations of the Delphi process, but the reduction in error from Round One to Round Three is very small, less than 10% of total error.

As an afterthought it was acknowledged that to rule out concerns about high change rate through the rounds, a confidence self-assessment (Dietz 1987) is recommended for future Delphi studies. Further measures address provision of explicit instructions, e.g. what to be done should the informant fully concurs or disagrees with the group views.

8.2.5. LIMITATIONS OF THE RESEARCH

> *"The trouble with generalisations is that they don't apply to particulars."* Lincoln & Guba (1985, p.110)

This research has sought to employ a multifaceted comprehensive approach: a triangulation of research methods representing the qualitative and quantitative paradigms, the multidisciplinary domain and various sources (academic research, commercial/ practitioner's literature, supervisor's expertise and guidance, information management researchers and scholars, IS practitioners/consultants, conference proceedings, Internet, selected electronic bibliographical databases and personal experience). Despite the utmost effort to overcome any threats to the quality of the product and the process of this research investigation, several limitations must be acknowledged.

Firstly, the comparison of the IA frameworks from the Engineering School was based on three criteria, namely the focus of the framework, the dimensions it supported and the extent of support for inter-organisational practices. It was recognised that a more comprehensive set of criteria could have been employed, e.g. Evernden's checklist (2002) (Table 2.2). However, it was thought that the use of such a detailed framework would be inefficient in the case of secondary research, as many of the papers presenting IA frameworks did not provide sufficient information to enable the use of some of the suggested criteria.

There are a number of limitations associated with the data collection, not least of which is the fact that the sample is self-selecting, i.e. only those who are inclined to participate do so. As discussed earlier, the self-selection of participants is considered to be beneficial, in particularly for Delphi studies, as only people who have vested interest or experience in the subject area, would take part in the research. On the other hand, it is recognised that the views expressed by the participants are subjective and reflect their individual background and expertise, hence, do not allow for deductions on the applicability of the framework in the context of a single case of a business network. A series of case studies is needed to illustrate the application of framework and provide a worked example of the milestones users need to follow (See Section 8.4).

Perhaps the most significant constraint is the ability of the questionnaire to fully represent the proposed framework. Since, in some cases, one question addressed more than one information category. Usually, this is to reflect a relationship between these information categories. This limitation was addressed by introducing the third evaluation test, i.e. the interviews.

8.3. CONTRIBUTIONS TO KNOWLEDGE

"For most people information architecture is invisible and intangible."
Morville in Hill (1998)

"... information architecture is really about what's not obvious. "
Rosenfeld & Morville (1998)

This research study has investigated existing theory and conceptual models on information architecture (IA) and information systems architecture (ISA) [1] and established whether and to what extent they are applicable in the case of electronically mediated business networks. It further aimed to broaden these ideas by bringing in components identified in related research areas, with the ultimate goal being the development of an integrated framework for Information Architecture for e-business networks.

In meeting these research objectives, the work has generated a number of outcomes that are contributions to knowledge. These are discussed below by referencing objectives of the study (Chapter 1 and Section 8.1), where appropriate.

(i) An anthology of IA frameworks

Investigation of frameworks and models of Information Architecture and Information Systems Architecture identified about thirty architectural frameworks from the area of IS Management, Business Systems Planning and IS Design and Development, referred to as 'Engineering' group. These were first analysed based on their originality and contribution to IA knowledge and as a result nineteen I(S)As were chosen to represent the state of the art for IA (Objective 1). To establish their status within the IS knowledge domain and to elicit fundamental IA components (Objective 2) conceptual analysis was conducted on these principal works, grouping them in terms of their organisational focus and core components and based on their complexity and coverage were organised into three groups, i.e. Basic Architectures, Common Architectures and Advanced Architectures (Section 2.1.2).

[1] As specified in the introduction, the acronym I(S)A is used to represent both IA and ISA frameworks in cases when hey are used together (Cf. Chapter 1).

(ii) A critical evaluation of the Zachman framework and the Evernden's IA works

The I(S)A works of two authors who have dedicated most of their research efforts to modelling the information asset in the enterprise, i.e. John Zachman and Roger Evernden, were critically evaluated and compared. Although the Zachman Framework has been known and employed for about 20 years, it is believed that this is the first attempt to scrutinise this tool to such a level of detail. Similarly, no previous investigations were done on the evolution of Evernden's work on IA. Attentions were drawn to the attention of users and researchers on aspects that could trigger different interpretations.

(iii) A synthesis of IA knowledge developed in different subject areas

This study is the first research endeavour to *bring together research work on IA carried out in the fields of IS management and Web design.* Extensive investigation was conducted to identify studies on Information Architecture that integrate the body of knowledge developed in these two subject domains. It was concluded that despite the common name and task, there has been no collaboration in this area. Parallels and differences were then drawn between the works of Zachman and Evernden as representatives of the IS Management domain and this of Rosenfeld and Morville representing the Web design domain. Together, these informed the work on developing an IA framework for e-business.

(iv) A set of I(S)A definitions and propositions for resolving any semantic ambiguities

The research has also built an comprehensive collection of I(S)A definitions. Analysis of this work evidences of an inextricable problem with defining the boundaries of the term Information Architecture. Auxiliary work includes the generation and notional proof of two propositions challenging the primacy of the concepts Enterprise Architecture (as used by Zachman), Enterprise Information Architecture and Information Systems Architecture:

- Proposition 1: In the case of e-business the terms Information Systems Architecture and Information Architecture are equivalent (Section 1.3.7).
- Proposition 2: In the context of e-business systems, the terms Enterprise Architecture and Information System Architecture could be used interchangeably (Section 4.1.1.4).

However, these propositions were proven only theoretically, but not tested empirically.

(v) An synopsis of requirements for an IA for e-business alliances

The analysis of works referencing I(S)A in subject domains of Electronic integration, Inter-organisational Information Systems, e-business and virtual teamworking has provided a set of requirements for operational rules and components for electronically mediated business networks was put forward (Table 2.14).

(vi) An IA framework for electronically mediated business alliances

The major contribution from this research has been the development of the generic framework for IA in electronically mediated business networks, named FEBuS.

Having established that the existing IA tools only meet partially the requirements for e-business IA (Objective 3), this research sought to expand current state of art in IA, through the development of a framework for e-business IA. This was accomplished by building upon multi-discipline research in IA (Objective 4) at both network and organisational level. FEBuS is a tool, which can enable the data-rich, but information-weak digital business environment to benefit from more knowledge of contextual information. An IA, based upon FEBuS, will help users with understanding of the wider aspects of the system, such as the infrastructure and context of the information. Thus enabling them to better judge the quality of the information used and the impact their decisions or actions could have on the system.

Furthermore, the proposed framework is a generic one. Variations in the attribute set or in the value domains could be customised to customise it so as to include abstractions and perspectives that are specific to a particular business network. Vertical and horizontal integration are the key drivers to eliminate any potential problems encountered when implementing enterprise integration systems (Davenport 1998).

(vii) An innovative multi-methodological/meta-triangulation research design

To ascertain the reliability, validity and applicability of the tool and establish its role, the proposed analytical tool was subjected to both theoretical evaluation through a set of theoretical tests, identified in the secondary research (Evernden 2002, Andersen & Opdahl, 1995), and empirical evaluation through a triangulation of a Delphi study, an electronic survey and evaluation interviewing. Such a multi-method evaluation allowed for balancing out any limited reliability arising form the low response rate of the empirical evaluation and contributed to the enhancement of the tool and the research, respectively.

The design of the evaluation exercise is another original feature of this study. It is based upon the following principles:

⇒ triangulation of methods

⇒ synthesis of quantitative and qualitative data

⇒ use of different samples – academics and practitioners in the IS field.

Although these have been employed in other studies, the lessons learnt through the implementation of these principles have not been identified in any previous research of similar design. Despite the extensive number of publications reporting the results of Delphi studies, no work was found on analysing the convergence of the views, the pattern of change in individual results and the impact of any changes in individual circumstances on the results. These findings together with the work conducted on the evaluation of methods appropriate for models building and testing (Section 3.4) support development of the methodological underpinnings of IS research. A first attempt to address deficiencies in the body of knowledge on Delphi studies was the development of a generic toolkit for the successful management of Delphi studies (Bobeva & Day 2005, Day & Bobeva 2005).

8.4. IMPLICATIONS FOR FUTURE RESEARCH

The research agenda for future extensions of the work has two major aspects: extensions of the FEBuS as a framework for IA for e-mediated business networks, and further developments of the methodological issues raised by the work.

The multi-disciplined approach employed in this study has determined that further research in the fields of Software Engineering, Systems Theory and Information Management could allow for better definition of some of the attributes and attribute domains of the information categories in the proposed architectural framework. To allow for this, the first task would be to use the framework in practice. As mentioned earlier, a process has been launched with the web evaluation of the work Section 6.2) that will be extended to a dedicated web site that provides full support for understanding and using the framework, and invites visitors to give feedback or ask questions. An on-line discussion forum is another distinctive feature of this facility. It allows to explore how object-orientation technology could be employed in modelling and automating the FEBuS. Of particular interest is how object-orientation could enhance the presentation of multi-dimensional relationships. It is likely that these changes would not affect the content of the framework, as it has already been tested through use of three separate evaluation panels.

Similarly, further work could be carried out in establishing how the framework could be utilised as a quality assurance tool through a mapping exercise comparing it to ISO9001.

Of primary importance, as specified by The Open Group (2002) is the extension of the framework through the provision of a method to support the framework. Although there are other frameworks that do not come with methodological guidelines, e.g. Zachman's framework, it is considered that an advantageous feature that would improve the usability of the tool. Such method could further be complemented with an appropriate visualisation tool. Evernden (1996) concedes that his work was improved through the experience of developing models and methodologies to support his frameworks. Similarly, the next step for this research is to develop a computer-based model to improve the usability of the framework. The experience from vendors such as IBM in developing or using generic information architectures for banking, insurance, retail and other industries could be sought in this endeavour.

Another area of interest would be to compare the results of further evaluation tests with these collected here, thus confirming the quality of the tool and outlining further opportunities for improvement. This could be done in a series of cross-sectional and longitudinal studies, conducted either by replicating the evaluation strategy implemented here, or by adopting different evaluation approaches, such as case studies (cf. Chapter 3 and Appendices A and B). Participatory evaluation (Edwards 1989, Shaw 1999) such as Action research, should be also considered, where a full co-operative testing of the framework could be undertaken in live-action contexts. This move from conventional (although a post-positivist stance) to a more interpretivist approach would be of benefit for the researcher and the users of the tool and could lead to improving the usability of the framework. For the researcher it would allow to delve deeper into the practical issues arising when using the tool, i.e. to participate in the experience (See Table 8.1), whilst for user of the framework, this will be an opportunity to increase understanding and acceptance of this architectural framework and take part in decisions on use and customisation of the tool.

	Researcher		Subject	
Criteria	**Conventional inquiry[2]**	**This study**	**Conventional) inquiry**	**This study**
Participation in decisions	Full	Full	Nil	Some
Participation in experience	Nil	Nill	Full	Some
Full co-operative inquiry				
	Researcher		**Subject**	
Participation in decisions	Full		Full	
Participation in experience	Full		Full	

Table. 8.1: The participatory nature of conventional and co-operative inquiries (Shaw 1999)

The two controversial propositions about the semantical overlap in the concepts of IA, ISA and EA in e-business context (Cf. Section 1.3.7 and 4.1.1.4) could be tested empirically with experts through qualitative research using group

[2] **Conventional inquiry, which according to Shaw (1999) is typically quantitative.**

elicitation techniques such as brainstorming, focus groups, Nominal Group Techniques, Delphi studies et al. This exploration could be extended further to study specialists' understanding of another disputatious issue, this of defining the boundaries and relationships of the terms information architecture, information infrastructure and information context.

The second aspect of the future development concerns the methodological basis of the work. It is believed that the thorough documentation of the research experience and the lessons learned from it could be of help to academics in their research, teaching and consultancy. Throughout the work the tribulations of dealing with insufficiently documented research had been discussed. Work to address this limitation in the use of research methods for IS research and the employment of Delphi study in general has already commenced (Bobeva & Day 2005, Day & Bobeva 2003, Day & Bobeva 2005).

8.5. IMPLICATIONS FOR PRACTICE

> *"To be relevant research must be in* some way *be linked to the real experience and concerns of people at grassroots level"*
>
> (Edwards, M. 1994)

The proposed framework is a representative of the family of architecture frameworks designed to facilitate the management of information. As such, its role as a managerial tool has already been extensively discussed and promoted in the publications of writers in I(S)A and Enterprise Integration, through the work of professional bodies such as the Zachman Institute for Framework Advancement (ZIFA), the Digital Consulting Institute (DCI), and IS-product and service vendors, such as IBM Corporation and Argus Associates. These reputable players on the IA market could be approached for collaboration on future developments of IA for e-business networks. Individual practitioners should be able to familiarise themselves with the work presented here from journal publications based on this thesis. The dedicated web site will be another channel for reaching users to promote the tool. The key characteristics and the managerial potential of the FEBuS has already been briefly outlined in Section 5.2. These ideas are expanded as follows:

- The practitioners evaluating the framework viewed it mostly as a strategic tool, which ultimate usability will be affected by the extent to which corporate resources can be assigned for populating and maintaining the content of the information categories. It is suggested that when considering the adoption of this extended IA framework, a cost-benefit and impact analysis is conducted, or a Balanced Scorecard (Kaplan & Norton 1992, 1993, 1996) is developed for gaining a better understanding of the intangible benefits that the use of the tool could provide. It is recognised that to ensure sustainable benefits, rethinking and repositioning of processes and responsibilities is required. Some of the information content is deemed to come from modifications to existing tools and applications to allow them to make contextual details more transparent to the user.
- Further use of the framework is foreseen in the area of Web systems development, where the framework could be used to provide the underlying architecture. Existing IS development has employed frameworks developed in the field of traditional system development and software engineering,

whilst current web site development is driven by frameworks for information architecture for the World Wide Web, such as the one developed by Rosenfeld and Morville (1998). The architectural framework proposed in this thesis brings together these two schools in a systemic way, outlining opportunities for vendors to expand the scope of characteristics their products and services offer.

- Another potential application of the framework is to use it as a quality management system, as suggested in Section 5.2.6. This means that the framework must comply with ISO 9001:2000. This requires that a quality manual for the framework is provided and includes a description of the scope of the framework, details of any exclusions with appropriate justifications, documented procedures for using the framework and a description of the interaction between the processes of the quality management system (BS EN ISO 9001:2000, British Standards Institution 2000, p.18). Whilst it is recognised that such an application is a long-term potential, it draws the attention to the need of users to be aware of what the criteria they could use to establish the quality of the information they use, provide or manage. This potential has already been confirmed by two of the participants in the interviews.
- The proposed IS framework offers additional advantages to e-business practitioners as a source of empowerment. By ensuring that information on the infrastructure and context of the information object is incorporated in the Information Architecture, the tool equips the users with a better understanding of the information they have, including its reliability and validity, as a key indicator of its quality. This affirms the potential of the framework to enhance the knowledge of users and consequently, the power they have. Table 8.2 lists various sources of power in organisations suggested by Morgan (1997) and highlights the ones, which the proposed framework FEBuS nourishes. The role of the framework is mainly seen in the provision of more contextual information that allows to reduce the dependencies upon others, improve knowledge of rules that guide organisational functioning, build confidence through being able to exercise timely and informed decision making and guard better organisational information boundaries.

Table 8.2: The FEBuS potential as a source of power in organizations
(Based on Morgan (1997))

1. Formal authority
2. **Control of scarce resources**
3. **Use of organisational structure, rules and regulations**
4. **Control of decision processes**
5. **Control of knowledge and information**
6. **Control of boundaries**
7. **Ability to cope with uncertainty**
8. Control of technology
9. Interpersonal alliances, networks, and control of informal organisation.
10. Control of counter-organisations
11. Symbolism and the management of meaning
12. Gender and the management of gender relations
13. **Structural factors that define the stage of action**
14. The power that one already has

In agreement with the above quote, it is argued that the use of the proposed analytical tool could in effect empower the users' organisation and/or the business network they are a part of. This in turn could be turned into an advantage of the overall business system over the competition.

8.6. CONCLUSION

> *"... [information] architecture can and should change information behaviour and culture. If it doesn't do so, in even the smallest way, then all the technical elegance in the world won't solve an organisation's information problems."*
>
> Davenport & Prusak (1997)

Organisations are increasingly finding it necessary to enter into partnerships with other parties. These, in turn, require successful management of their resources, including information and its infrastructure. This is a particularly challenging task when in an electronically mediated environment. This thesis addresses this challenge by providing the FEBuS Information Architecture, a framework for Information Architecture for electronically mediated networks of business units and justifies the need for such a tool in the light of the growing digitisation, dynamism and competition in business. The framework synthesises existing IAs and extends them with components that allow their application for planning, aligning and evaluating business information relationships in electronic environments. Empirical evidence on the importance of the work is provided and implications for research and practice have been outlined with particular focus on future developments of the work. However, the completion of this work does not denote the end of the researcher's study of information architectures, but rather marks the beginning by establishing a practical tested and comprehensive basis for establishing successful e-mediated business relationships.

> *"Still round the corner there may wait,*
> *A new road or a secret gate."*
>
> J.R.R. Tolkien (1986) The Return of the King

References

Achrol, R.S. (1997). Changes in the Theory of Inter-organizational Relations in Marketing: Toward a Network Paradigm. *Journal of the Academy of Marketing Science*, 25 (1), 56-72.

Allen, B.R. and Boynton, A.C. (1991). Information Architecture: In Search of Efficiency and Flexibility. *MIS Quarterly,* 15 (4), 435-445.

Andersen, E.S. and Opdahl, A.L. (1995). *A Metamodel for IS-Architecture Representation Reports in Information Science,* Report No. 42, RAISA Ref. 2.0. 1995. ISSN 0803-6489, Available from:http://www.ifi.uib.no/projects/raisa/ [Accessed on 08 Aug. 2003]

Andersen, E.S. and Opdahl, A.L. (1996). *Supporting IS Architecture work: Progress Report from the RAISA Project* 1996. 53 RAISA Ref. 6.0.

Bacharach, S.B. (1989). Organizational Theories: Some Criteria of Evaluation. *Academy of Management Review*, 14 (4), 496-515.

Barnatt, C. (1995). *Cyber Business: Mindsets for a Wired Age.* John Wiley & Sons Ltd., Chichester, England.

Beer, S. (1984). The Viable System Model: its provenance, development, methodology ans pathology. *Journal of the Operational Research Society,* 35 7-26.

Belbin, U. (2003). *Belbin Team-Roles* [online]. Available from: http://www.belbin.com/belbin-team-roles.htm [Accessed on 07 Aug. 2003].

Benjamin, R. and Blunt, J. (1992). Critical IT issues: The Next 10 Years. *Sloan Management Review,* (Summer), 7-19.

Bloor, M. (1997). Techniques of evaluation in qualitative research. In: G. Miller and Dingwall R., eds. *Context and Method in Qualitative Research.* London: SAGE

Bobeva, M. (1997) Interview with V.Weldon [unpublished], 30th September 1997, Bournemouth.

Bobeva, M. (1998) Interview with R.Evernden [unpublished], 4th August 1998, Southampton.

Bobeva, M. and Day, J. (2005) Managing Delphi Studies: A decision-making toolkit, in Remenyi, D. and Cass, A. (2005) *Proceedings of the 4th European Conference on Research Methods in Business and Management Studies,* Universite Paris-Dauphine, Paris, France, 21-22 April 2005, pp.55-66.

Bobeva, M. and Greenway, E. (2002). E-Procurement A Catalyst of Change in the Buyer-Supplier Trading Relationships. In: *Proceedings from the UKAIS'2002 conference, 10-12 April 2002, Leeds,*. McGraw Hill.

Bocij, P., Chaffey, D., Greasley, A. and Hicjie, A. (2003). *Business Information Systems.* Financial Times- Prentice Hall.

Boynton, A.C., Zmud, R.W. and Jacobs, G. (1994). The Influence of IT Management Practice on IT Use in Large Organizations. *MIS Quarterly,* 18 (3), 299-319.

Brancheau, J.C. and Wetherbe, J.C. (1986). Information Architectures: Methods and Practice. *Information Processing & Management,* 22 (6), 453-463.

Brancheau, J.C. and Wetherbe, J.C. (1987). Key Issues in Information Systems Management. *MIS Quarterly,* 22 (1), 23-46.

Brancheau, J.C., Janz, B.D. and Wetherbe, J.C. (1996). Key Issues in Information Systems Management: 1994-95 SIM Delphi Results. *MIS Quarterly,* 20 (2), 225-242.

Brancheau, J.C., Schuster, L., and March, S.T. (1989). Building and Implementing an Information Architecture: The Pillsbury Approach, *Data Base,* Spring, 9-17.

Brannen, J. (ed.) (1995) *Mixing Methods: Qualitative and Quantitative Research.* London: Aldershot Ayebury.

Brewerton, P. and Millward, L. (2001). *Organizational Research Methods.* SAGE Publications.

British Psychological Society (2000). *Code of Conduct, Ethical Principles and Guidelines* [online]. Available from: http://www.scutrea.ac.uk/BPSCode.pdf [Accessed on 28 Aug. 2003].

British Standards Institution (2000). *Quality management systems - Requirements (BS EN ISO 9001: 2000).* London: BSI.

British Standards Online (2001). Available from: http://bsonline.techindex.co.uk [Accessed on 08 Aug. 2003].

Burrell, G. and Morgan, G. (1979). *Sociological Paradigms and Organisational Analysis.* London: Heinemann Books.

Butler, T. (1998). Towards a hermeneutic method for interpretive research in information systems. *Journal of Information Technology,* (13), 285-300.

Buzan, T. and Buzan, B., (1994). *The Mind Map Book: How to Use Radiant Thinking to Maximize Your Brain's Untapped Potential.* E P Dutton.

Byrne, J. (1993). The virtual corporation. *Business Week* (8 February)

Cadle, J. and Yeates, D. (2001). *Project management for Information Systems.* Pearson Education Ltd.

Card, S., Macinlay, J. and Schneiderman, B. (1999). *Readings in information visualization : using vision to think*. San Francisco: Morgan Kaufmann Publishers.

Cash, J.I. and Lawrence, P.R. (1989). *The Information Systems Research Challenge: Qualitative Research Methods, v.1.* Boston, Massachuzets: Harvard Business School.

Cash, J.I.Jr. and Konsynski, B.R. (1985). IS Redraws Competitive Boundaries. *Harvard Business Review,* (March-April), 134-142.

Cashmore, C. and Lyall, R. (1991). *Business Information: Systems and Strategies.* Prentice Hall.

Cassell, C. and Symon, G. (1994). *Qualitative methods in organizational research.* SAGE Publications.

Caudle, S.L., Gorr, W.L. and Newcomer, K.E. (1991). Changes in the management of the information systems organization: an exploratory study. *MIS Quarterly,* 15 (2 (June)), 171-188.

Cavaye, A.L.M. and Cragg, P.B. (1995). Factors Contributing to the Success of Customer Oriented Interorganizational Systems. *Journal of Strategic Information Systems*, 4 (1), 13-30.

Chaffey, D. (2002). *E-business and E-commerce Management.* Prentice Hall.

Charan, R. (1991). How Networks Reshape Organizations - For Results. *Harvard Business Review,* (Sept.-Oct.), 104-115.

Checkland, P. (1999). *Soft systems methodology : a 30-year retrospective*. Chichester: Wiley.

Checkland, P. and Scholes, J. (1999). *Soft Systems Methodology in Action.* Wiley.

CIO Council (1999). *Federal Enterprise Architecture Framework v.1.1* [online]. Available from: www.cio.org/Documents/fedarch1.pdf [Accessed on 15 Apr. 2003].

Cohen,L. and Manion, L. (1989). *Research methods in education.* London: Routledge.

Cook, M.A. (1996). *Building Enterprise Information Architecture: Reengineering Information Systems.*

Cook, T. (1985). Postpositivist critical multiplism. In: R. Shortland and M. Mark, eds. *Social Science and Social Policy.* Beverley Hills: Sage,

Cook, T.D. and Campbell, D. (1979). *Quasi-experimentation: Design and analysis issues for field settings.* Boston: Houghton Mifflin.

Coombes, H. (2001). *Research Using IT.* Palgrave.

Creswell, J.W. (1998). *Research Design: Qualitative and Quantitative Approaches.* SAGE Publications.

Cronbach, L. (1986). Social enquiry by and for earthlings. In: D. Friske and R. Shweder, eds. *Metatheory in Social Science: Pluralisms and Subjectivities.* University of Chicago Press

Currie, W. (2000). *The Global Information Society.* John Wiley & Sons, Ltd.

Cuyler, D., (19 Mar. 2002). *What's in a Name? Or, What Exactly Do We Call Ourselves?* E-mail to *www.boxesandarrows.com*

Darnton, G. and Giacoletto, S. (1998). *Information in the Enterprise.* Darnton & Darnton.

Davenport, T., Short. J. (1990). *The new industrial engineering: Information technology and business process redesign.* Sloan Management Review. 31(4) 11-26.

Davenport, T.H. (1993). *Process Innovation: Reengineering Work Through Information Technology.* Boston: Harvard Business Review.

Davenport, T.H. (1994). Saving IT's Soul: Human-Centered Information Management. *Harvard Business Review,* (March-April), 119-131.

Davenport, T.H. (1998). Putting the Enterprise into the Enterprise System. *Harvard Business Review,* (July-August), 121-131.

Davenport, T.H. and Prusak, L. (1997). *Information Ecology, Mastering the Information and Knowledge Environment.* Oxford University Press.

Davenport, T.H., Harris, J.G., De Long, D.W. and Jacobson, A.L. (2001). Data to Knowledge to results: Building an Analytical Capability. *California Management Review,* 43 (2), 117-138.

Day, J. and Bobeva, M. (2003) Seeking the truth: The use of Delphi studies for IS research, in Grant, K., Edgar, D.A. and Jordan, M. (eds) (2004*) Reflection on the past, ,making sense of today and predicting the future of information systems,* 9th Annual UKAIS Conference Proceedings , Annual Conference, 5-7 May 2004, Glasgow Caledonian University, Glasgow.

Day, J. and Bobeva, M. (2005) A Generic Toolkit for the Successful Management of Delphi Studies, paper accepted in the *Electronic Journal for Business Research Method,* Journal available from*: http://www.ejbrm.com.*

Denn, S.O. and Maglaughlin, K.L. (2000). World's Fastest Modeling Job, or Information Architecture: What Is It? The Multidisciplinary Adventures of Two Ph.D. Students. *Bulletin of the Americal Society of Information Science*, 26 (5), 13-15.

Dennis, A., Wixom, B.H. and Tegarden, D. (2003). *Systems Analysis & Design, An Object-Oriented Approach with UML*. John Wiley & Sons.

Denzin, N.K. (1970). Chapter 12: Strategies of Multiple Triangulation. In: N.K. Denzin, ed. *The Research Act: A Theoretical Introduction to Sociological Methods*. Chicago: Aldine Publishing Co.,

Denzin, N.K. and Lincoln, Y.S. (1998a). *Collecting and Interpreting Qualitative Materials*. SAGE Publications.

Denzin, N.K. and Lincoln, Y.S. eds. (1998b). *Strategies in Qualitative Inquiry*. SAGE Publications.

Denzin, N.K. and Lincoln, Y.S. eds. (2000). *Handbook of Qualitative Research*. 2nd ed. SAGE Publications.

Devlin, B.A. and Murphy, P.T. (1988). An architecture for business and information system. *IBM Systems Journal*, 27 (1), 60-80.

Dietz, T. (1987). Methods for Analyzing Data from Delphi Panels: Some Evidence from a Forecasting Study. *Technological Forecasting & Social Change*, 31 79-85.

Dommeyer,C.J. and Moriarty, E. (2000). Comparing two forms of an e-mail survey: embedded vs. attached. *Marketing Research Society. Journal of the Market Research Society*. Winter 199/2000. 42(1), 39-50.

Downes, L. and Mui, C. (1998). The End of Strategy. *Strategy & Leadership*, 26 (5), 4-9.

Downes, L. and Mui, C. (2000). *Unleashing the Killer App : digital strategies for market dominance*. Harvard Business School.

Earl, M.J. (1989). *Management Strategies for Information technology*. UK: Prentice Hall Int.

Earl, M.J. (2001). Knowledge Management Strategies: Toward a Taxonomy. *Journal of Management Information Systems*, 18 (1), 215-233.

Edwards, M. (1989). The irrelevance of development studies. *Third World Quarterly*, 11 (1), 116-135.

Edwards, M. (1994). Rethinking social development: the search for relevance. In: D. Booth, ed. *Rethinking social development*. Harlow: Longman,

Eisenhardt, K.M. (1989). Building Theories from Case Study Research. *Academy of Management Review*, 14 (4), 532-550.

Emery, F.E. (1981). *SystemsThinking*. PenguinBooks.

Errfmeyer, R.C., Errfmeyer, E.S. and Lane, I.M. (1986). The Delphi Technique: An Empirical Evaluation of the Optimal Number of Rounds. *Group & Organization Studies*, 11 (1-2, March-June), 120-128.

Espejo, R. (1989). The VSM Revisited . In: R. Espejo and R. Harden, eds. *The Viable System Model: Interpretations and Applications of Stafford Beer's VSM*. Wiley, 77-100.

Evans, P.B. and Wurster, T.S. (1997). Strategy and the New Economics of Information. *Harvard Business Review*, (September-October), 71-82.

Evernden, R. (1996). The Information FrameWork. *IBM Systems Journal*, 35 (1), 37-68.

Evernden, R. (2000). *The Information Model* [online]. Available from: http://www.4thresource.com/content/tim01.htm [Accessed on 10 June. 2000].

Evernden, R. (2002). *The 4th Resource, Innovations in information* [online]. Available from: www.4thresource.com [Accessed on 10 Mar. 2004].

Evernden, R. and Evernden, E. (2003a). *Information first: integrating knowledge and information architecture for business advantage.* Oxford : Butterworth-Heinemann.

Evernden, R. and Evernden, E. (2003b). Third-Generation Information Architecture. *Communications of the ACM,* 46 (3 (March)), 95-98.

Evernden, R. and Phillips, N. (1999). In the Know: Knowledge Management using an information management framework. *Knowledge Management,* 2 (6),

Evgeniou, T. (2002). Information integration and information strategies for adaptive enterprises *European Management Journal,* 20 (5), 486-494.

Fink, A. (1998). *Conducting Research Literature Reviews, From Paper to the Internet.* SAGE Publications.

Fink, A. (2003). *How to design surveys.* SAGE Publications.

Finkelstein, C. (1989). *An Introduction to Information Engineering.* Addison-Wesley.

Finkelstein, C. (1993). *Information Engineering: Strategic Systems Development.* New York: Addison-Wesley Publishing.

Finnegan, P.J. (1995). Inter-Organisational Network Engineering: A Planning Perspective. In: *Proceedings of BIT'95,* Manchester, UK

Finnegan, P.J., Galliers, R.D. and Powell, P. (1998). System Planning in an Electronic Commerce Environment in Europe: Rethinking Current Approaches. *EM- Electronic Markets,* 8 (2), p.35-38.

Fischer, R. (1978). The Delphi Method: A Description, Review and Criticism. The *Journal of Advanced Librarianship,* 4(2), 64-70.

Fischhoff, B. and MacGregor, D. (1982). Subjective Confidence in Forecasts. *Journal of Forecasting,* 1 155-172.

Fitzgerald, B. and Howcroft, D. (1998a). Competing Dichotomies in IS Research and Possible Strategies for Resolution . In: R. Hirschheim, M. Newman and J. de Cross, eds. *Proceedings of the 19th International Conference in Information Systems, Helsinki.* 155-164.

Fitzgerald, B. and Howcroft, D. (1998b). Towards dissolution of the IS research debate, from polarization to polarity. *Journal of Information Technology,* (13), 313-326.

Forrester, J.W. (1991). *System Dynamics and the Lessons of 35 Years* [online]. Available from: http://web.mit.edu/sdg/www/Papers/D-4224-4.pdf [Accessed on 11 June 2003].

Fowler, F.J. (1995). *Improving survey questions: design and evaluation.* SAGE Publications.

Fredriksson, O. and Viglon, M. (1996). Evolution of inter-organisational information systems in industrial distribution: the cases of Luna and Pappersgruppen. *European Journal of Information Systems,* 5 (1), 47-61.

Freed, E.R. (1996). *Viable System Modelling* [online]. Available from: http://www.newciv.org/ncn/eric/focus4.html [Accessed on 12 June 2003].

Gable, G.G. (1994). Integrating case study and survey research methods: an example in information systems. *European Journal of Information Systems,* 3 (2), 112-126.

Galbraith, J.R. (1973). *Organisation Design.* Reading, Mass.: Addison-Wesley.

Galbraith, J.R. and Lawler, E. (1993). *Organizing for the Future - The New Logic for Managing Complex Organizations.* San Francisco: Jossey-Bass .

Galliers, R.D. (1987). *Information Analysis, Selected Readings.* Addison-Wesley.

Galliers, R.D. (1992). *Information Systems Research: Issues, Methods and Practical Guidelines.* Oxford: Blackwell.

Galliers, R.D. (1993a). IT strategies: beyond competitive advantage. *Journal of Strategic Information Systems*, 2 (4), 283-291.

Galliers, R.D. (1993b). Towards a flexible information architecture: integrating business strategies, information systems strategies and business process redesign. *Journal of Information Systems,* 3 (3), 199-213.

Galliers, R.D. (1995). A Manifesto for Information Management Research. *British Journal of Management,* 6 (Special Issue, December), 45-52.

Galliers, R.D. and Land, F.F. (1988). Authors Response to Jarvenpaa (1988) The Importance of Laboratory Experimentation in IS Research. *Communications of the ACM,* 31 (12), 1502-1504.

Galliers, R.D., Merali, Y. and Spearing, L. (1994). Coping with information technology? How British executives perceive the key information systems management issues in the mid-1990s. *Journal of Information Technology,* 9 223-238.

Garrett, J.J. (2002). *The Information Architecture of Everyday Things* [online]. Available from: www.jjg.net/ia [Accessed on 1 Aug. 2002].

Gifford (1992). Implementing the Information Systems Architecture. *Journal of Information Systems Management,* (Fall), 41-47.

Gioia, D.A. and Pitre, E. (1990). Multiparadigm Perspectives on Theory Building . *Academy of Management Review*, 15 (4), 584-602.

Giovinazzo, W.A. (2000). *Object-oriented Datawarehouse Design.* Prentice Hall PTR.

Goles and Hirschheim, R.A. (2000). The paradigm is dead, the paradigm is dead...long live the paradigm: the legacy of Burrell and Morgan. *Omega,* (28), 249-268.

Goold, M. and Campbell, A. (1998). Desperately Seeking Synergy. *Harvard Business Review,* (September-October), 131-143.

Gordon, T.J. (1994) The Delphi Method in Futures Research Methodology, AC/UNU Project, Available online: *www.futurovenezuela.org/_curso/5-delphi.pdf* [6th June 2004].

Gorry, G.A. and Scott-Morton (1971). A Framework for Management Information Systems. *Sloan Management Review,* (Fall), 55-70.

Goss, J.D. and Leinbach, T.R. (1996). Focus groups as alternative research practice. *Area,* 28 (2), 115-123.

Gottschalk, P., (2000), Studies of key issues in IS management around the world. *International Journal of Information Management,* 20, 169-180.

Guba, E.G. (1990). *The Paradigm Dialog.* SAGE.

Guba, E.G. and Lincoln , Y.S. (1989). *Fourth Generation Evaluation.* Newbury Park CA.: SAGE.

Hamel, G., Doz, Y.L. and Prahalad, C.K. (1989). Collaborate with Competitors and Win. *Harvard Business Review,* (January-February), 133-139.

Hamilton, S. and Ives, B. (1992). MIS Research Strategies. In: R.D. Galliers, ed. *Information Systems Research: Issues, Methods and Practical Guidelines.* Oxford: Blackwell, 132-143.

Handy, C. (1995). Trust and the Virtual Organization. *Harvard Business Review*, (May-June), 40-50.

Hasson, F., Keeney, S. and McKenna, H. (2000) Research guidelines for the Delphi survey technique, *Journal of Advanced Nursing*, 32(4), 1008-1015.

Haywood, M. (1998). *Managing Virtual Teams*. Artech House.

Haywood, M. (1999). Managing Geographically Distributed Project Teams. *On Track*, (November), 3-6.

Henderson, J.C. (1990). Plugging into Strategic Partnerships: The Critical IS Connection. *Sloan Management Review*, 31 (3), 7-18.

Herman, G.T. and Levkowitz, H. (1992). Color Scales for Image Data. *IEEE CG & A*, 12 (January), 72-80.

Hill, S. (2000). *Interview with Louis Rosenfeld and Peter Morville* [online]. Available from: www.intranetjournal.com/articles/200004/im_04_29_00a.html [Accessed on 10 July 2002].

Hinterhuber, H.H. and Levin, B.M. (1994). Strategic Networks - The Organization of the Future. *Long Range Planning*, 27 (3), 43-53.

Hirschheim, R.A. (1992). Information Systems Epistemology: An Historical Perspective. In: R.D. Galliers, ed. *Information Systems Research: Issues, Methods and Practical Guidelines*. Oxford: Blackwell, 28-60.

Hokel, T.A. (1999). *The Zachman Framework for Enterprise Architecture* [online]. Available from: http://hmrresc.hirs.osd.mil/hmr/zifn_3_1/html/zf-overview.htm [Accessed on 8 Dec. 1999].

Hollocks, B. (2001). *Managing Your Research Study*. Bournemouth University.

Hollocks, B. (2002). *System Simulation in Decision Support*. 5th ed. Bournemouth University.

Holsapple, C.W. and Joshi, K.D. (2002). Knowledge manipulation activities: results of a Delphi study. *Information & Management*, 39 477-490.

Hoppe, M.J., Wells E.A., Morrison, D.M., Gilmore, M.R. and Wilsdon, A. (1995). Using focus groups to discuss sensitive topics with children. *Evaluation Review*, 19 (1), 102-114.

Huber, G. (1990). A theory of the effects of advanced information technologies on organizational design, intelligence, and decision-making. *Academy of Management Review*, 14 47-71.

Hussey, J. and Hussey, R. (1997). *Business Research - A practical guide for undergraduate and postgraduate students*. McMillan Business Press.

IBM (1981). *Business Systems Planing: Information Systems Planning Guide, GE20-0527-3* IBM.

IFIP (1997). *IFIP/IFAC Task Force on Architectures for Enterprise Integration* [online]. Available from: http://www.cit.gu.edu.au/^bernus/ei.references/task.force.info.htm [Accessed on 26 November 1997].

Inmon, W.H. (1986). *Information Systems Architecture: A System Developer's Primer*. New Jersey: Prentice-Hall Inc.

Inmon, W.H. and Caplan, J.H. (1992). *Information Systems Architecture : Development in the 90's*. QED Pub. Group .

Inmon, W.H., Zachman, J.A. and Geiger, J.G. (1997). *Data Stores, Data Warehousing and the Zachman Framework, Managing Enterprise Knowledge*. McGraw-Hill.

Jackson, M. (2001). *Problem Frames, Analysing and structuring software development problems.* Addison-Wesley.

Jackson, M.C. (1988). Evaluating the managerial significance of the VSM . *Journal of Management Studies,* 25 (6),

Jarillo, J.C. (1988). On Strategic Networks. *Strategic Management Journal,* (9), 31-41.

Jarillo, J.C. (1993). *Strategic Networks, Creating the borderless organization.* Butterworth-Heinemann.

Jarvenpaa, S.L. (1988). The Importance of Laboratory Experimentation in IS Research. *Communications of the ACM,* 31 (12), 1502-1504.

Jarvenpaa, S.L. and Ives, B. (1994). The Global Network Organization of the Future: Information Management Opportunities and Challenges. *Journal of Management Information Systems,* 10 (4), 25-57.

Johnston, R. and Lawrence, P. (1988). Beyond Vertical Integration - the Rise of the Value-Adding Partnership. *Harvard Business Review,* (July-August), 94-101.

Jones, M. (1999). Mission impossible? Pluralism and multiparadigm IS research. In: L. Brooks and C. Kimble, eds. *Information Systems - The Next Generation.* UK: McGraw Hill, 71-82.

Jones, S. (1999). *Doing Internet Research, Critical Issues and Methods for Examining the Net.* SAGE Publications.

Kalakota, R. and Robinson, M. (1999). *E-business: roadmap for success.* Addison-Wesley.

Kalakota, R. and Whinston, A.B. (1996). *Frontiers of Electronic Commerce.* Addison-Wesley.

Kambil, A. (1992) *Electronic Integration: Designing Information Technology Mediated Exchange Relations and Networks.* Thesis (PhD). Sloan School of Management, Massachusetts Institute of Technology.

Kambil, A. and Short, J. (1994). Electronic Integration and Business Network Redesign: A Role-Linkage Perspective. *Journal of Management Information Systems,* 10 (4), 59-83.

Kaplan, R.S. and Norton, D.P. (1992). The Balanced Scorecard - Measures That Drive Performance. *Harvard Business Review*, (Jan-Feb),

Kaplan, R.S. and Norton, D.P. (1993). Putting the Balanced Scorecard to Work. *Harvard Business Review*, (Sept-Oct), 134-147 .

Kaplan, R.S. and Norton, D.P. (1996). Using the Balanced Scorecard as a Strategic Management System. *Harvard Business Review*, (Jan-Feb), 75-85.

Kaplan, S. and Sawhney, M. (2000). E-Hubs: The New B2B Marketplaces. *Harvard Business Review,* (May-June), 97-103.

Kast, F.E. and Rosenweig, J.E. (1972). General Systems Theory: Applications for Organization and Management. *Academy of Management Journal,* (December), 447-465.

Keen, P. (1991). Shaping the Future: Business Design Through Information Technology. *Boston: Harvard Business School Press.*

Keen, P. (1993). Information Technology and the Management Difference: A Fusion Map. *IBM Systems Journal,* 32 (1), 17-39.

Kelle, U. and Laurie, H. (1995). Computer Use in Qualitative Research and Issues of Validity. In: U. Kelle, ed. *Computer-Aided Qualitative Data Analysis: Theory, Methods and Practice.* London: SAGE.

Kelle, U. (ed.) (1995). *Computer-Aided Qualitative Data Analysis, Theory, Methods and Practice.* SAGE Publications.

Kerssens-van Drongelen, I. (2001). The iterative theory-building process: rationale, principles and evaluation. *Management Decision*, 39 (7), 503-512.

Kettinger, W.J., Teng, J.T.C. and Guha, S. (1996). Information architectural design in business process reengineering. *Journal of Information Technology*, 11 27-37.

Kim, Y.G. and Everest, G.C. (1994). Building and Information Systems Architecture. *Information & Management*, 26 1-11.

King, N. (1994). The Qualitative Research Interview. In: C. Cassell and G. Symon, eds. *Qualitative methods in organizational research.* SAGE Publications, 14-36.

King, S.F. (1999) The Role of Components in Electronic Commerce: A Stages of Growth Model. In: Brooks, LB and Kimble, C. eds. *Information Systems - the Next Generation, Proceedings of the 4th UKAIS Conference, University of York, 7-9 April 1999*, 78-187.

Klein, S. (1997). *Dimensions of IOS* [online]. Available from: http://www-iwi.unisg.ch/iwi4/contents/papers/dimensio.html [Accessed on 10 Feb. 1997].

Kohen, S.G. (1993). New Approaches to Team and Teamwork . In: J.R. Galbraith and E. Lawler, eds. *Organizing for the Future - The New Logic for Managing Complex Organizations.* San Francisco: Jossey-Bass,

Konsynski, B.R. (1992). Issues in Design of Interorganisational Systems. In: W.W. Cotterman and J.A. Senn, eds. *Challenges and Strategies for Research in Systems Development.* John Wiley & Sons Ltd., 43-63.

Konsynski, B.R. (1993). Strategic Control in the Extended Enterprise. *IBM Systems Journal*, 32 (1), 111-142.

Kovitz, B.L. (1999). *Practical Software Requirements, A Manual of Content and Style.* Greenwich: Manning.

Kraemer, K.L. (1991). *The Information Systems Research Challenge: Survey Research Methods, vol.3.* Harvard Business School.

Kraemer, K.L. and Dutton, W.H. (1991). Survey Research in the Study of management Information Systems. In: K.L. Kraemer, ed. *The Information Systems Research Challenge: Survey Research Methods. Volume 3.* Boston, Massachusetts. Harvard Business School, 3-58.

Kuhn, T. (1970). *The Structure of Scientific Revolutions.* University of Chicago Press.

Lai, V.S. (2001). Issues of international information systems management: a perspective of affiliates. *Information & Management*, (38), 253-264.

Lauchlan, S. (Dec 2, 1999). The Zachman Framework. *Computing* : 58-60.

Laudon, K.C. and Laudon, J.P. (2002). *Management Information Systems, Managing the Digital Firm.* Pearson Education.

Lee, A., Cheng, C.H. and Chadha, G.S. (1995). Synergism Between Information Technology and Organizational Structure: A Managerial Perspective. *Journal of Information Technology*, 10 37-43.

Lee, A.S. (1991). Integrating positivist and interpretivist approaches to organisational research. *Organisational Science*, 2 (4), 342-365.

Lee, A.S. (1999). Rigor and Relevance in MIS Research: Beyond the Approach of Positivism Alone. *MIS Quarterly*, 23 (1), 29-34.

Lee, T.W. (1999). *Using Qualitative Methods in Organizational Research.* SAGE Publications.

Lehmann, H.P. (1996). Towards a specific architecture for international information systems: An exploratory study. *Journal of International Information Management,* 5 (1), 15-33.

Lewis, M.W. and Grimes, A.J. (1999). Metatriangulation: Building Theory From Multiple Paradigms. *Academy of Management Review*, 24 (4), 672-690.

Lincoln , Y.S. and Guba, E.G. (1985). *Naturalistic Inquiry.* Beverly Hills, CA: SAGE.

Lincoln , Y.S. and Guba, E.G. (1986). Research, evaluation and policy analysis. *Policy Studies Review,* 5 (3), 546-565.

Linstone, H.L. (1978). The Delphi Technique. In: J. Fowles, ed. *Handbook of Futures Research.* London: Greenwood Place,

Linstone, H.L. and Turoff, M., (eds.)(1975). *The Delphi Method: Techniques and Applications.* Reading MA: Addison-Wesley.

Linstone, H.L. and Turoff, M., (eds) (2002). *The Delphi Method: Techniques and Applications.* Available online at www.is.njit.edu/pubs/delphibook [Accessed on 20 Aug. 2005].

Lucke, K. (1997). *Reading E-mail Headers* [online]. Available from: http://www.stopspam.org/email/headers/headers.html [Accessed on 20 Sept. 2003].

Malhorta, Y. (1996). *Enterprise Architecture: An Overview* [online]. Available from: http://www.brint.com/papers/enterarch.htm [Accessed on 26 Nov. 1997].

Malone, T.W. and Laubacher, R.J. (1998). The Dawn of the E-lance Economy. *Harvard Business Review,* (September-October), 145-152.

Malone, T.W., Yates, J. and Benjamin, R.I. (1987). Electronic Markets and Electronic Hierarchies. *Communications of the ACM,* (30 June), 484-497.

Malone, T.W., Yates, J. and Benjamin, R.I. (1989). The Logic of Electronic Markets. *Harvard Business Review,* (May-June), 166-172.

Marchand, D.A., Kettinger, W.J. and Rollins, J.D. (2000). Company performance and IM: the view from the top. In: D.A. Marchand, T.H. Davenport and T. Dickson, eds. *Mastering Information Management.* Financial Times, 10-16.

Martin, J. (1989). *Information Engineering, Book I: Introduction*. Englewood Cliffs, NJ: Prentice Hall Inc.

Martin, J. (1990). *Information Engineering, Book II: Planning and Analysis.* Englewood Cliffs, NJ: Prentice Hall Inc.

Mason, R.O., McKenney, J.L. and Copeland, D.G. (1991). *Developing an Historical Tradition in MIS Research. The Harvard MIS History Project* 1991. Harvard Business School, Boston.

May, T. (1993). *Social Research: Issues, Methods, and Processes.* Buckingham: Open University Press.

McDermott, R. (2001). Why Information technology Inspired But Cannot Deliver Knowledge Management. *California Management Review,* 41 (4), 103-117.

Meier, J. (1995). The Importance of Relationship Management in Establishing Successful Interorganizational Systems. *Journal of Strategic Information Systems*, 4 (2), 135-148.

Meier, J. and Sprague Jr., R.H. (1991). The Evolution of Interorganisational Systems. *Journal of Information Technology,* (6), 184-191.

Merriam-Webster. http://www.m-w.com OnLine Dictionary and Thesaurus.

Miles R.E. and Snow, C.C. (1986). Organizations: New Concepts for New Forms. *California Management Review,* 28 (3), 62-73.

Miles R.E. and Snow, C.C. (1992). Causes of Failure in Network Organizations. *California Management Review,* (Summer), 53-72.

Miles, M.B. and Huberman, A.M. (1994). *Qualitative Data Analysis, An Expanded Sourcebook.* SAGE Publications.

Miles, R.E. and Snow, C.C. (1984). Fit, Failure and the Hall of Fame. *California Management Review,* 26 (3), 10-28.

Miller, P. (2001). *Architects of the Information Age* [online]. Available from: www.ariadne.ac.uk/issue29/miller/intro.html [Accessed on 14 Feb. 2002].

Millett, B. (1998). Understanding Organisations: The Dominance of Systems Theory. *International Journal of Organisational Behaviour,* 1 (1), 1-12.

Mingers, J. (1997). Combining research methods in information systems:multi-paradigm methodology. In: R. Galliers, C. Murphy, H. Hansen, R. O'Callaghan, S. Carlsson and C. Loebbecke, eds. *Proceedings of the 5th European Conference on Information Systems, Cork, Ireland, June 19-21.* 760-776.

Mingers, J. (2001). Combining IS Research Methods: Towards a Pluralist Methodology. *Information Systems Research,* 12 (3), 240-259.

Mitchell, V. (1996). Assessing the Reliability and Validity of Questionnaires: an empirical example. *Journal of Applied Management Studies,* 5 (2), 199-207.

Moore, G. (1965) Cramming more components onto integrated circuits. Electronics, 38(8), 19 April, 114-117, Available from http://www.intel.com/museum/archives/history_docs/mooreslaw.htm [Accessed on 3 Oct 2004].

Morgan, D.L., (1997). *Focus Groups as Qualitative Research.* 2nd ed. SAGE Publications.

Morse, J.ed. (1994). *Critical Issues in Qualitative Research Methods.* SAGE Publications.

Morville, P. (2001). *Information Architecture and Business Strategy* [online]. Available from: www.methodjournal.com/artman/publish/article_19.shtml [Accessed on 10 July 2002].

Ngai, E.W.T. and Wat, F.K.T. (2002). A literature review and classification of electronic commerce research. *Information & Management,* (39), 415-429.

Niederman, F., Brancheau, J.C. and Wetherbe, J.C. (1991). Information management Issues in the 1990s. *MIS Quarterly,* 16 (4), 474-500.

Nohria, N. and Eccles, R. (1992). *Networks and Organisations, Structure, Form, and Action.* Harvard Business School Press.

Norris, G. (2000). *E-business and ERP.* John Wiley & Sons, Inc.

Oppenheim, A.N. (2000). *Questionnaire Design, Interviewing, and Attitude Measurement.* Pinter Publishers.

Pant, S. and Ravichandran, T. (2001). A framework for information systems planning for e-business. *Logistics Information Management,* 14 (1/2), 85-98.

Parente, F.J., Anderson, J., Myers, P. and O'Brien, T. (1984). An Examination of Factors Contributing to Delphi Accuracy. *Journal of Forecasting,* (3), 173-182.

Patterson, J.H. (1994). Enterprise Information Architecture. In: K. Duncan and K. Krueger, eds. *IFIP Transactions of Computer Science and Technology, 13th World Computer Congress, v.3.* Elsevier Science B.V.

Patton, M.Q. (1982). *Practical Evaluation.* SAGE.

Patton, M.Q. (1987). *How to Use Qualitative Methods in Evaluation.* SAGE.

Patton, M.Q. (1990). *Qualitative Evaluation and Research Methods.* SAGE.

Patton, M.Q., (2002). *Qualitative Evaluation and Research Methods.* 3rd ed. SAGE.

Pavlia, P.C. and Wang, P. (1995). An expanded global architecture issue model: an addition of newly industrialised countries . *The Journal of Information Technology Management,* 1 (2), 29-39.

Pavlia, P.C., Pavlia, S.C.J. and Whitworth, J.E. (2002). Global Information Technology: A meta analysis of key issues. *Information & Management,* (39), 403-414.

Penrose, E. (1996). Growth of the Firm and Networking. In: W. Malcom, ed. *International Encyclopaedia of Business and Management.* London Routledge,

Periasamy, K.P. (1994) *Development and Usage of Information Architecture, A Management Perspective.* Thesis (PhD). Michaelmas.

Periasamy, P. and Feeny, D. (1993b). *The State and Status of Information Architecture: An Empirical Investigation.* 1993. Oxford Institute of Information Management, The Oxford Centre for Management Studies, Tempelton College. RDP 93/4.

Periasamy, P. and Feeny, D. (1997). Information architecture: research-based recommendations for the practitioner. *Journal of Information Technology,* 12 197-205.

Periasamy, P. and Feeny, D. eds. (1993a) *Gaining Value from Information Architecture: Research-based Recommendations for the Practitioner.* Oxford Institute of Information Management, The Oxford Centre for Management Studies and Tempelton College.

Perkins, A. (1997). *A Visible Solution Paper* [online]. Available from: http://members.ozemail.com.au/~visible/papers/Architecture.html [Accessed on 10 July 2002].

Pervan, G. (1998). How chief executive officers in large organisations view the management of their information systems. *Journal of Information Technology,* 13 95-109.

Phillips, D.C. (1987). Validity in Qualitative Research. *Education and Urban Society,* 20 (1), 9-24.

Pinkiston, J. (2001). The Ins and Outs of Integration, How EAI differs from B2B Integration. *eAI Journal,* (August), 48-52.

Pivotal Corporation (2001). *The extent to which Customer Relationship Management could be used to enhance business performance.* Pivotal Corporation.

Porter, M.E., (1985). *Competitive Advantage: Creating & Sustaining Superior Performance.* Free Press.

Powell, W.W. (1990). Neither Market, Nor Hierarchy: Network Forms of Organization. In: B.M. Staw and L.L. Cummings, eds. *Research in Organizational Behaviour.*

Probert, S. (1997). The Actuality of Information Systems. In: J. Mingers and F. Stowell, eds. *Information Systems: An Emerging Discipline.* McGraw-Hill,

Provost Jr.(n.d.) Wallacce *Structure and Change in Complex Systems* [online]. Available from: http://www.geocities.com/~n4bz/gst/gst0.htm [Accessed on 25 June 2003].

Ranchhod, A. and Zhou, F. (2001). Comparing respondents of e-mail and mail surveys: Understanding the implications of technology. *Marketing Intelligence & Planning.* 19(4). 254-262.

Rayport, J.F. and Sviokla, J.J. (1995). Exploiting the Virtual Value Chain. *Harvard Business Review,* (Novermber-December), 75-85.

Reichardt, C.S. (2000). A Typology of Strategies for Ruling Out Threats to Validity. In: L. Bickman, ed. *Research Design.* SAGE Publications, 89-115.

Reiss, E.L., (2000). *Practical information architecture: a hands on approach to structuring successful web sites.* Harlow, UK : Addison-Wesley.

Remenyi, D., Williams, B., Money, M. and Swartz, E. (1998). *Doing Research in Business and Management.* London: Sage.

Rigby, D.K., Reichheld, F.F. and Schefter, P. (2002). Avoid the Perils of CRM. *Harvard Business Review,* (February), 101-109.

Robson, C. (2002). *Real World Research.* Blackwell.

Rockart, J.F. and Short, J.E. (1991). The Networked Organization and the Management of Interdependence. In: M.S. Morton, ed. *The Corporations of the 1990s.* 189-219.

Rosenfeld, L. and Morville, P. (1998). *Information architecture for the World Wide Web.* Cambridge: O'Reilly.

Rowley, J.E. (2002). *E-business: Principles and practice.* New York, NY: Palgrave.

Sackman, H. (1974). *Delphi Critique: Expert Opinion, Forecasting and Group Process.* Lexington, MA: D.C. Health.

Saunders, M., Lewis, P. and Thornhill, A. (2003). *Research Methods for Business Students.* 2nd ed. Harlow : Financial Times/Prentice Hall.

Savage, C.M. (1996). *5th Generation Management, Co-operating Through Virtual Enterprising, Dynamic Teaming, and Knowledge Networking.* Butterworth-Heinemann.

Schleicher, D. and Kush, J. (2001) *Retail Ecologies, E-commerce, and Information Architecture* [online]. Available from: http://argus-acia.com/white_papers/ethnography.pdf [Accessed on 1 Aug. 2002].

Schmidt, R., Lyytinen, K., Keil, M. and Cule, P. (2001) Identifying Software Project Risks: An International Delphi Study, *Journal of Management Information Systems,* 17(4), 5-36

Scott-Morton, M.S., (1991). *The Corporation of the 1990s: Information technology and Organisational Transformation.* Oxford University Press.

Scriven, M. (1986). New Frontiers of Evaluation. *Evaluation Practice,* 7 (1), 7-44.

Scriven, M. (1997). Truth and Objectivity in Evaluation. In: E. Chelimsky and W.R. Shadish, eds. *Evaluation for the 21st Century: A Handbook.* Thousand Oaks, CA: Sage.

Sekaran, U. (2003). *Research Methods for Business: a skill building approach.* Wiley & Sons.

Senge, P. (1990). *The Fifth Discipline: the art and practice of the learning organization.* Doubleday.

Shaw, I.F. (1999). *Qualitative Evaluation, Introducing Qualitative Methods.* SAGE Publications.

Sheridan, JH (1994). A Vision of Agility, *Industry Week Magazine* (March 21, 1994).

Silverman, D. (1998). Qualitative research: meanings or practices? *Information Systems Journal,* (8), 3-20.

Silverman, D. (2000). *Doing Qualitative Research, A Practical Handbook.* SAGE Publications.

SLBS (2001). *Types of Standards* [online]. Available from: http://www.slbs.org.lc/standards_types.html [Accessed on 08 Aug. 2003].

Snow, Ch., Miles, R.E. and Coleman, H.J.Jr. (1992). Managing 21st Century Network Organizations. *Organizational Dynamics,* (Winter), 5-20.

Sowa, J.F. and Zachman, J.A. (1992a). Extending and formalizing the framework for information systems architecture. *IBM Systems Journal*, 31 (3), 590-616.

Sowa, J.F. and Zachman, J.A. (1992b). Logic-Based Approach to Enterprise Integration. In: C.J. Petrie, ed. *Enterprise Integration Modeling*. Cambridge, MA: MIT Press, 152-163.

Spikes Cavell & Co. (n.d.) *Meeting the Information Challenge, Why Corporates Must Fix their Information Infrastructures Before Their Users Do It For Them.* Anonymous

Spiteri, L.F. (2001). Information architecture of business-to-consumer e-commerce websites. Part 1: The online catalogue of selected video retailers. *Journal of Information Science*, 27 (4), 239-248.

Stake, R. (1998). Case Studies. In: N.K. Denzin and Y.S. Lincoln, eds. *Strategies in Qualitative Inquiry*. SAGE Publications, 86-109.

Stake, R.E. (1995). *The Art of Case Study Research.* SAGE Publications.

Staw, B.M. and Cummings, L.L. (1990). *Research in Organizational Behaviour.*

STC Information Design SIG (2001). *What's in a name?* [online]. Available from: www.stcsig.org/id/whatis.html [Accessed on 10 July 2002].

Stevenson, D. (1995a). *Architecture Frameworks* [online]. Available from: http://users.iafrica.con/o/om/omisditd/denniss/text/ [Accessed on 27 June 2002].

Stevenson, D. (1995b). *Positioning Enterprise Architecture* [online]. Available from: http://www.aztec.co.za/users/dstevens/text/eapositn.html [Accessed on 8 May 1997].

Strassman, P. (1995). *The Politics of Information Management - Policy Guidelines.* The Information Economics Press.

Straub, D.W. and Watson, R.T. (2001). Research Commentary: Transformational Issues in Researching IS and Net-Enabled Organizations. *Information Systems Research*, 12 (4), 337-345.

Suomi, R. (1994). What to Take into Account When Building an inter-organisational information System. *Information Processing and Management*, (30), 115-119.

Swatman, P.M.C., Swatman P.A. and Fowler, D.C. (1993). *Strategic Business Re-engineering Through Electronic Data Interchange* 1993. School of Computing Technical Report, Curtin University of Technology, Perth, Western Australia, August.

Tan, D.S. and Uijttenbroek, A.A. (1997). Information Infrastructure Management. *Information Systems Management*, (Fall), 33-41.

Tapscott, D. (1996). *The Digital Economy, Promise and Peril in the Age of Networkes Intelligence.* McGraw Hill.

Teng, J.T.C., Kettinger, W.J., and Guha, S. (1992). Business Process Redesign and information architecture: Establishing the missing links. In: *International conference on Information Systems*, 81-89.

The HCI Space (1999). *Definition of Usability (ISO 9241)* [online]. Available from: http://www.tau-web.de/hci/space/i7.html [Accessed on 23 July 2002].

The Interoperability Clearinghouse *The Interoperability Clearinghouse Glossary of Terms* [online]. The Interoperability Clearinghouse. Available from: http://www.ichnet.org/glossary.htm [Accessed on 28 Feb. 2004].

The Open Group (2002). *The Open Group Architectural Framework (TOGAF) Version 8* [online]. Available from: http://www.opengroup.org/architecture/togaf/ [Accessed on 10 May 2003].

Theuerkauf, T. (1991). Reshaping the Global Organization. *McKinsley Quarterly*, (3), 102-109.

Thompson, B. (2002). *eService: Strategies for Success in the Customer Age.* RightNow Technologies.

Thorelli, H.B. (1986). Networks: Between Markets and Hierarchies. *Strategic Management Journal,* 7 (1), 37-51.

Timmers, P. (1998). Business Models for Electronic Markets. *EM- Electronic Markets,* 8 (2), 3-8.

Toffler, A. (1990). *Powershift: Knowledge, Wealth and Violence at the edge of the 21st century.* Bantam books.

Tolkien, J.R.R. (1986) *The Return of the King. (The Lord of the Ring Part 3).* HarperCollins.

Toub, Steve (2000). *Evaluating Information Architecture* [online]. Available from: http://argus-acia.com/white_papers/evaluating_ia.html [Accessed on 1 Aug. 2002].

Tufte, E.R. (1983). *The visual display of quantitative information.* Graphics Press.

Tufte, E.R. (1990). *Envisioning information*. Graphics Press.

Tufte, E.R. (1997). *Visual explanations : images and quantities, evidence and narrative.* Graphics Press.

Turoff, M. and Hiltz, S.R. *Computer Based Delphi Processes* [online]. Available from: http://eies.njit.edu/~turoff/Papers/delphi3.html [Accessed on 09 Dec. 1996].

UKAIS (1999). But just what is IS? *Newsletter for the UK Academy of Information Systems,* 5 (1), 4.

US Department of Energy (1997). *Information Architecture, Vol 3* [online]. Available from: http://www-it.hr.doe.gov/iat/impact/volume3/guidetoc/htm [Accessed on 26 May 1998].

Vail III, E.F. (2002). Causal Architecture Bringing the Zachman Framework to Life. *Information Systems Management,* (Summer), 8-19.

Van Swede, V. and Van Vliet, J.C. (1993). A flexible framework for contingent information systems modelling. *Information and Software Technology,* 35 (9), 530-548.

Venkatraman, N. (1991). IT-Induced Business Reconfiguration. In: M.S. Morton, ed. *The Corporations of the 1990s.* 123-158.

Venkatraman, N. (1994). IT-enabled Business Transformation: From Automation to Business Scope Redefinition. *Sloan Management Review,* (Winter), 73-87.

Venkatraman, N. (1998). Real Strategies for Virtual Organising. *Sloan Management Review,* 40 (1), 33-48.

Venkatraman, N. and Kambil, A. (1991). The Check's Not in the Mail: Strategies for Electronic Integration in Tax Return Filing. *Sloan Management Review,* (Winter), 33-43.

Venkatraman, N. and Zaheer (1990). Electronic Integration and Strategic Advantage: A Quasi-Experimental Study in the Insurance Industry. *Information Systems Research,* 1 (4), 377-393.

Vogel, D.R. and Wetherbe, J.C. (1984). MIS Research: A Profile of Leading Journals and Universities. *Data Base,* 16 (1), 3-14.

von Bertalanffy, L. (1968). *General System Theory: Foundations, Development, Applications.* George Braziller.

Walsham, G. (2001). Knowledge Management: The Benefits and Limitations of Computer Systems. *European Management Journal,* 19 (6), 599-608.

Wang, P. (1994). Information systems management issues in the Republic of China, *Information & Management,* 26: 341-352.

Watson, R.T. (1989). Key Issues in Information Systems Management: An Australian Perspective - 1988. *The Australian Computer Journal,* 21 (2), 118-129.

Watson, R.T. and Brancheau, J.C. (1992). Key Issues in Information Systems Management: An International Perspective. In: R.D. Galliers, ed. *Information Systems Research: Issues, Methods and Practical Guidelines.* Oxford: Blackwell, 112-119.

Watson, R.T., Kelly, G.G., Galliers, R.D. and Brancheau, J.C. (1997). Key Issues in Information Systems Management: An International Perspective. *Journal of Management Information Systems,* 13 (4), 91-.

Watson, R.W. (2000). An Enterprise Information Architecture: A Case Study for Decentralized Organizations. In: *Proceedings of the Thirty-Third Annual Hawaii International Conference on System Science,* Maui, Hawaii IEEE.

Weaver, P.L., Lambrou N. and Walkley, M. (1998). *Practical SSADM 4+, A Complete Tutorial Guide.* 2nd ed. Financial Times, Pitman Publishing.

Weill, P. and Broadbent, M. (1998). Competing with IT infrastructure. *Financial Times,* pp.13-15

Werbach, K. (2000). Syndication: The emerging model for business in the Internet era. *Harvard Business Review,* (May-June), 85-93.

Wetherbe, J.C. and Davis, G.B. (1983). *Information Systems Architecture.* Boston: QED Publishing Group.

Wetherbe, J.C., Dock and Mandell (1988). *Readings in Information Systems: A Managerial Perspective.* West Publishing Co.

White, Martin (2002). *Behind the Firewall - Information Architecture and Usability* [online]. Available from: http://econtentmag.com/Magazine/Columns/02/firewall4_02.html [Accessed on 10 July 2002].

WorkSpace International Ltd. (1997). *The Organisation Model, General Information.* IBM Banking Solution Centre, IBM Ireland Information Services Ltd.

WorkSpace International Ltd. (1999). *The Information Model* [online]. Available from: www.4thresource.com/content/tim2000features.htm [Accessed on 15 Mar. 2002].

Wurman, R.S., (1996). *Information Architects.* Zurich, Switzerland: Graphis Press Corp.

Wynekoop, J.L. and Russo, N.L. (1997). Studying system development methodologies: an examination of research methods. *Information Systems Journal,* (7), 47-65.

Yin, R.K. (1989). Research Design Issues in Using the Case Study Method to Study Management Information Systems. In: J.I. Cash and Lawrence , eds. *The Information Systems Research Challenge: Qualitative Research Methods, v.1.* Harvard Business School, 1-26.

Yin, R.K. (1994). *Case Study Research: Design and Methods* . California: Sage Publications Inc.

Yu, E.S.K. (1995) *Modelling Strategic Relationships for Process Reengineering.* Thesis (PhD). Gaduate Department of Computer Science, University of Toronto.

Zachman, J.A. (1987). A framework for information systems architecture. *IBM Systems Journal,* 26 (3), 276-292.

Zachman, J.A. (1996a). *Enterprise Architecture: The Issue of the Century* [online]. Available from: www.zifa.com/zifajz01.htm [Accessed on 23 Apr. 1999].

Zachman, J.A. (1996b). *The Framework for Enterprise Architecture: Getting Beyond the "Legacy"* [online]. Available from: http://www.ies.aust.com/~ieinfo/zachman1.htm [Accessed on 8 Jan. 1997].

Zachman, J.A. (1999). Enterprise Architecture: The Past and the Future. *DM Review*, (December).

Zachman, J.A. (2001). *Enterprise Architecture: "Straight from the Shoulder" (Framework for Enterprise Architecture)* [online]. META Group.

Zeffane, R. (1994). Inter-organizational Alliance and Networking: Dynamics, processes and Technology? *Leadership & Organizational Development Journal*, 15 (7), 28-32.

Ziglio, E. (1996). The Delphi Method and its Contribution to Decision Making. In: M. Adler and E. Ziglio, eds. *Gazing into the Oracle, The Delphi Method and Its Application to Social Policy and Public Health.* London: Jessica Kingsley Publishers, 3-33.

Zwass, V. (1996). Electronic commerce: structures and issues. *International Journal of Electronic Commerce*, 1 (1) Autumn, 3-23.

Zwies, R. (2000). Observations on the American Society for Information Science summit 2000 meeting: Defining Information Architecture. *American Society for Information Science*, 26 (5), 10-12.

Bibliography

On Information Architecture: Models, Frameworks, Views

Anonymous (2000) Information architecture practice: An interview with Gayle Curtis Modem Media. *American Society for Information Science* 26,6 11-12.

Anonymous (2000) Information architecture practice: An interview with Lou Rosenfeld Argus. *American Society for Information Science* 26,6 19-21.

Anonymous (August/September) Information architecture practice: An interview with Seth Gordon Zefer. *American Society for Information Science* 26,6 13-15.

Andersen Consulting (1992) *Systems Architecture Overview* Andersen Consulting.

Anonymous IFW00101, IBM Banking Solution Centre, IBM Ireland Information Services.

Bauer, M.A., Finnigan, P.J., Hong, J.W., Rolia, J.A., Teorey, T.J. and Winters, G.A. (1994) Reference architecture for distributed systems management. *IBM Systems Journal* 33 (3) 426-444.

Bobeva, M. (2001) Information Architecture for Electronically Integrated Business Networks, In: *Proceedings from the 6th Annual UKAIS conference,* McGraw-Hill Int.

Bracchi, G. and Francalanci, Chiara. (1996) A Framework for the Alignment of IT Architectures with Information Processing Requirements of Organizations. http://hsb.baylor.edu/ramsower/ais.ac.96/papers/BRACCHI.htm

Burns, F. (1998). *Information for Health, An Information Strategy for the Modern NHS 1998-2005.* 1998. NHS Executive.

Carter, H. (1999) Information architecture. *Work Study,* 48(5), 182-185.

Cody, E. (1999) InformationArchitecture: Building the right foundation for customer choice in energy. *Public Utilities Fortnightly* 137,17 46, 48+.

Cottey, P.T. and Chang, R.A. (Jun 24, 1996) Technology How-To - Plan Your Enterprise Architecture - Thinking about where your organization wants to be is the first step in making sure it gets there. *InformationWeek* InformationWeek Labs edn, Techweb.

Dobson, J., Martin, M. Bonatti M., and Morganti, M. Architectural Discourse for Information Systems. Pp. 105- 116p. Also available at: http://www.campus.ncl.ac.uk/unbs/sbi/emad/discourse1.htm [20 August 2005]

Ebels, Enno J.(1992) IDEA Group Publishing, (Ed.) A Multiple Methodology Approach Toward Information Architecture Specification. IDEA Group Publishing.

Feeny, D. and Willcoks, L. Selective sourcing and core capabilities. *Financial Times* Mastering Information Management edn, 4 mastering Information Management.

Flynn, D. and Jazi, M.D., 1994. Organisational and Information System Modelling for Information Systems Requirements Determination. *Lecture Notes in Computer Science,* 881 79-93.

Francalanci, C. and Piuri, V. (1999) Designing information technology architectures: a cost-oriented methodology. *Journal of Information Technology* 14 ,181-192.

Goedvolk, J.G. and Rijsenbrij, D., (1999). *White Paper Integrated Architecture Framework* [online]. Available from: - http://home.hetnet.nl/~daan.rijsenbrij/arch/publ.htm [Accessed 10 May 2003]

Gullikson, S. and McKibbon S. (1999) The impact of information architecture on academic web site usability. *The Electronic Library,* 17(5), 1999-304.

Hertzberger, L.O., van Albada, G.D. and den Boer, G.A. (1995) Information Architecture Concepts for Autonomous Control. *Intelligent Autonomous Systems* 190-197.

Iggulden, David The ANSA Architecture as Framework for Heterogeneous Execution Environments.

Inmon, W.H., Zachman, J.A. and Geiger, J.G. (1997) *Data Stores, Data Warehousing and the Zachman Framework, Managing Enterprise Knowledge* McGraw-Hill.

Konsynski, B., Morris, H., Witt, B. and Land, F.F.e.a. (1992) System Architecture and Long-term development strategy. In: Cotterman, W.W. and Senn, J.A., (Eds.) *Challenges and Strategies for Research in Systems Development,* pp. 434-5.

Kruchten, P., 1995. Architectural Blueprints - The "4+1" View Model of Software Architecture. *IEEE Software,* 12 (6), 42-50.

Laudato, N.C. and DeSantis, D.J. You CAN Teach an Old Dog New Tricks: Extending Legacy Applications to the New Enterprise Architecture.

Leary, J.R., 1995. An Architectural Basis for Evolving Software Systems. *Journal of Systems Software,* 30 (1-2), 27-43.

Lechner, U. and Hummel, J., 2002. Business Models and System Architectures of Virtual Communities: From a Sociological Phenomenon to Perr-to-Peer Architectures. *International Journal of Electronic Commerce,* 6 (3), 41-53.

Lee, S.M. and Kim, B.-O. (1996) Developing the information systems architecture for world-class organisations. *Management Decision* 34,2 46-52.

Meisingset, A. (1998) Introduction to Information Architecture. *Telektronikk* 94,1 3-11.

MIT (2002) *MIT e-commerce project* [online]. Available from: http://ecitizen.mit.edu/ [Accessed on 8 Jan. 2002].

Mudie, M.W. and Schafer, D.J., 1985. An Information technology Architecture for Change. *IBM Systems Journal,* 24 (3/4), 307-315.

Myer. T. (2002) Information architecture concepts, Misconceptions explained, Available from: http://www-106.ibm.com/developerworks/web/library/us-inarch.htm [Accessed on 14 Feb 2004].

Nezlek, S.J., et al., An integrated approach to enterprise computing architectures. *Communications of the ACM*, 42 (11), 82-90.

Opdahl, A.L. *A Model for Comparing Approaches to IS-Architecture Alignment* [online]. Available from: - www.ifi.uib.no/staff/andreas/ [Accessed 2 August 2002]

Peek, R. (2000) ASIS Summit 2000: Defining Anformation Architecture. 17,6 (June) 14-18.

Peng, Y. (2000) Study of Enterprise Information Systems Architecture. *Journal of Systems Science and Systems Engineering* 9,1 77-86.

Rolfe, R., Bobeva, M. and Roushan, G. (1997). Information Relationship Management in Electronic Commerce. In: D. Avison, ed. *Key Issues in Information Systems, Proceedings of the 2nd UKAIS Conference.* McGraw-Hill Int. (UK) Ltd.

Segars, A.H. and Grover, V. (1994) Communications architecture: towards a more robust understanding of information flows and emergent patterns of communication in organizations. *European Journal of Information Systems* 3,2 87-100.

Sharif, A., Elliman,T., Love, P. and Badii, A. (2004) Integrating the IS with the enterprise: key EAI research challenges. *The Journal of Enterprise Information Management*, 17(2), 164-170.

Targowski, A. (1988) Systems Planning for the Enterpise-wide Information Management Complex: The Architectural Approach. *Journal of Management Information Systems* 5,2 23-37.

Umbaugh, R.E. (1998). James Martin: Educating for the Cybercorp (Interview). *Information Systems Management,* (Winter), 93-96.

US Department of Energy (1995). *Information Architecture: Foundations, Volume 1* [online]. Available from: http://cio.doe.gov/iap/publications/vol1_foundations/vision3.html [Accessed on 19 July 2002].

US Department of Energy. (1997) Information Architecture, Vol 3.

Wardle, Caroline (1984) The Evolution of Information Systems Architecture. 205-217

Weill, P. and Broadbent, M. Competing with IT infrastructure. *Financial Times* Mastering Information Management edn, 13-15.

Wetherbe, J.C. and Bracheau, J.C. (1986) Information Architectures: Methods and Practice. *Information Processing & Management* 22(6) 453-463.

Wetherbe, J.C. and March, S.T. (1989) Building and Implementing an Information Architecture. *Data Base* 19, Summer 9-17.

Appendices

Appendix A: Research Strategy v.1 (NHS case study)

A.1: Data Collection Flowchart (August 1996)

A.2: The NHS questionnaire

A.3. The Research Business card (sent together with the questionnaire)

A.4. The NHS Survey report (June 1997)

A.5. R.Evernden's reply to the interview invitation (July 1997)

Appendix B: Research strategy v.2 (Multiple case studies)

B.1. Responses from Ladbrokes to the invitation for participation (Dec 1999)

B.2. Responses from SLB to the invitation for participation (Jan 2000)

B.3. Responses from Tesco to the invitation for participation (Feb 2000)

Appendix C: Evaluation of the framework

C.1: Participants in the Delphi study

C.2: Students questionnaire for collecting participant's data

C.3: Delphi Round 1: supporting letter and questionnaire

C.4: Delphi Round 2: supporting letter and questionnaire

C.5: Delphi Round 3: supporting letter and questionnaire

C.6: Electronic survey: e-mail invitations and samples

C.7: Interviews: Frequencies of codes

Appendix A:

Research Strategy v.1 (The NHS case study)

A.1: Data Collection Flowchart (August 1996)

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SUMMARY

The initial strategy for theory building was based upon a single case study based on the NHS sector. This strategy employed a multi-paradigm theory-building approach (Gioia & Pitre 1990) that envisaged complementing conceptual analysis based on secondary research, with an empirical investigation of the status and state of information architecture in the NHS business network. Thus, the developed framework would have been based on both deductive and inductive approaches. The empirical work sustained the traditional scientific approach, and complemented it with the case study material to add empirical rigour to the final deliverable. A case study was chosen as it is one of the most widely used research strategies for theory building (Yin 1984, Eisenhardt 1989, Kerssens-van Drongelen 2001). Furthermore, it provides for extensive examination of a specific instance of the research object, i.e. the framework for Information Architecture (IA), and allows for understanding of the dynamics and relationships within the business unit.

The advertising sampling technique using industry publications has already determined that the NHS sector meets all the rest of the criteria for participation devised earlier. This sector also exhibits the characteristics of a business network (although not a dynamic, but a stable one (See Section 2.2.1.1)), actively is involved in projects developing NHS-global and inter-organisational supply chain information systems and has to report to the public on the progress of its projects. The NHS was considered to be more responsive to research on information management, as at the time the NHS has just produced their information strategy for the period 1998-2005 "Information for Health, An Information Strategy for the Modern NHS 1998-2005" (Burns 1998) and had clearly defined strategy for the information architecture within the sector. The secondary research established that there are no regional variations in the information and information systems architectures in the NHS. This justified the choice of homogeneous sampling. As a result, the research sample for this strategy constituted from the Information Managers (IM)/IT managers in the South-West NHS.

The process advised by this strategy would have resembled the theory building and testing process, suggested by Jarvenpaa (1988) (Fig.A.1), with the only difference being that the case study would have been run in parallel with the conceptual analysis based on secondary research (Fig.A.2).

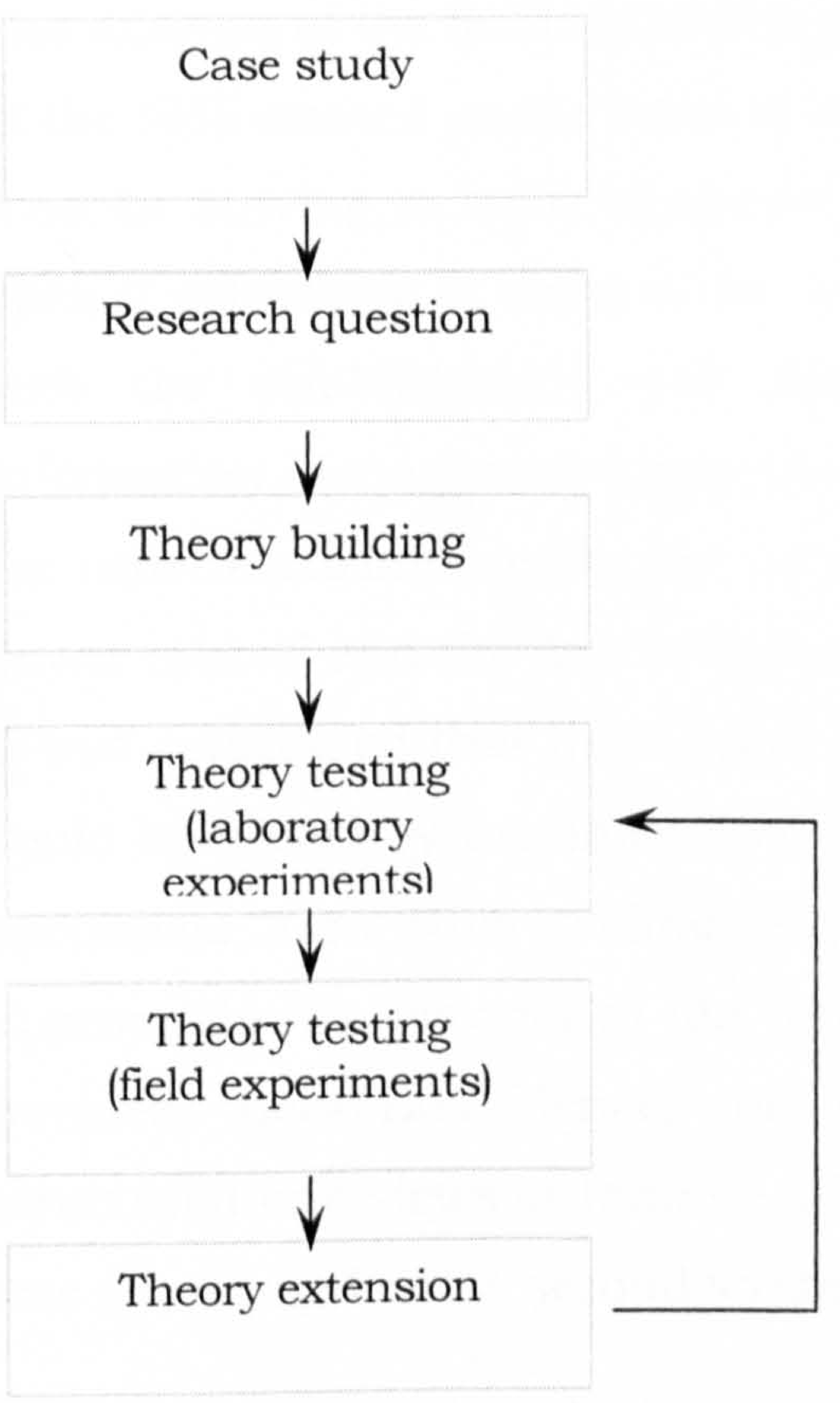

Fig.A.1: The use of alternative IS research approaches in theory building, testing and extension (Jarvenpaa, 1988, p.1504)

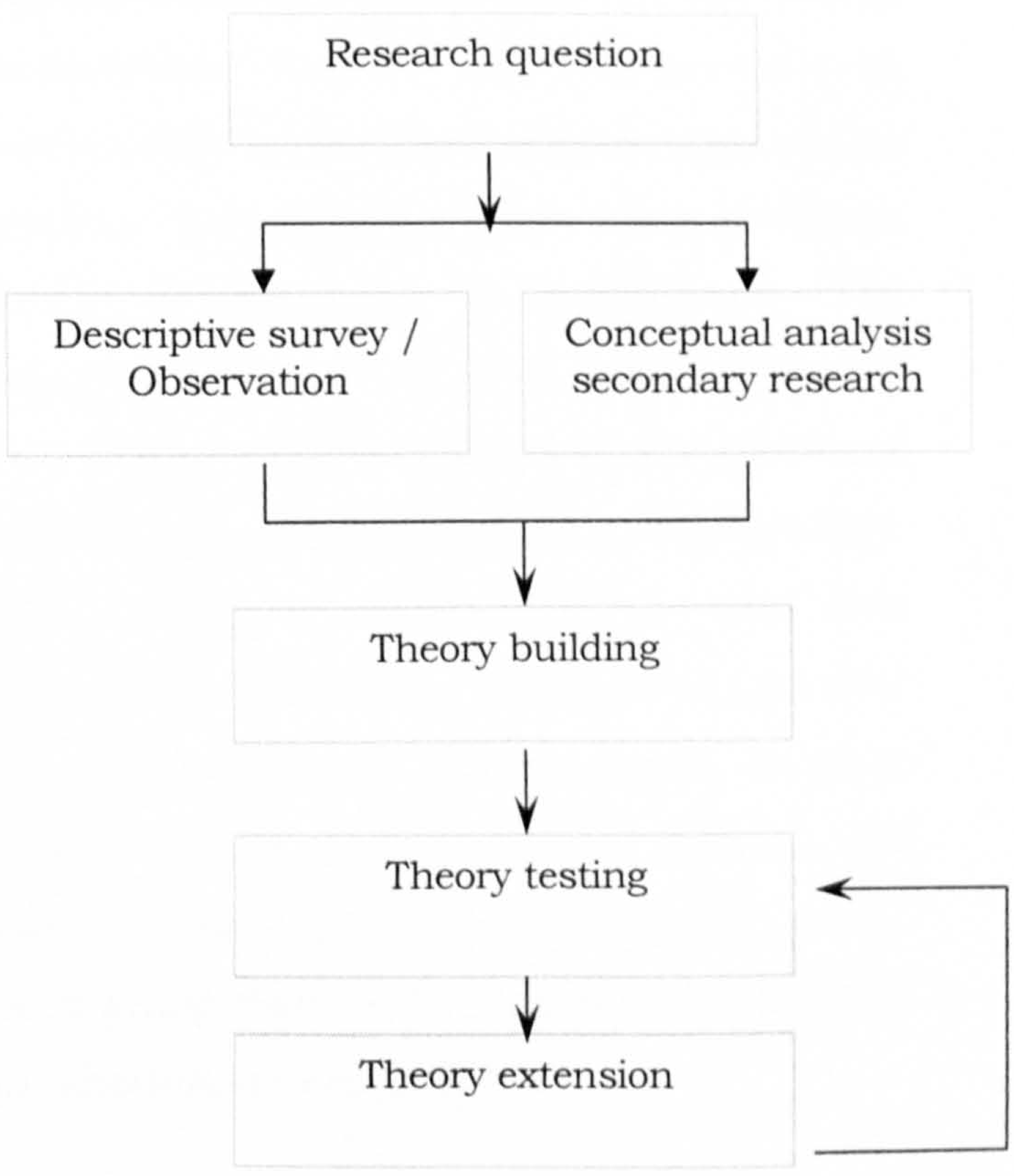

Fig.A.2: Theory building strategy, version 1

Methods that were considered appropriate for implementing this strategy were interviews, survey, study of archives, and observation. The implementation of the strategy included:

- examination of internal documentation provided by the NHS IM&T Strategy group, London.
- a survey with IM/IT managers in NHS in the South West England, aiming to establish the degree of state and status of electronic integration;
- a formal semi-structured interview with the Information Manager of one of the South-West NHS trusts (Bobeva, 1997) to pilot a forth coming series of semi-structured interviews with the participants in the research sample who had taken part in the survey and agreed to take part in further research.
- observation at an NHS conference dedicated to the new information management strategy in NHS, i.e. Developing Technology and People, Wolverhampton, 5th June 1998;
- two informal semi-structured interviews with IS professionals in the sector;

Materials used during the work on this strategy option, including the project business card, the postal and web version of the electronic integration survey and the survey report, sent to those participants in the survey who expressed interest in the results, are presented in Appendix A.

The analysis of the findings of this primary research contradicted the impression of the NHS created on the basis of the secondary research. The NHS proved to be a sector striving to build integrated sector-wide information architecture and to open it selectively to some of its suppliers. It has encountered many problems with the establishment and financing of its basic IT architecture. The Information Managers at organisational and regional level were very realistic of the constraints imposed by the need for highly secure information, the politics of power control and the day-to-day problems with the management of technology. It was considered that the reliability and validity of a theory built on their view could be biased by the limited achievement in information integration, and that specialists from other technologically more advanced sectors would be more appropriate as visionaries on the architecture of information systems for business networks. Hence, the plan for conducting further formal semi-structured interviews or forming a focus group with IS professionals in the NHS was abandoned and a second strategic alternative was explored.

Research Data Collection Flowchart

M. Bobeva

Electronic Communication and Integration Practices Survey

This questionnaire forms the first phase of a survey that is being conducted as a part of a doctoral research project investigating the information and communication infrastructure that best supports intra- and inter-organisational relationships.

Objectives of the survey:
To determine:
- the design and structure of information and communication technologies in use
- how well it supports collaboration with other groups outside the organisation
- the degree of flexibility and dynamism of the current information and communication infrastructures

Information and communication infrastructure
The set of information systems, communication networks and other technologies supporting information and communication management practices in an organisation.

All replies will be strictly confidentially .
Please tick all answers that are appropriate.

IS - Information system
IT - Information technology

Are electronic communications in your company planned as a part of its business strategy?
- ❍ No, because
  - ❐ it is not considered a part of the business strategy
  - ❐ we don't have business strategy
  - ❐ (Please specify if other reason) ....
- ❍ Yes

2. How would you evaluate the contribution of those involved in creating the information and communication infrastructure within your organisation?

	None	Negligible	Somewhat important	Important	Considerably important	Critical
❍ senior management	......	......	......	......	......	......
❍ departmental/section managers	......	......	......	......	......	......
❍ IS managers/professionals	......	......	......	......	......	......
❍ IT managers/professionals	......	......	......	......	......	......
❍ external consultants	......	......	......	......	......	......
❍ others (Please specify)	......	......	......	......	......	......

....

3. Which of these technologies are used in your business? (Please tick all appropriate)
- ❍ LANs (Local Area Networks)
- ❍ WANs (Wide Area Networks)
- ❍ the Internet
- ❍ intranets
- ❍ the WWW (World Wide Web/the Web)
- ❍ groupware applications
- ❍ client-server
- ❍ datawarehousing
- ❍ workflow applications
- ❍ distributed databases
- ❍ others (Please, specify) ....

4. What other electronic communication technologies used in your organisation are essential in your everyday business? (Please tick all appropriate)
- ❍ voice mail
- ❍ internal e-mail
- ❍ e-mail via the Internet
- ❍ FTP (File Transfer Protocol)
- ❍ Telnet
- ❍ EDI (Electronic Data Interchange)
- ❍ EFT (Electronic Funds Transfer)
- ❍ video conferencing
- ❍ others (Please, specify) ....

5. Does the Internet play part in your everyday business?
- ❍ No, because
  - ❐ it has no implications on our business

- ❒ it brings too much risk and distraction
- ❒ we can't invest in it at that moment
- ❒ but we are planning how to integrate it
- ❒ (Please specify if other reason) ……………………………………………………………………

❍ Yes, we are using it for:

- ❒ marketing
- ❒ customer feedback
- ❒ contact with partners (suppliers, distributors, etc.)
- ❒ developing organisational knowledge
- ❒ (Please specify if other reason) ……………………………………………………………………

6. Do you have an Internet Web site?

❍ No, because

- ❒ it has no implications on our business
- ❒ it is no worth investing in it
- ❒ it is not a part of the company business strategy
- ❒ (Please specify if other reason) ……………………………………………………………………

❍ No, but

- ❒ we are planning to build one
- ❒ we are developing one
- ❒ (Please specify if other reason) ……………………………………………………………………

❍ Yes

Thinking of your Web site how would you classify it?

- ❒ useless
- ❒ fashion
- ❒ an opportunity
- ❒ leading edge
- ❒ (Please specify if other) ……………………………………………………………………

Intranet
- the use of Internet standards and derived technology within an organisation;
- a new type of information system based on Internet Web technology to enhance internal and external communication.

7. Do you consider intranet technology as applicable to your business?

❍ No, because

- ❒ it has no implications on our business
- ❒ it is no worth investing in it
- ❒ but we are exploring how to implement it
- ❒ (Please specify if other reason) ……………………………………………………………………

❍ Yes,

- ❒ we are exploring how to implement it
- ❒ we have already implemented it, but it does not provide access to the Internet
- ❒ we have already implemented it and it provides access to the Internet
- ❒ (Please specify if other) ……………………………………………………………………

What security measures regarding your proprietary information are integrated in your organisational computer networks ?
(Please tick all appropriate)

- ❍ firewalls
- ❍ backup and recovery
- ❍ reports on unauthorised access
- ❍ confirmation to the end-user on each message delivery (if requested)
- ❍ error determination and solution
- ❍ encryption
- ❍ electronic signatures
- ❍ analysis of unauthorised access attempts
- ❍ None
- ❍ I don't know

9. What do you consider are the major advantages of your information and communication practices? (Please tick all appropriate)
   - ❍ availability of network resources for all employees
   - ❍ working times
   - ❍ internal integration
   - ❍ external integration with business partners (e.g. suppliers, distributors, etc.)
   - ❍ security (encryption)
   - ❍ monitoring
   - ❍ flexibility
   - ❍ remote access provision
   - ❍ full utilisation
   - ❍ training and personal assistance provision
   - ❍ help desk
   - ❍ regular upgrade
   - ❍ back up
   - ❍ gateways architecture
   - ❍ firewalls location
   - ❍ feedback policy
   - ❍ automatic contact database (addresses/telephones/e-mails) generation
   - ❍ others (Please, specify) ………………………………………………………………………………

10. Do you consider that your information and communication infrastructure (ICI) supports <u>electronic</u> collaboration with?

Business partners	**Customers**
❍ No, because ❒ we don't think it is essential to our business ❒ (Please specify if other) ……………………………… …………………………………………………… ……………………………………………………	❍ No, because ❒ we don't think it is essential to our business ❒ (Please specify if other) ……………………………… …………………………………………………… ……………………………………………………
❍ No, but ❒ we are planning to redesign our ICI so that it allows this ❒ we are developing new ICI modules to allow greater electronic integration ❒ (Please specify if other) ……………………………… …………………………………………………… ……………………………………………………	❍ No, but ❒ we are planning to redesign our ICI so that it allows this ❒ we are developing new ICI modules to allow greater electronic integration ❒ (Please specify if other) ……………………………… …………………………………………………… ……………………………………………………
❍ Yes (Please specify in what way) …………………………… …………………………………………………… ……………………………………………………	❍ Yes (Please specify in what way) …………………………… …………………………………………………… ……………………………………………………

11. Please identify the roles of your business partners (e.g. catering suppliers, IT services providers, health authorities, primary care providers, marketing agents, etc.):

………………………………… ………………………………… …………………………………

………………………………… ………………………………… …………………………………

………………………………… ………………………………… …………………………………

12. Does IT in your organisation support any of the following? (Please tick all appropriate)
    - ❍ flat organisational hierarchy
    - ❍ cross-functional teams
    - ❍ multi-tasked employees
    - ❍ empowered individual workers
    - ❍ empowered teams
    - ❍ customer focus
    - ❍ partner's collaboration
    - ❍ none
    - ❍ (Please, specify if other) ………………………………………………………………………………

1. How would you characterise the information and communication infrastructure in your organisation?
   - ❍ process-based
   - ❍ functional
   - ❍ data-based
   - ❍ (Please, specify if other) ....

Thank you for filling in the questionnaire. I would appreciate if you agree on participating in the next stage of the research.

Would you like a copy of the results?	Yes	❍	No	❍
Would you be willing to discuss these replies over the telephone?	Yes	❍	No	❍
Would you like to take part in a group discussion?	Yes	❍	No	❍

If 'No' please indicate any other person from your organisation:

Name: .... Telephone: ....

Please fill-in some further details or attach your business card.

Your name:
Job title:
Organisation:
Tel. No.:
Personal e-mail address *(if available)*: ......
Company's Web site URL *(if available)*:

Your comments, enquiries or recommendations: ....
....

Please return the questionnaire to me on the following address:

Milena Bobeva
School of Design, Eng. and Computing
Bournemouth University
Talbot Campus
Fern Barrow
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The Project

Information Architecture for Business Networks

Research aims

The research originates in the works of John Zachman on creating a framework for Information Systems Architecture in the 80s and 90s and Roger Evernden and IBM on Information FrameWork and The Information Model. Both sources take an internal perspective, focusing on information management within one enterprise or within one market sector. With the increasing development of electronic communications and the emergence of new organisational forms, electronic integration with partners, now defined as e-business, has become an imperative for many companies. Research has identified that there is no common methodology nor a framework for planning and designing of such electronically mediated business relationships.

The aim of this research is to produce and test a framework for information architecture supporting electronic integration at internal (intra-) and inter-organisational levels.

Evaluation of the framework (Your contribution)

Evaluation of the research product will be fulfilled through a set of case studies in companies, that have practical experience in setting up an electronically mediated business network. Interviews with business and IS/IT managers are going to take place in each of the participating parties.

The interviews are going to focus on your company's experience in establishing electronic intregration with business partners and/or customers. The key factors that have been considered are going to be discussed, the roles of each of the partners, as well as what recommendations you have for future similar projects.

Researcher's details

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Electronic Integration and Communication Practices Survey

Report

Milena Bobeva
Department of Computing
School of Design, Engineering and Computing
June 1997

Contents

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The purpose of analysis

It is already recognised that electronic communications are transforming the way business is done by overcoming the boundaries of space and time. However, the differences in the technological and application infrastructure of collaborating organisations turn integration of business processes into a complicated issue. Technologies such as the Internet and intranets claim to offer many advantages and significant return on investment.

The purpose of this survey is to test the awareness, applicability and usage of current electronic communications and integration technologies in the National Health Services Sector (NHS), mainly of intranets and the Internet.

The participants

The sample for the survey consisted of those health services organisations in the South West England (Fig. 1). It comprises all the NHS trusts and authorities in the region, as well as blood centres, NHS supplies and executives. It is considered that business relationships between the different bodies within the South-West NHS present patterns that are repeatable throughout the 14 regional divisions of the NHS (Fig. 2). Hence it is considered that the results of the survey can be generalised on a national NHS base.

Fig. 2: NHS regional division

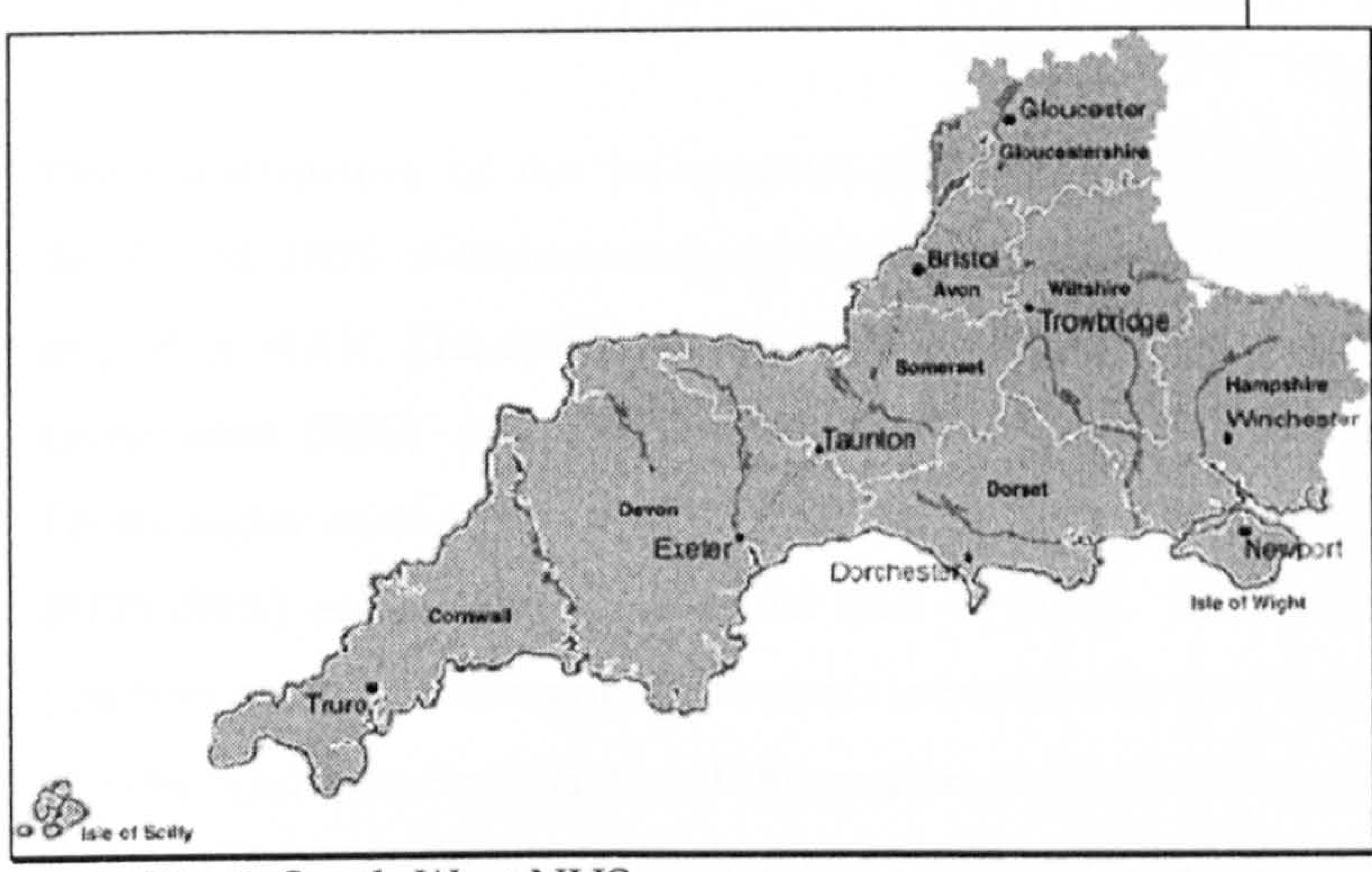


Fig. 1: South-West NHS

Interpreting the results

The planning of electronic communications is an integrated part of the business strategy for 93% of the respondents in the health services. Aligning business and IT strategies has already been addressed in an administrative way (The Information Management Group of the NHS) by developing a strategic vision "to support better care and communication through the appropriate use of information management and technology". This global for the NHS strategy could also be seen as a means for bridging the difference gap between the business and the IT community.

However, it was evident that technological competence is dominant among the IS managers, while there was still a considerable lack of understanding and appreciation of contemporary business transformation strategies such as empowerment, flattening the organisational hierarchy and process orientation.

It was observed that those that have a critical importance involved in creating the information and communication (IC) infrastructure are the IS managers/professionals (52%), the IT managers/professionals (63%) and the users (both internal and external, i.e. business partners) (66%). Senior and departmental managers are assessed to have considerable importance (39%), while participation of external consultants is assessed as negligible in importance (36%). These results identify that the NHS is relying mostly on its internal resources for developing the information systems infrastructure and values the user as an important participant in the design of its IC infrastructure. In some cases, users are considered as more important to the development of the infrastructure than senior and departmental managers. This fact could be treated as an indicative of the emerging user-centred focus of ICT developments in the NHS.

The infrastructure of the information and communication technologies in the NHS sector is well developed. 100% of the respondents indicate that they have LANs in place and 79% have their networks as part of WAN. The applications which are most widely used have a client-server architecture (61%). Groupware (32%) and datawarehousing (29%) applications are gaining considerable importance. Technologies such as e-mail (79%), Electronic Data Interchange (EDI) (57%) and File Transfer Protocol (FTP) (46%) are already an essential part of the IC infrastructure. Their adoption in everyday NHS practices confirms the tendency towards external efficiency and effectiveness. This lays the foundations of intra- and inter-organisational integration, but it also demands addressing further concerns, such as building up a culture of a proactive and information sharing user. A fact that indicates the lack of such culture is that out of 39% of the respondents stating that external e-mail is essential to their business, only 11% provided their e-mail address, although they have provided their telephone number for future contacts. It is interesting to observe that e-mail addresses as an alternative point of contact, are not included on business cards attached to the survey.

Although the Internet and the World Wide Web are well recognised in the sector, they are not playing an essential role in the everyday business in the NHS. However, 49% of the respondents are planning to integrate them. Those of the participants who consider the Internet essential for their everyday business, explore it mostly for developing organisational knowledge and for contacts with partners. The presence of a Web site is available for only 7% of those in the survey, although 57% of the respondents are planning to develop or are already developing such a site.

The intranet is considered by 63% of the participants to be applicable for internal electronic integration in the health services sector, 76% are exploring how to integrate it in their IC infrastructure. Such percentages indicate that in the NHS sector there is awareness of new IC technologies and that their adoption is considered both in terms of leveraging with business goals and legacy systems, and of bringing new managerial concerns.

The most employed security measure within the organisations in the NHS sector include backup (89%), firewalls (85%), reports on unauthorised access (82%) and electronic signatures (68%). Electronic identification, network boundary guarding and electronic data protection are part of the security policy for managing organisational boundaries, delineated by ICT.

From the survey it is perceived that in the NHS the most advantageous characteristics of the information and communication practices are the availability of network practices (rated by 89%), internal integration (78%), flexibility and back up (both 61%).. This indicates that information and communication technologies in the NHS sector are primarily employed for supporting internal processes rather than processes that span the boundaries of the organisation.

More than half of the participants anticipate that their IC infrastructure supports integration with business partners (52%) and with customers (59%). However, they state that their objective is to achieve efficiency and effectiveness. This is clearly focused on automating existing administrative and clerical functions that are data or function driven. Electronic integration is defined as a process-oriented strategy, and as such it is not possible until the NHS develops a process model equivalent in scope and detail to the existing data model.

The results have strongly indicated that the health services sector is developing as a stable business network. It is clear that they are adopting new technologies for achieving intra-network integration. The technological infrastructure (both hardware and software) is already well developed to enable computerised relationships between partners and clients. Electronic communications are used as a technological basis for a first stage inter-organisational systems, which are facilitating electronic exchange of information. However, this stage has its importance in bringing in partner's/users ICT infrastructure into consideration as a factor in the development of the internal ICT infrastructure. This gradually shifts the focus outwards expanding organisational boundaries to embrace both internal and external business partners.

Appendix A: Research model

Survey method - core stages

After identifying the research sample, the method for administering the survey was set to include the following steps:

I. Developing a research model to show the variables tested and how they are related

II. Determining how to measure the research variables

III. Designing data collection instruments

IV. Piloting the data collection instrument

V. Collecting data

- Postal survey
- Interviews

VI. Analysing the data and testing the hypotheses

VII. Interpreting the results

A pilot test was conducted with the UK National Health Service.

Research population and research sample

The population for this research comprises organisational units of the National Health Service. This organisational unit was chosen because the sub-units:

- are proactive to electronic communications practices for collaboration at intra- and inter-organisational level;
- present a network type of organisation;
- are not in the computer or software development business;
- have many customers and business partners that could change frequently as individuals.

The NHS therefore provided an ideal test area because it represents a stable business network from the non-computer industry sector, that develops extensively electronic communications practices and is aiming at developing strategies for electronic integration. The results from the survey in that sector indicate the current state of IS architecture and integration within the NHS.

The data was collected in November-December 1996. A sample of 74 NHS organisations were mailed a questionnaire of 13 questions. The questionnaire was supported with a cover letter explaining the purpose of the survey and providing the World Wide Web address (the URL[1]) of the on-line version of the questionnaire.

Research questions and variables

The variables[2] that formed the construct of the survey and the interviews are:

- relationship between business strategy and electronic communications planning (*strategy*)
- degree of importance of the participants in the design of information and communications technologies (ICT) infrastructure (*participation*)
- communication technologies in place (*CT*)
- Internet recognition (*Internet*)
- intranet as a potential solution (*intranet*)
- security measures in place (*security*)
- information and communication features available (*IC features*)
- support of electronic collaboration with partners (*partners*)
- support of electronic collaboration with customers (*customers*)
- role perceptions (*role*)
- IT as an enabler of organisational transformation (*new*)
- information and communication infrastructure outlining (*ICI*)

These variables were identified in the course of literature research on the topic and were tested through this survey for their appropriateness as factors influencing electronic integration practices. The use of these variables sets out to identify :

- recognition of the need for alignment between business and IT strategies to make the most of the power of information technology in pursue of business goals (tested with the variable *strategy*);
- awareness of the importance of management commitment, users participation and cross-functional teams for achieving the aims of a project/business (tested with *participation*);
- proliferation of computing and communication technologies to support information exchange and teamwork (tested with *CT*);
- the increasing importance of the Internet as a global reconfigurable open platform system and open-user technology (*Internet*);

---

[1] URL - Universal Resource Locator

[2] The abbreviated names of the variables are given in brackets

- increased security measures (*security*);
- increased span and complexity of the IC features (*IC features*);
- organisational transformation, management approaches and culture changes (*new*)

The rest of the variables aim to test the emerging tendencies, such as:

- the arrival of the intranet - a corporate network based on Web technology (*intranet*)
- ICT-based strategies towards integration and information sharing with partners (*partners*)
- strategies towards making the customer an active part in the information systems development and exploitation (*customers*)
- focus on processes running within an organisation, rather than on data and function (*ICI*).

The variable ***role*** was included to facilitate the future development of the research project with some concrete examples.

The research questions, the variables to test them and the numbers of the questions that they were tested with are presented in Table 6.1

Table 1: Variables and questions measuring them

Research question	Variable	Question No.
Is there a relationship between business and IT strategy	*strategy*	1
What is the degree of importance of the participants in IC infrastructure design	*participation*	2
What is the infrastructure of communication technologies in place	*CT*	3, 4
Is the Internet considered to be appropriate for business use	*Internet*	5, 6
Is an intranet considered as a technology for information management	*intranet*	7
What are the most used security measures in place	*security*	8
What are the most common features of information and communication practices	*IC features*	9
Is electronic collaboration with partners supported	*partners*	10a
Is electronic collaboration with customers supported	*customers*	10b
What are the perceptions of partners roles	*role*	11
What new approaches in organisational design and performances are enabled by IT	*new*	12
What is the orientation of information and communication infrastructure	*ICI*	13

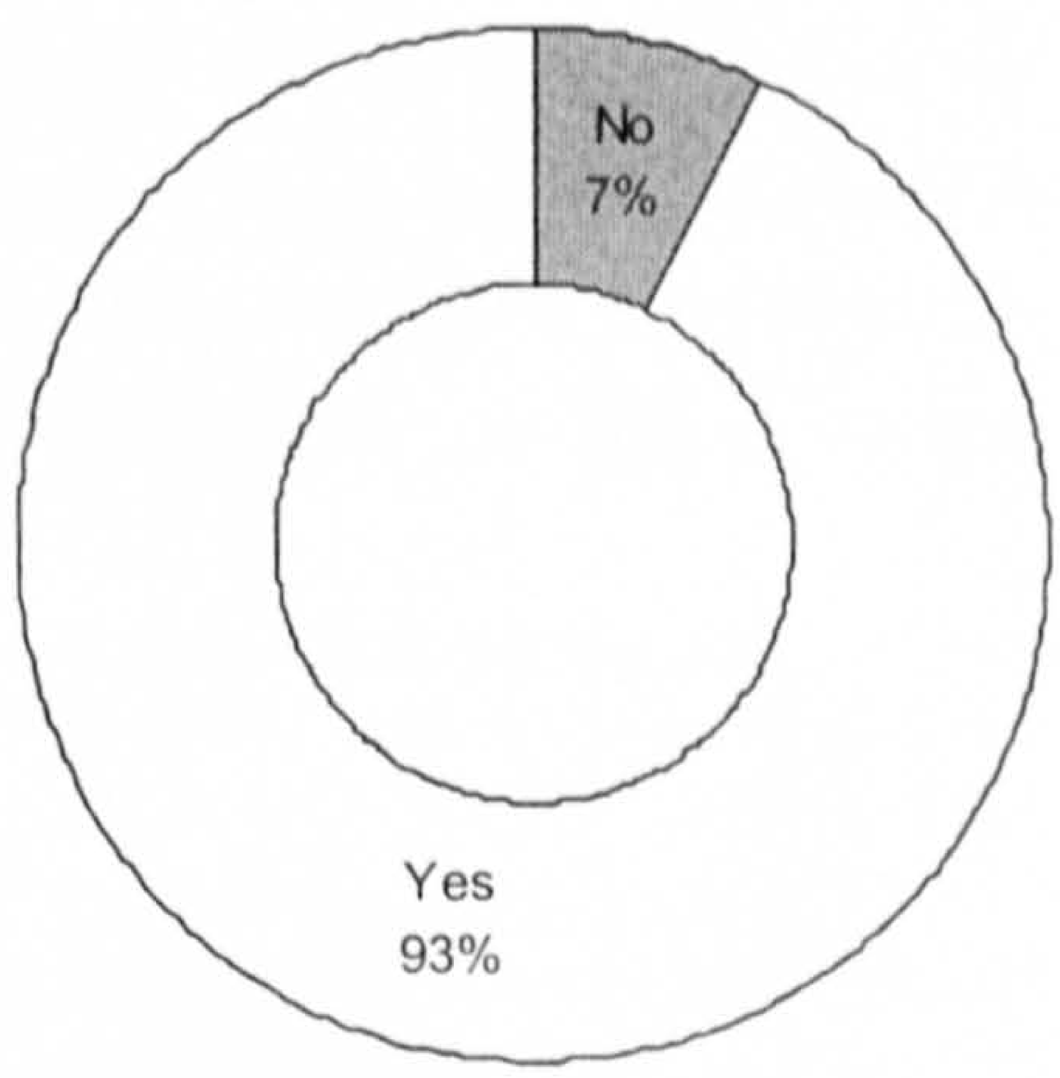
Appendix B: Analysis of the data

The appendix present the analysis of the questionnaire grouped by variables. A subsequent structuring has been done for these of the variables which were tested with more than one question.

Variable: *Strategy*

- *relationship between business strategy and electronic communications planning*

Only two replies, out of 28, indicated that electronic communications are not planned as part of the organisation's business strategy. In the first case the explanation is that there was no business strategy in place, while in the second it was stated that electronic communications are becoming a part of the business strategy.



The high percentage of positive replies (93 %) denotes that the organisations studied are striving to leverage electronic communications technologies with their business mission. It also confirms that there is a tendency in the NHS towards aligning business and IT strategies.

Variable: *Participation*

- *degree of importance of the participants in IC infrastructure design*

	Senior management		Departmental managers		IS managers/ professionals		IT managers/ professionals		External consultants		Others	
Importance	**Freq***	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
None	0	0.0	0	0.0	0	0.0	0	0.0	5	20.0	0	0.0
Negligible	0	0.0	0	0.0	0	0.0	0	0.0	9	36.0	0	0.0
Somewhat important	1	3.6	1	3.6	0	0.0	0	0.0	7	28.0	0	0.0
Important	7	25.0	10	35.7	3	11.1	3	11.1	3	12.0	1	16.7
Cons. important	11	39.3	11	39.3	10	37.0	7	25.9	1	4.0	1	16.7
Critical	9	32.1	6	21.4	14	51.9	17	63.0	0	0.0	4	66.6
Valid cases	28		28		27		27		25		6	
Central tendency	**Considerably important**		**Considerably important**		**Critical**		**Critical**		**Negligible**		**Critical**	

* Freq - adjusted frequency

It is assumed that as far as the first five categories of participants in developing the IC infrastructure (i.e. senior management, departmental managers, IS managers/professionals, IT managers/professionals and external consultants) are concerned, the missing answers for some of the categories are an indication that this category was not participating in the design. With regards to the 'Others' category, that was tested with an open ended question, such an assumption is not appropriate. 19% of the respondents described who was included in the 'Others' category. 67% of them indicated that were the users. The rest included the General Practitioners and the Trust Hospitals, that could be generalised as users or business partners. Thus the user, whether s/he is internal or external to the organisation, has confirmed her/his increasing role as a party in building the company IC infrastructure.

The radar chart on **Fig. 1** presents the assessment of the importance of the different participants in the establishment of IC infrastructure. Each of the axis shows a category of participants, while the axis scale indicates the degree of importance. Starting from the centre of the radar, the tick marks show the categories of importance in the following order: 0-none, 10-negligible, 20-somewhat important, 30-important, 40-considerably important and 50-critical. As it is seen from the chart, the participation of IS managers/professionals, IT managers/professionals and users (others) is assessed to be critical, the participation of senior and departmental managers as considerably important, and this of external consultants, as negligible.

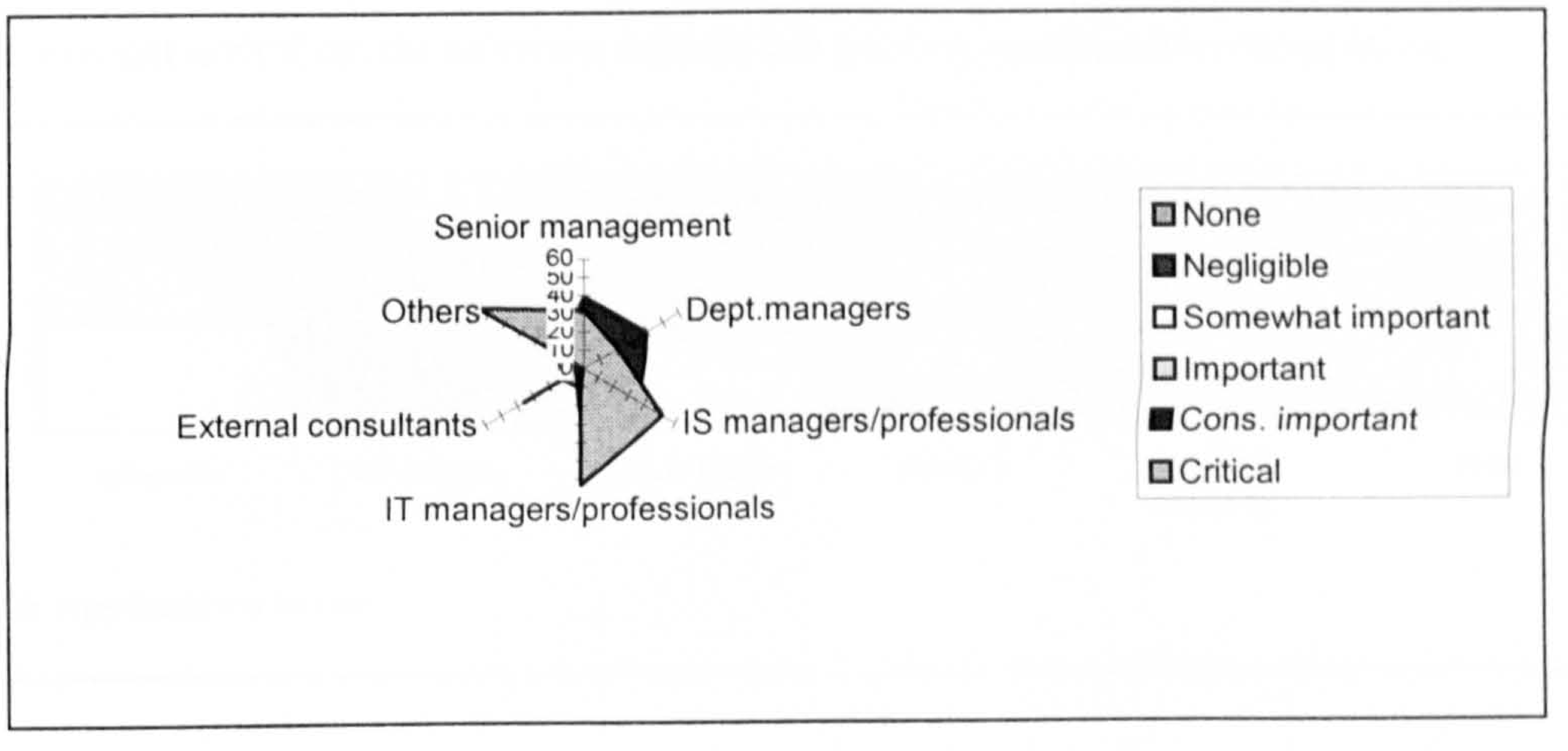


Fig. 1: Importance of participation

Variable: ***Communication Technologies (CT)***

- *communication technologies in place and applications in use*

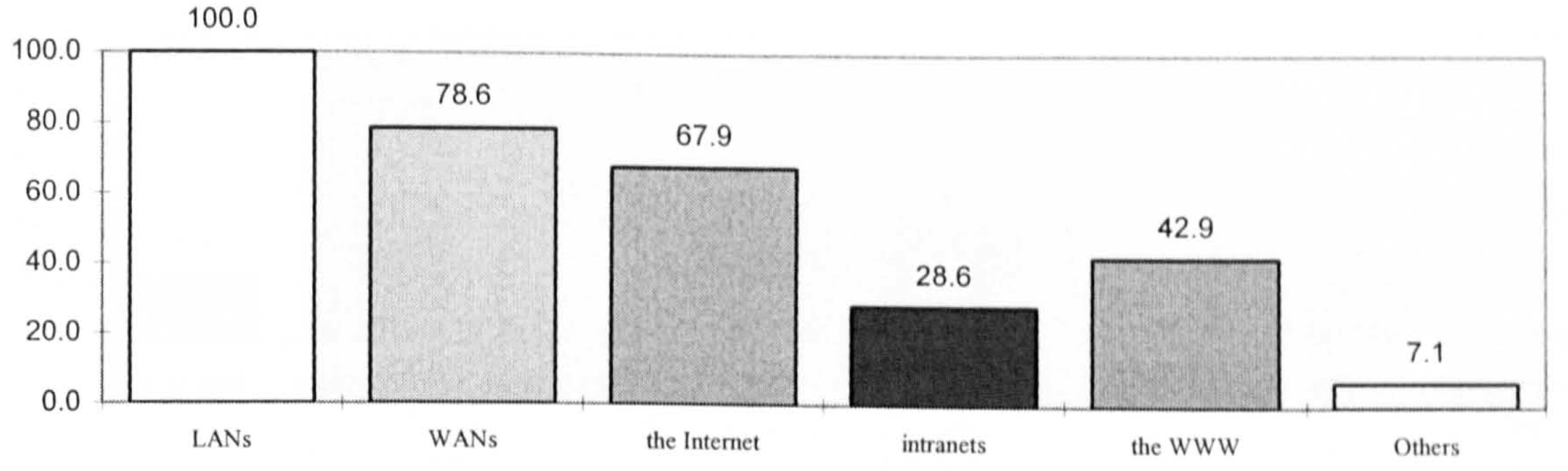


Fig. 2: Electronic communications technologies in place

All of the sample organisations are networked internally via Local Area Networks (LANs) with 79% of them having their networks as part of Wide Area Networks (WANs). 68% of the participants have recognised the Internet as a media that could be used in their business.

The analysis of the software applications in use reveals that 61% of the companies have client-server applications in place. Other applications such as groupware (32.1%) and datawarehousing (28.6%) despite of their recent arrival on the software market, are gaining considerable recognition.

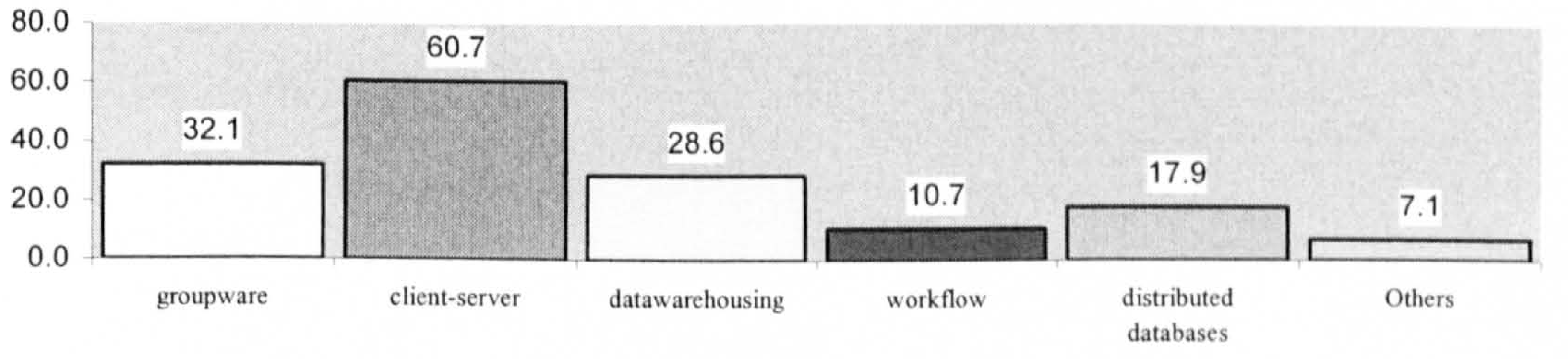


Fig. 3: Applications in use

- *communication technologies that are essential for everyday business*

Although the question was phrased to elicit essential for the everyday business communication technologies, many of the respondents denoted that their replies depict the useful rather than essential technologies that are in place. Internal e-mail (78.6 %), Electronic Data Interchange (EDI) (57.1 %) and File Transfer Protocol (FTP) (46.4 %) are the most widely used technologies in the NHS.

These results confirm that the NHS is pro-active towards adopting electronic communications practices.

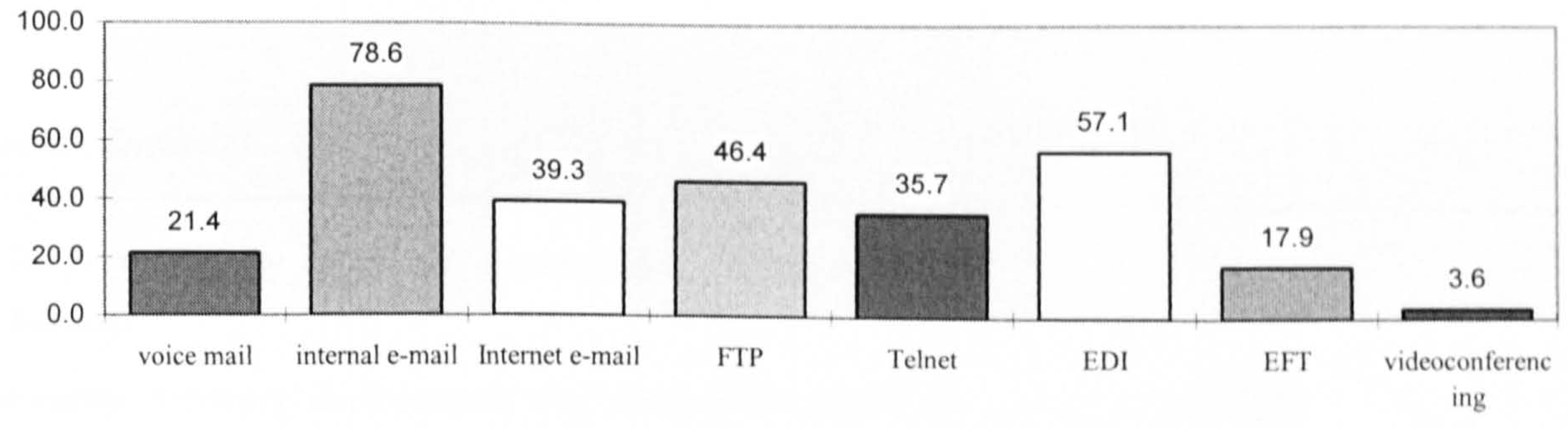


Fig. 4: Essential for everyday business electronic communications technologies

Variable: ***Internet***

- ***Internet playing part in organisation's everyday business***

The central tendency demonstrates that the Internet does not play part in NHS everyday business. This result was expected, considering the following three factors:

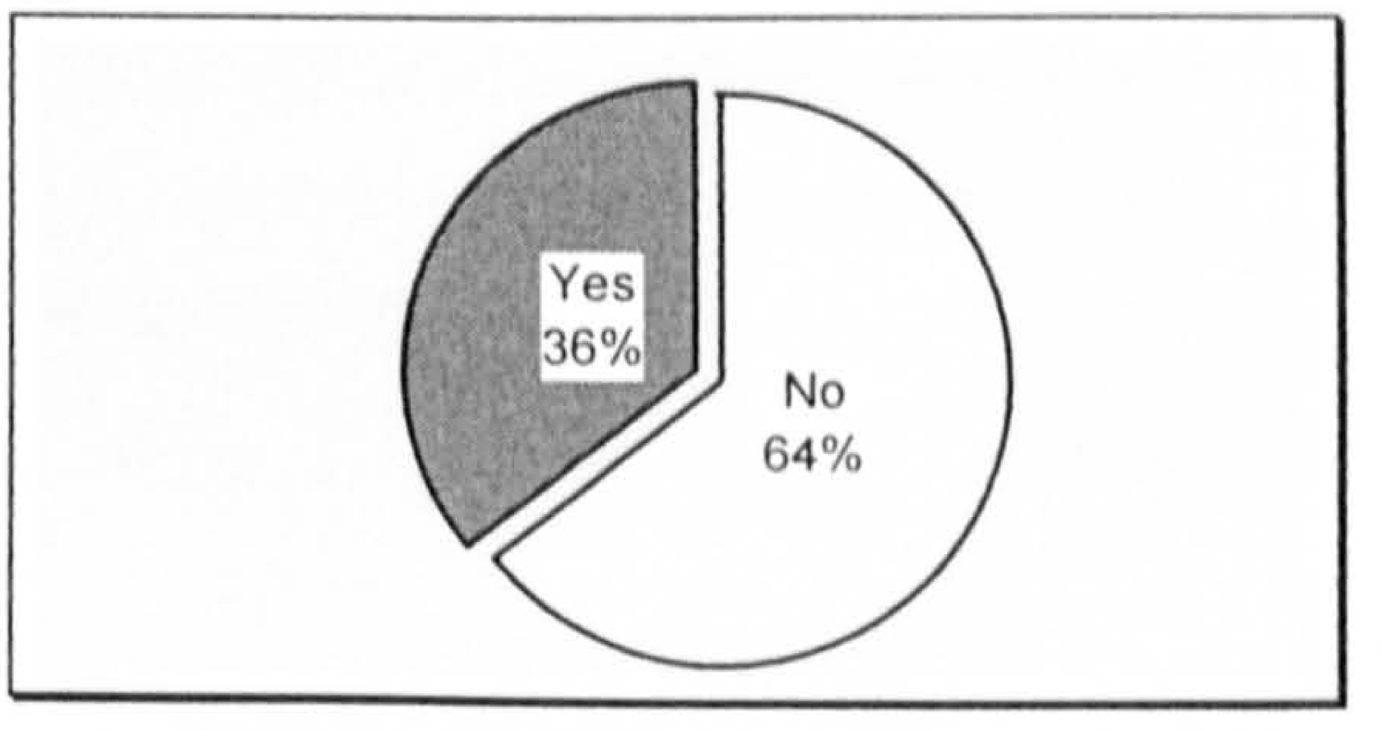


Fig. 5: Internet playing part in everyday business

- the mission of NHS to provide health services (hence the informing and educating the population comprises just a minor part of the NHS activities, respectively incestments);
- the increasing, but still not considerable degree of using the Internet for everyday communications among the general population (which in turn implies that those of the NHS patient who are Internet users are even less); and
- the concerns of confidentiality of private information distributed via not-dedicated communication lines.

However, it is considered that Internet technology is applicable in the NHS as a media for informing the patients on more practical everyday issues such as working times of the clinics and doctors, advises on most common problems, and other topic of interest to the patients.

- ***Reasons for the negative answer***

The result reveals that 49% out of these respondents, who perceive the Internet does not play part in their everyday business, are planning to integrate the Internet in their routine operations. This fact indicates the growing importance of the Internet even to organisations whose primary business is not directly dependent on information technology. It also indicate that there is awareness of potential Internet

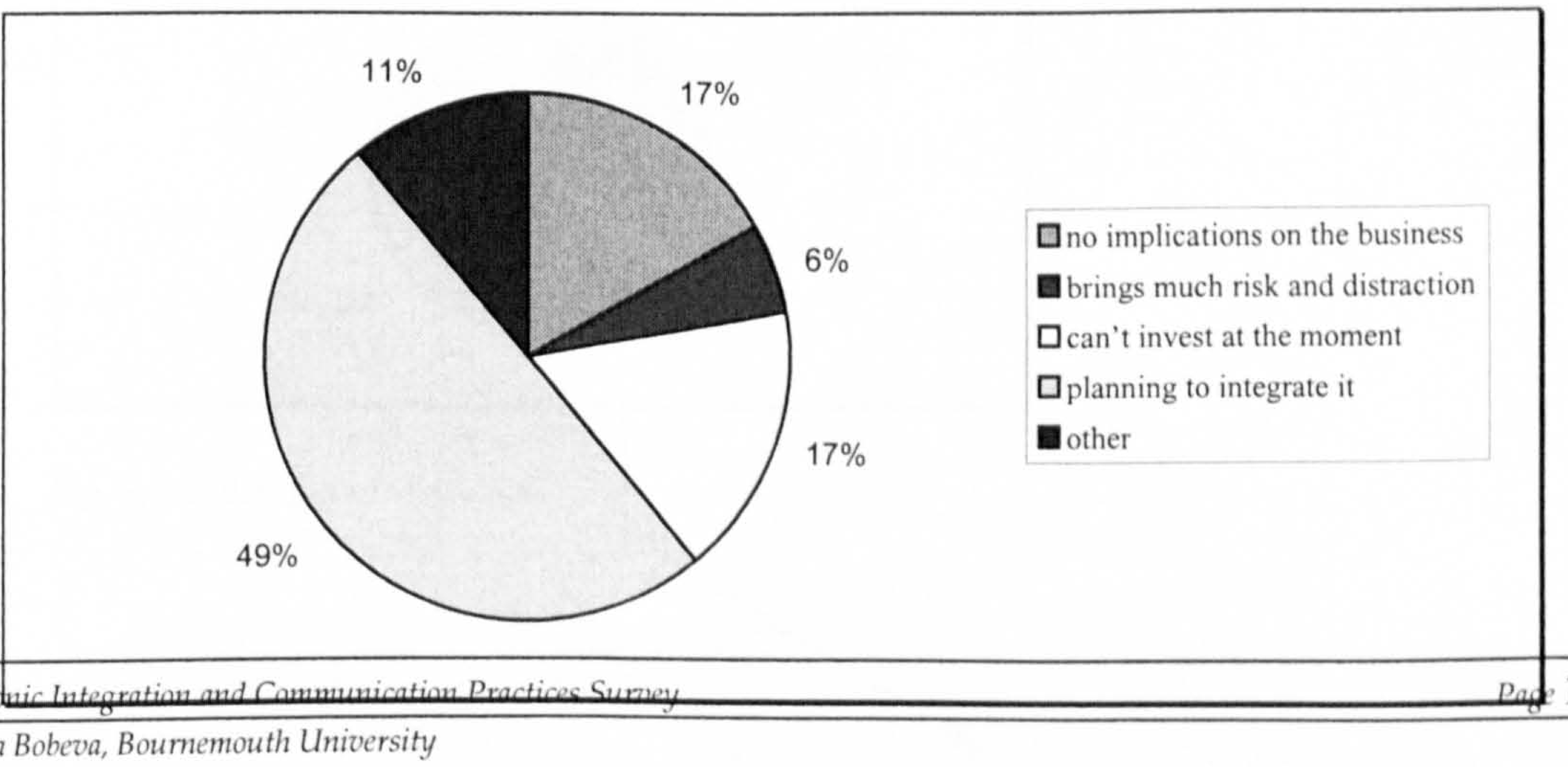


Fig. 6: Reasons for not using the Internet in everyday business

applications in the NHS sector.

- *Usage of the Internet in everyday business*

The chart below presents the different categories of Internet usage in the NHS everyday business, i.e. marketing, customer feedback, contact with partners, developing organisational knowledge, and others. The tendency shows that the Internet is used primarily for developing organisational knowledge and contact with partners. Other purposes for using the Internet include research and mailing service. The survey did not tested whether this usage was not restricted only to e-mail and Web browsing using the Internet, or it also provided some real-time services..

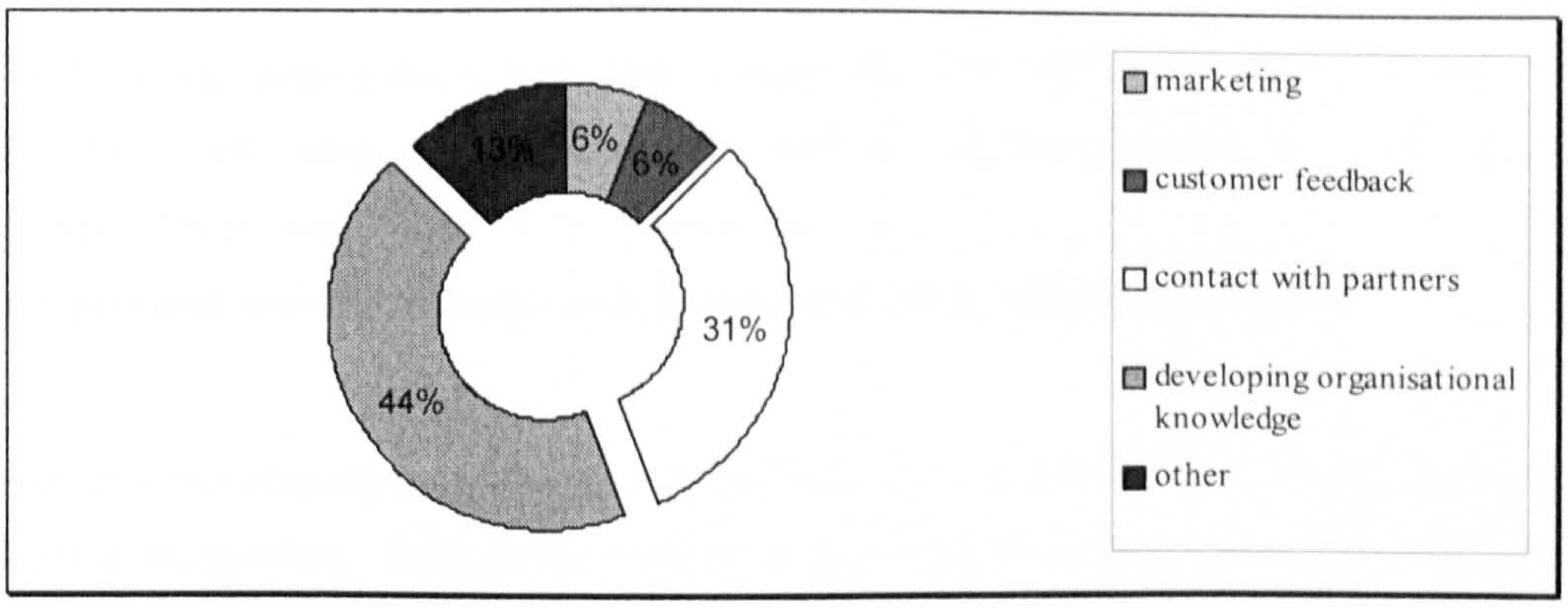


Fig. 7: Usage of the Internet in everyday business

- *Availability of Web sites*

The analysis of the answers to this question indicates that only 7% of the participants in the survey have already got a Web site. Although the percentage of these who do not consider building up a virtual model of their organisation is marginally greater (36%), the results show that the major organisational tendency with regards to the World Wide Web is the development or planning to develop a Web site (57.1 % from the participating companies).

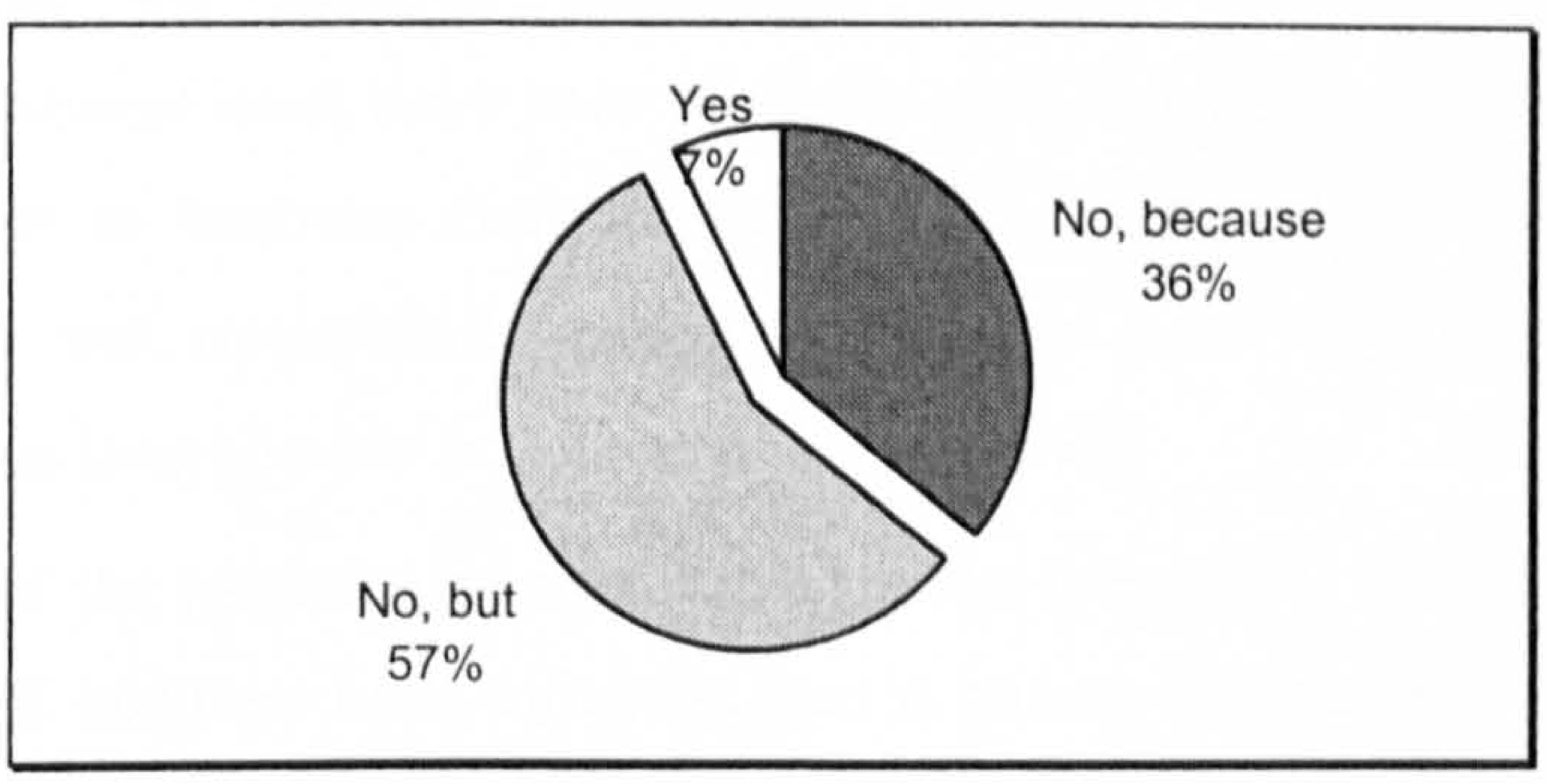


Fig. 8: Availability of Web sites

- ***Reasons for not having a Web sites***

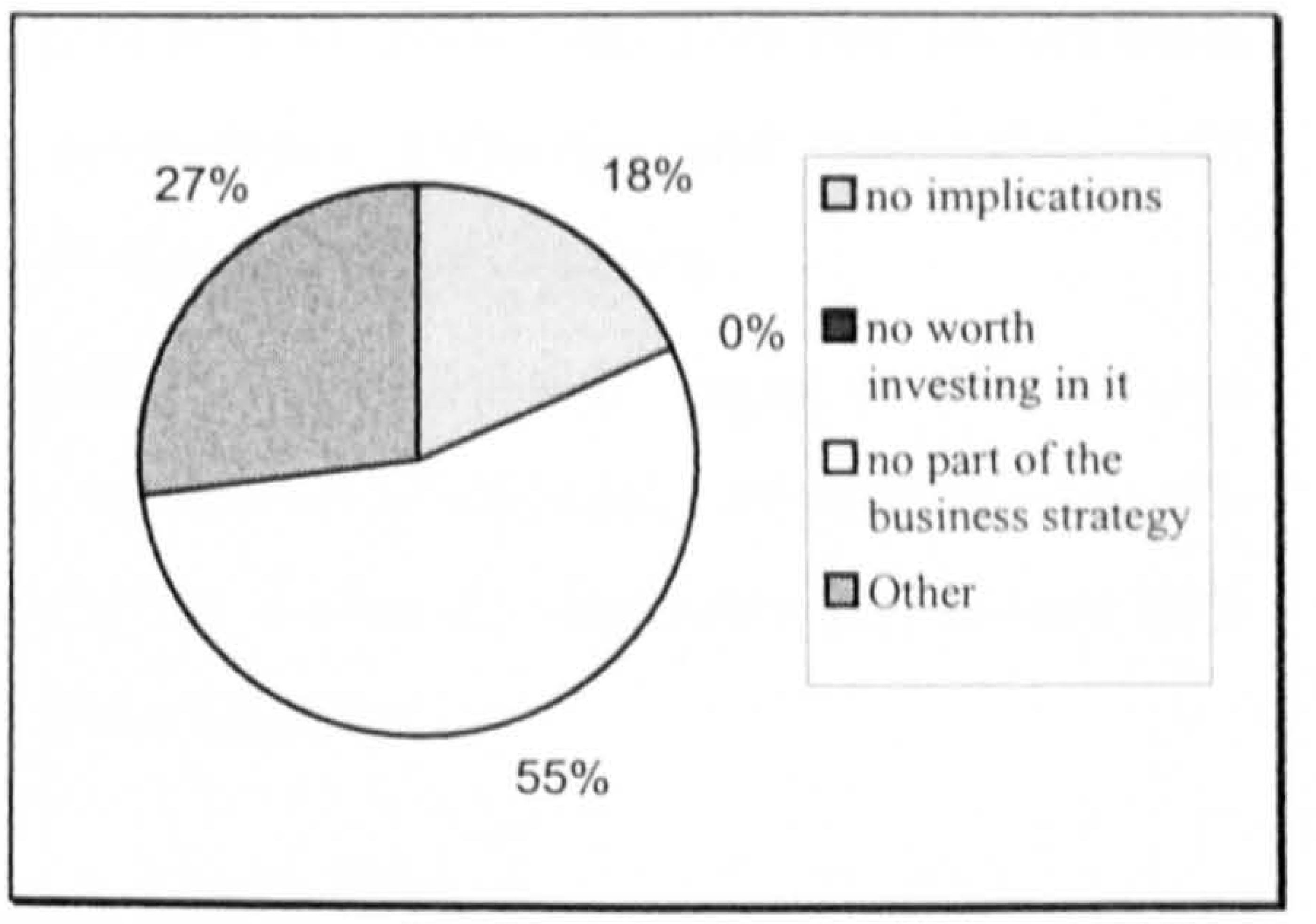


Fig. 9: Reasons for not having a Web site

The examining of the reasons for not having an Web site indicates this is mainly because such a task is not a part of the business strategy. Other reasons include cost and access restrictions to users, data security and lack of time to develop.

Those 18% of the respondents that have a web site classified their web sites as a leading edge and an opportunity. Their web sites were visited by the research team and assessed as being well planned and rich in information content.

The Internet is not playing part in the everyday business of most (64%) of the respondents, it is gaining considerable recognition - 50% of those who are not using it in their everyday work, are planning to integrate it. Up to now the Internet has been seen as a tool for developing organisational knowledge and communication with partners. The technology of the World Wide Web can also been evaluated as attracting business attention - despite of the fact that *only 7.2 % of the respondents* have developed and maintained a Web site, another 57.1% are developing or planning to develop such.

Variable: ***Intranet***

- ***intranet as a potential solution***

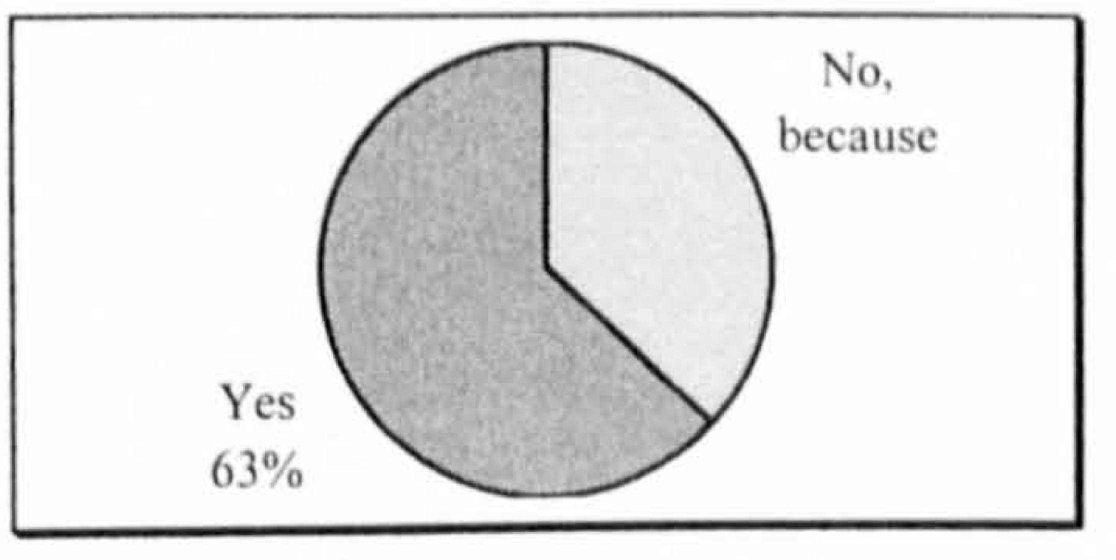


Fig. 10: Applicability of the intranet

Intranets, the Internet technology utilised at an internal organisational level, have been explored as the newest cost-effective solutions to business communication and integration problems. 63% of the respondents perceive that this new technological platform, is applicable in their everyday business.

Those of the participants that don't see the intranet as relevant to the NHS business have indicated that it has no implications on their business (20%) and that it is not worth investing in it (20%). However, 30% of this group are exploring the intranet issue. The remaining 30% of the respondents in this group declared that they are using other similar technologies.

Although the respondents who do not consider intranet technology as applicable to their business, the central tendency of this category is to explore the intranet technology.

The awareness of 63% of the respondents that answered that intranets are a technology that could be applicable in the NHS everyday business, and the intention of 30% of those who does not see intranets applicability in their work, reflects the change towards information exchange and integration, and supports the concern about managing this new information environment and culture.

The table below indicates the percentage of the respondents at the different stages of the intranet development cycle. The central tendency is for exploring the intranet as a technology of potential benefits to the way everyday business is done. 24 % of the respondents have already implemented intranet. 50% of them have provided a gateway between their intranet and the Internet.

Table 2: Results on Stages in Intranet Development	**Frequency**	**%**
exploring	13	76.4
implemented, but with no access to the Internet	2	11.8
implemented, with access to the Internet	2	11.8
other	0	0.0
Total	17	100.0

Variable: ***Security***

- *security measures in place*

The security measures in place were tested through an open-ended question that listed eight most common approaches to controlling the safety of the organisational electronic information resources. The central tendency shows that backup is the data protection measure that is most commonly used. This tendency to protecting the loss rather than controlling external access to proprietary information is understandable provided the fact that only 36% of the respondents are using the Internet in their everyday business and only 12% of them have provided their intranet with external access.

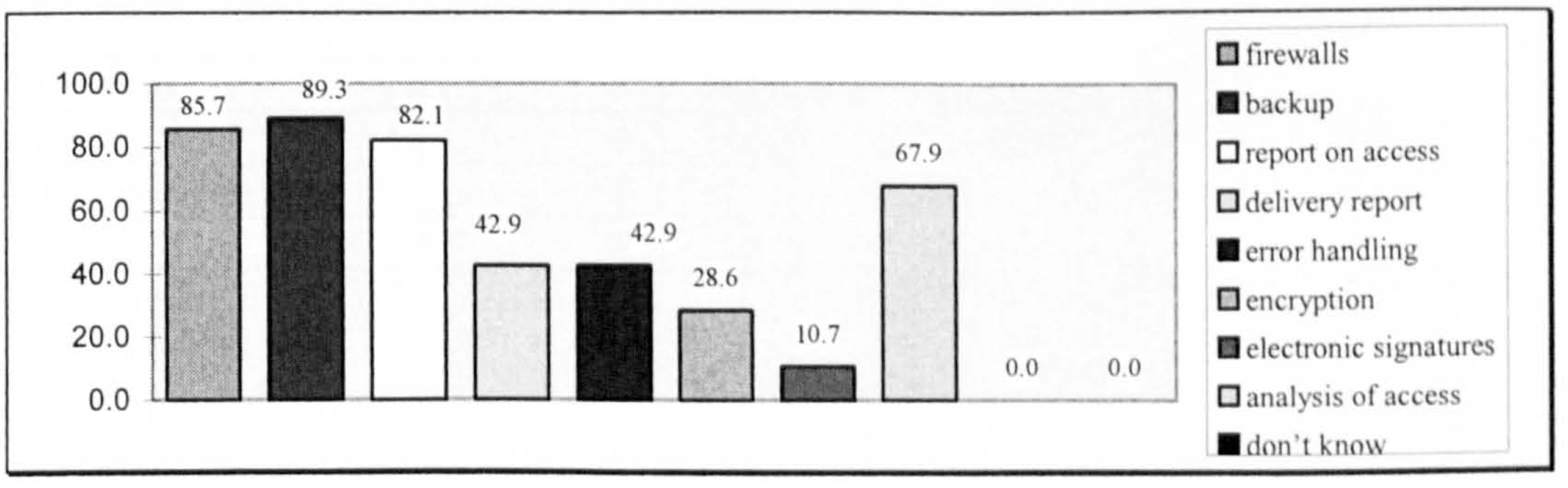


Fig. 11: Security measures in place

Variable: *Information and Communication Technologies Features (ICT features)*

- *information and communication features as a major advantage*

The results from the analysis of that question can be categorised into four major groups. The first one comprises these ICT features that are considered to be of major advantage for more than 75% of the respondents. These include availability of network resources (89%) and internal integration (79%). Such a response rate confirms the raising importance of communications technologies as a media for linking organisational resources, such as people, tools and data, as well as a means for transforming business processes and relations.

The second group of electronic communications features, that are estimated as being of advantage by 50%-75% of the participants, includes features such as flexibility (61%), backup (61%) and remote access (57%). These characterise the growing appreciation of flexible coupling to other information resources and some gathered experience in reducing the risk of losing electronically stored information.

The low rating of features such as security (21%), gateways (29%) and firewalls location (32%) can be linked to another the rating of integration with partners (46%) and be explained with the employment of ICTs mostly for supporting internal processes rather than processes that span the boundaries of the organisation.

	Frequency	% of all
availability of network resources	25	89.3
working times	7	25.0
internal integration	22	78.6
integration with partners	13	46.4
security	6	21.4
monitoring	9	32.1
flexibility	17	60.7
remote access	16	57.1
full utilisation	8	28.6
training	10	35.7
help desk	13	46.4
regular upgrade	9	32.1
backup	17	60.7
gateways	8	28.6
firewalls location	9	32.1
feedback policy	4	14.3
automatic contact database	9	32.1
other	0	0.0

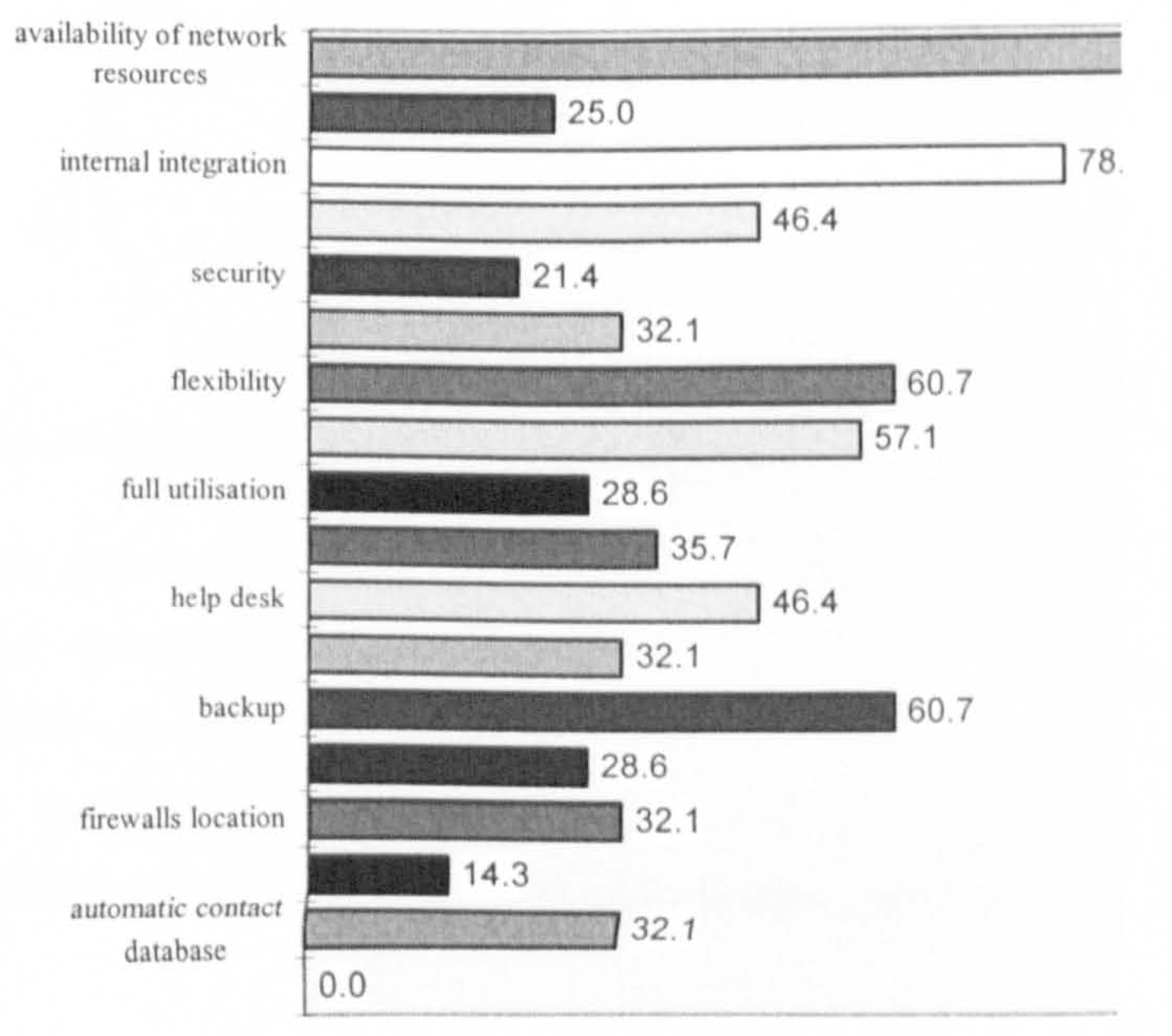


Fig. 12: Major advantages of ICI in place

Variable: ***Partners***

- *support of electronic collaboration with partners*

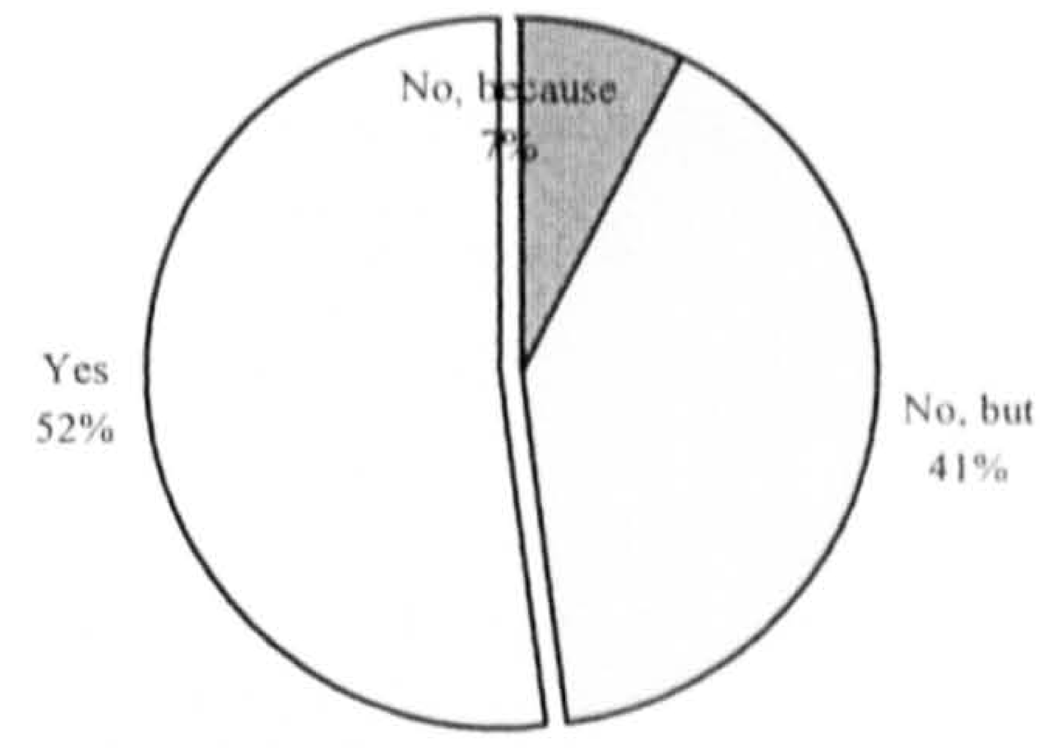


Fig. 13: Electronic collaboration with partners

52% of the respondents are electronically integrated with their partners. These electronically mediated relationships include activities such as data/ results transfer, planning and scheduling. The objective is to achieve economy and efficiency in routine activities.

These results point out that electronic integration practices in the NHS are only in the form of electronic information exchange. Sharing of common information resources using the opportunities offered by ICT was not declared in any of the answers. Furthermore, the objectives reflect an internal to the organisation focus on managing the quality of performance, rather than a proactive outwards approach to redesigning business processes through integration with business partners.

Variable: ***Customers***

- *electronic collaboration with customers*

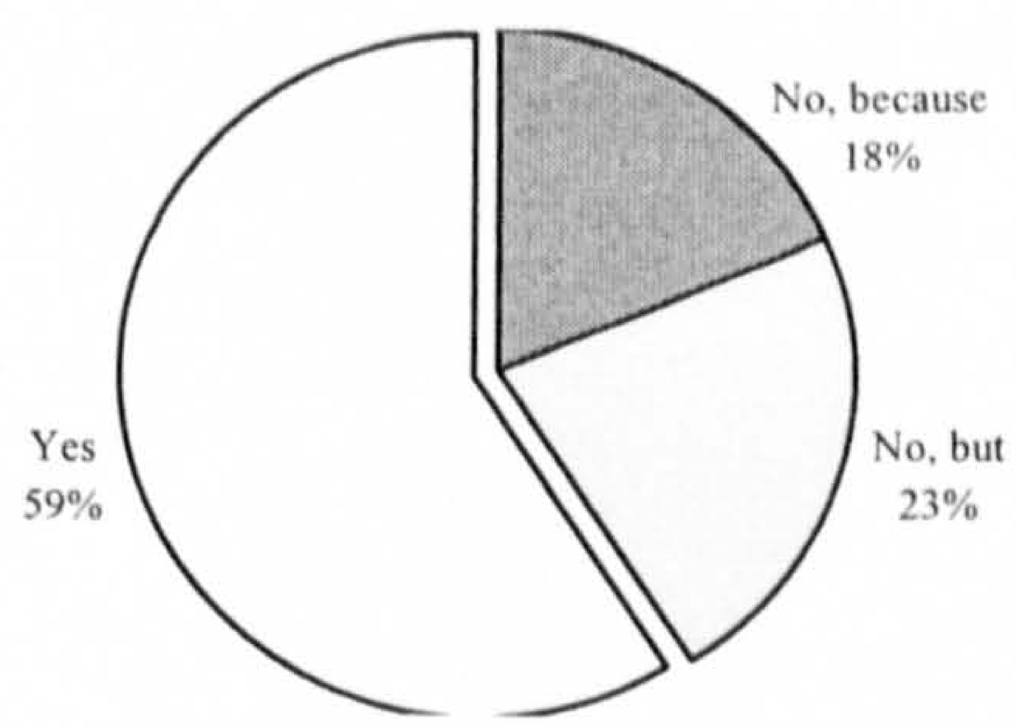


Fig. 14: Electronic collaboration with customers

The term 'customers' was used in the questionnaire to denote both individuals, i.e. patients, and business customers, i.e. clients.

Those of the respondents who answered that the IC infrastructure in their organisation supports electronic integration with customers, specified that it was for providing economy and efficiency as well as customer feedback. As with the previous variable (*partners*) in the research sample the objectives are more in the range of Total Quality Management, and shows use of communications technologies for automating business functions, rather than redesigning them through the use of ICT. This, however, shows that there is awareness of the capabilities of electronic communication technologies and the first steps towards incorporating them in the everyday business life are already made.

Variable: ***Roles***

This variable was introduced to assist further research on information systems for network organisations and building up a model of the NHS as such a business network. The respondents were asked to distinguish the roles of their business partners. The answers build up a spectrum of the role perceptions in the NHS, that were further grouped into three large groups indicating the relationship between the role as indicated and the NHS sector. The spectrum comprises the following categories:

Within NHS at the same hierarchical level	Within NHS at a different hierarchical level	Outside NHS
• acute care providers	• NHS Executive	• IT/service suppliers
• primary care providers	• Department of Health	• payroll suppliers
• community care providers	• Prescription pricing	• legal services
• NHS trusts	• Healthcare commissions	• patients
• Health Authorities	• Healthcare institutes	
• GP practices	• Social services	

Variable: ***New***

- ***IT as an enabler of organisational transformation***

It is perceived that IT enables mostly the cross-functional work of teams, empowers employees and their *multi-task work, and flattens organisational* hierarchy. The comparatively low rating of IT as an enabler of partner's collaboration indicates that the utilisation of IT in the NHS *is primarily internally focused.*

The comments to the question testing the awareness of IT as an enabler of organisational transformation, reflect that there is still lack of common language in-between the business and the IS/IT community. This is also a reflection of the culture differences which exist between those two groups within the NHS. Such differences may hinder the development of internal integration of the organisation, and its integration with partners and clients. Creating a common understanding of the organisational mission, strategy and operations amongst business and IS/IT specialists, is of extreme importance for making the most of current and future collaborative work. This is of utmost relevance when this work is mediated by information and communication technologies.

	Frequency	% of all
flat organisational hierarchy	11	39.3
cross-functional teams	13	46.4
multi-tasked employees	12	42.9
empowered employees	12	42.9
empowered teams	9	32.1
customer focus	9	32.1
partner's collaboration	4	14.3
none	1	3.6
other	0	0.0

Central tendency: Cross-functional teams

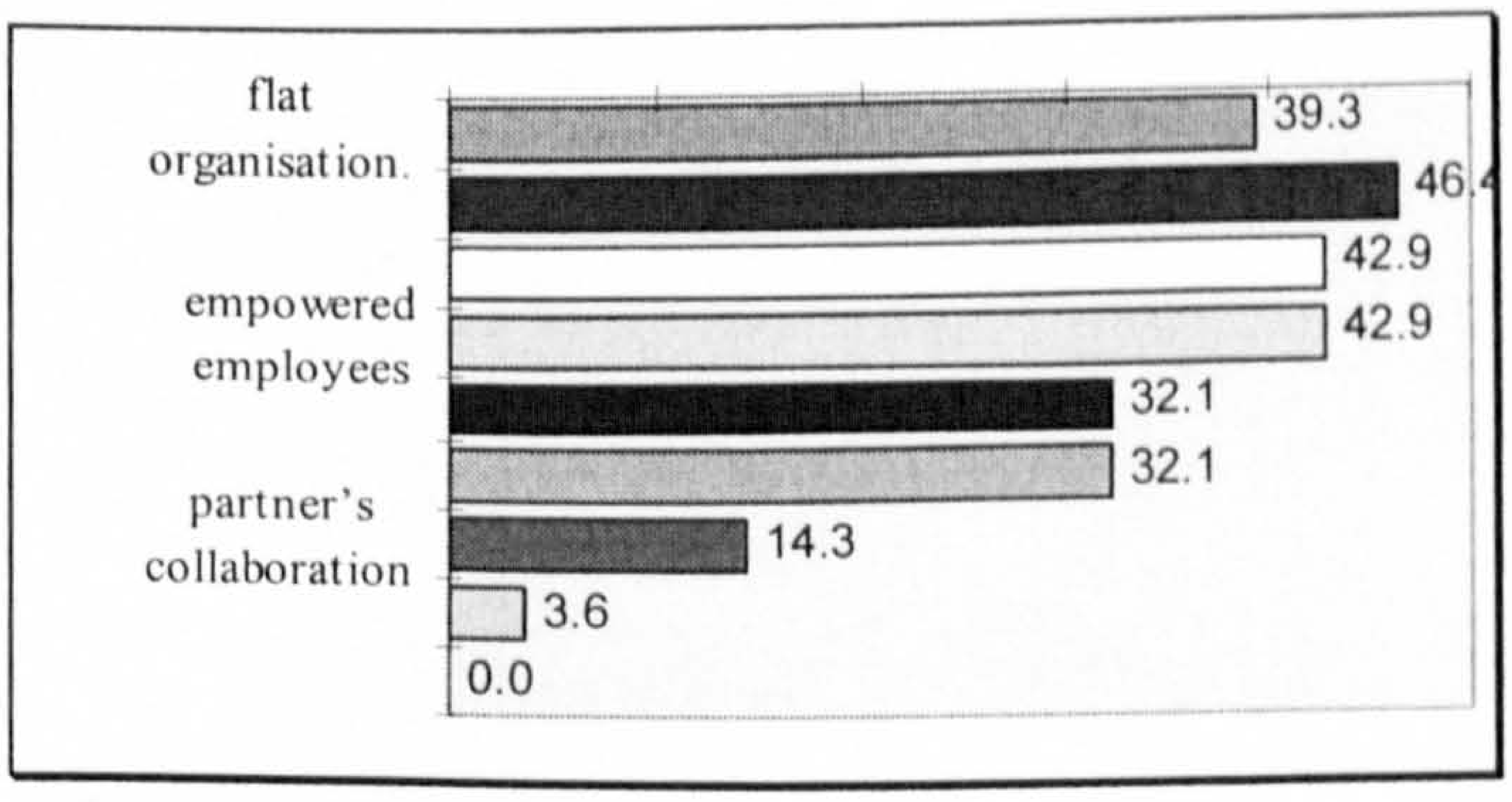


Fig. 15: Organisational transformation

Variable: ***ICI***

- ***information and communication infrastructure outlining***

	Frequency	%
Process	5	19.2
Function	13	50.0
Data	5	19.2
All three	3	11.6

Central tendency: 50 % of the respondents replied that their organisations are function oriented.

The results disagree with the initial expectation that the dominant orientation within the NHS network was process-based. This shows that when undertaking electronic integration initiatives, a process modelling of the organisation has to take place.. It could then be used as a basis in expanding the focus from internal to a network perspective to incorporate the relationships of the organisation with the other participants in the NHS network.

Appendix A.5

Subject: Re: The Information FrameWork
Date: 26 Jul 97 19:23:04 EDT
From: Roger Evernden <100035.3236@CompuServe.COM>
To: "INTERNET:mbobeva@bournemouth.ac.uk" <mbobeva@bournemouth.ac.uk>

Thank you for your e-mail. I am sorry for the delay in replying to you, but I have been travelling extensively in places that don't have such good e-mail access!!

Your research sounds very interesting and I am keen to support you through discussing my own experiences and research. The Systems Journal article was probably two years out-of-date when it was published due to the review procedures, etc. Much of the research behind the Information FrameWork (IFW) came out of my own experiences and those of my colleagues at WorkSpace International Ltd. The IFW is still being used by IBM as the foundation for much of its work in the financial sector. There are now 130+ licences for the use of IFW and the various models that populate the framework. Many licences cover more than one bank, so this is about 200-300 banks around the world, some of which have completed more than 40 projects using IFW - maybe a total of 1,000 projects or more. So it is still very much alive and well.

We have extended many of the concepts and practice - both in the work with IBM and independently in WorkSpace International.

I am keen to know how you got interested in this topic. Was it through some experiences of your own or through material provided by the university? I am always keen to read new ideas and research in this area, so if you have any suggestions from your own research or from the work of your supervisor, colleagues, etc. ..... please let me know.

As to how we might proceed. My company, WorkSpace, is based in Southampton, although I am often travelling on business. I will be in Southampton during next week - so perhaps you could call me. The easiest way during the day would be my mobile 0410 467 880. Evenings you should be able to catch me on 01703 583936. The WorkSpace office is 01703 678309. The best days next week would be Tuesday, Thursday or Friday. After that I am in Thailand for three weeks!

Apart from being able to discuss the intellectual foundations for things like the Information FrameWork you may be interested in participating in client projects to see how it "works" in practice (not always perfectly, but that is the learning cycle).

I hope to hear from you during the week. If it doesn't work out, send me an e-mail with the best times to contact you, etc. and I'll get in touch.

All the best

Roger Evernden

Appendix B:

Research strategy v.2 (Multiple case studies)

B.1. Responses from Ladbrokes to the invitation for participation (Dec 1999)

B.2. Responses from SLB to the invitation for participation (Jan 2000)

B.3. Responses from Tesco to the invitation for participation (Feb 2000)

SUMMARY

The second version of the research strategy replicated many of the features of the NHS version described in Appendix A, mainly a multi-paradigm theory-building approach (Gioia & Pitre 1990) integrating a conceptual analysis based on secondary research, with an empirical investigation from multiple case studies in different market sectors. Data sources such as interviews, archives and observation were considered. The initial sampling frame was extended with another sample selection criteria, i.e. participants should belong to different market sectors. Thus the strategy aspired to eliminate any bias which may occur from surveying one market sector only.

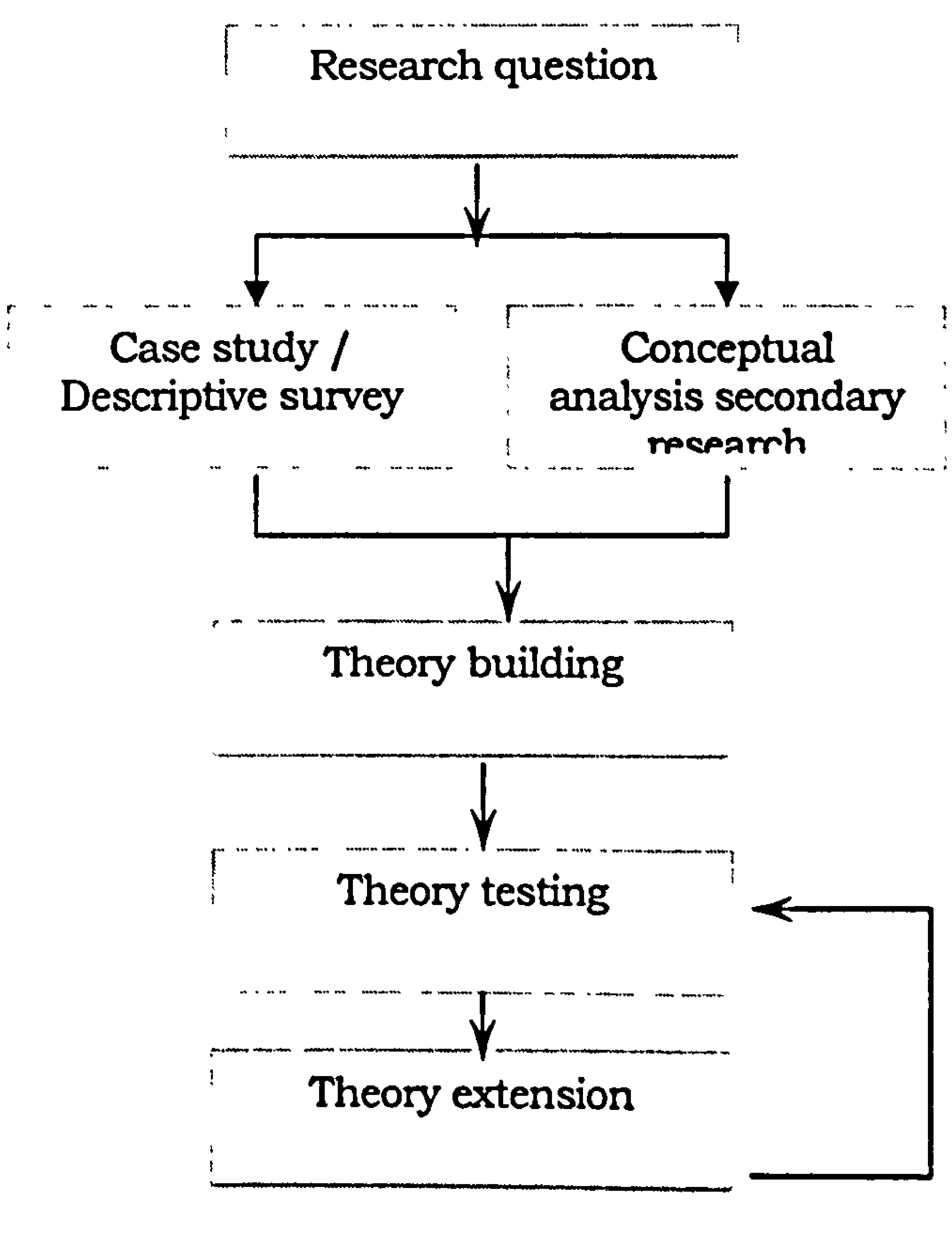


Fig.B.1: Theory building strategy, version 2

A non-probability sampling technique was chosen, in particular, *advertising* sampling (Hussey & Hussey 1997), as the participants were shortlisted through research on publications in professional IT magazines, such as Computing, Business Week, Computer Weekly, and through observation of presentations on IS-focused conferences for business professionals organised by Business Intelligence. *Extreme case* purposive sampling (Sanders *et. al. 2000)* was used in the second sampling round, targeting companies that has already reported positive experience with implementing e-business networks.

The notion was that the best practice could provide insights in the differences, if any, between information architecture for enterprises and this for business networks. Four companies were chosen – Barclays, as a representative of the financial and banking services sector; Tesco, from the retail sector, the bookmaker Ladbrokes, from the betting and gambling sector and SLB, from the electronic components manufacturing sector. A conference speaker from Barclays was approached for an informal interview, in which the research was briefly presented and an agreement for further study using Barclays as a case study was sought. The proposal was declined on the basis of the security and confidentiality needed to ensure the competitive position of the company. The IT directors of the other three companies were approached with a letter, introducing the research and an invitation to take part in the study. Three of the people declined unequivocally the invitation (Appendix B1-B3), whilst the fourth response although still negative, offered some option for discussion. However, it was made clear that a case study based on this organisation was not to be allowed. Should any of the four responses were positive, the author would have pursued this strategy further, trying to find other suitable case studies. Given the circumstances this option was considered impractical. However, throughout the period of working on this strategy the initial version of the conceptual review of IA for e-business networks was developed, that was further developed through the implementation of the third theory-building strategic option. The complete IA review is presented in Chapter 4.

Ladbrokes

Ladbroke Racing Limited
Imperial House Imperial Drive
Rayners Lane Harrow Middlesex HA2 7JW
Telephone 0181 868 8899 Telex 923073
Facsimile 0181 868 8767

Our Ref: PU/AJD

24 December 1999

Mrs M Bobeva
Business School
Bournemouth University
Talbot Campus
Bournemouth BH12 5BB

Dear Mrs Bobeva

Thank you for your letter dated 20 December in connection with information architecture for business networks.

Unfortunately I have enormous pressures on my time currently, and am therefore unable to help you on this occasion.

However, I would like to thank you for taking the trouble to write and wish you success in your research.

Yours sincerely

[anonymised]
IT DIRECTOR

INVESTOR IN PEOPLE

Milena Bobeva

From: l@selnet.co.uk]
Sent: 11 January 2000 14:14
To: 'Milena Bobeva'
Subject: RE: Research

As I recall, I don't think I agreed to a meeting, but suggested that we would not be able to help very much. To be honest, it was a while ago and I don't remember what it was about. Please remind me and I will let you know if I can spare the time.

Managing Director
http://www.slb.co.uk
http://www.selnet.co.uk

-----Original Message-----
From: Milena Bobeva [SMTP:mbobeva@bournemouth.ac.uk]
Sent: 10 January 2000 16:29
To:
Subject: RE: Research

Dear Mr.

Thank you so much for agreeing to take part in my research.
Please let me know of convenient dates and times for a meeting.
I would appreciate if you would consider for the meeting to take place between 11am to 3pm to allow for travel time.

Looking forward to hearing from you,

Kind regards,
Milena
Milena Bobeva
IS Department, Business School
Bournemouth University, UK
tel.(01202)595193
e-mail: mbobeva@bournemouth.ac.uk

-----Original Message-----
From:
Sent: Thursday, December 23, 1999 11:20 AM
To: 'mbobeva@bournemouth.ac.uk'
Subject: Research

Further to your request for an interview, although we consider ourselves to be at the leading edge of such technology, sadly the rest of our industry is not and we therefore cannot offer any insight to e-trading with our customers or suppliers, other than how we are able to do it and how we would like to do it.
However, I have been in the IT industry for many years and can certainly specify the requirements.
You may decide for yourself if we would be suitable.

Managing Director
http://www.slb.co.uk
http://www.selnet.co.uk

TESCO

Tesco House,
Delamare Road,
Cheshunt,
Hertfordshire EN8 9SL
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Extension:
Direct Line: 01992
Facsimile: 01992

Our Ref: IOR/ac
Direct Dial: 01992 644012
Direct Fax: 01992 646623

Mrs Milena Bobeva
Business School
Bournemouth University
Talbot Campus
Bournemouth
BH12 5BB

1st February 2000

Dear Mrs Bobeva

Thank you for your letter dated 20th December regarding PhD research on Information Architecture for Business Networks.

Unfortunately I am not able on this occasion to help with your research as my diary is very busy.

May I take this opportunity to wish you all the best in this project and to thank you for the interest in our company.

Best wishes

Yours sincerely
For and on behalf of
TESCO STORES LTD

Group IT Director

Appendix C:

Evaluation of the framework

C.1: Companies represented in the Delphi study

C.2: Students questionnaire for collecting participant's data

C.3: Delphi Round 1

a) Supporting letter

b) Questionnaire

C.4: Delphi Round 2

a) Supporting letter

b) Questionnaire

C.5: Delphi Round 3

a) Supporting letter

b) Questionnaire

C.6: Electronic survey:

a) E-mail invitations

b) Electronic survey (Web version)

c) Completed questionnaire (with comments)

C.7: Interviews: Frequencies of codes

Participants in the Delphi Study

No.	Company name	Represented by
1	BMW (GB) Ltd.	Marketing Manager
2	British Airways	Systems Development Exec
3	CAPITA Business Services	Pre-sales Support Consultant
4	COGENT Investment Operations Ltd.	Applications Architecture/PM
5	COGENT Investment Operations Ltd.	IS Project Manager
6	Crown Agents	Crown Agents
7	GLAXOSMITHKLINE	Resourcing Manager
8	Hewlett-Packard Ltd.	GIIO UK Operations Manager
9	Integrated Control Systems Ltd.	Project Manager
10	INTEL Corporation (UK) LTD	DSS Teamleader
11	KODAK Ltd.	Manager MFG Systems
12	Poole Hospital NHS Trust	IT Project Manager
13	PORTMAN Building Society	Programme Manager
14	PRISM Data Management	Data Services Manager
15	Royal & Sun Alliance	Executive Office Manager
16	SAFEWAY Stores PLC	Project Manager
17	TYCO Electronics	Sales Systems Manager
18	Urban Science	Senior Project Manager
19	Not known	Anonymous

Participants Sampling

Please describe the nature of your work during placement with regards to the information that you received used and processed.

1. Organisational work patterns *(Please circle one of the answers, or write in the provided space.)*

(1) E-mail access: *available to all* *restricted to certain people* *N/A*

Other: ....

(2) Access to the Internet *available to all* *restricted to certain people* *N/A*

Other: ....

(3) Network: *ISDN* *dial-up*

Other: ....

(4) Access to corporate intranet *available to all* *restricted to certain people* *N/A*

Other: ....

(5) Use of extranet

For what purposes: ....

How frequently: ....

2. Information *(Please circle all applicable answers.)*

(1) Preferred storage media *electronic* *paper*

(2) Origin (Inputs) *Internal* *from customers* *from business partners*

(3) Destination (Outputs) *Internal* *from customers* *from business partners*

3. Line manager *(Please write in the provided space or circle your preferred answer.)*

(1) Name ....

(2) Department/Organisation ....

(3) Location ....

(4) Personality (*open, willing to spend time on discussing issues will be ranked with 5*) 1 2 3 4 5

Other comments: ....

(5) E-mail friendliness 1 2 3 4 5

(6) Internet-friendliness 1 2 3 4 5

Please fill in your name: ....

The survey results are confidential.

Gazing into the Oracle

A Delphi Study on Information Architecture

Round 2

Vice-Chancellor:
Professor Gillian L Slater
MSc MA DPhil CMath
FIMA FRSA

The Business School

Head of School
Professor David Jones
BA (Hons) PhD

Dear Mr. Ponting,

Thank you warmly for taking part in the Delphi study on information architecture for business networks. I highly appreciate the invested time and effort.

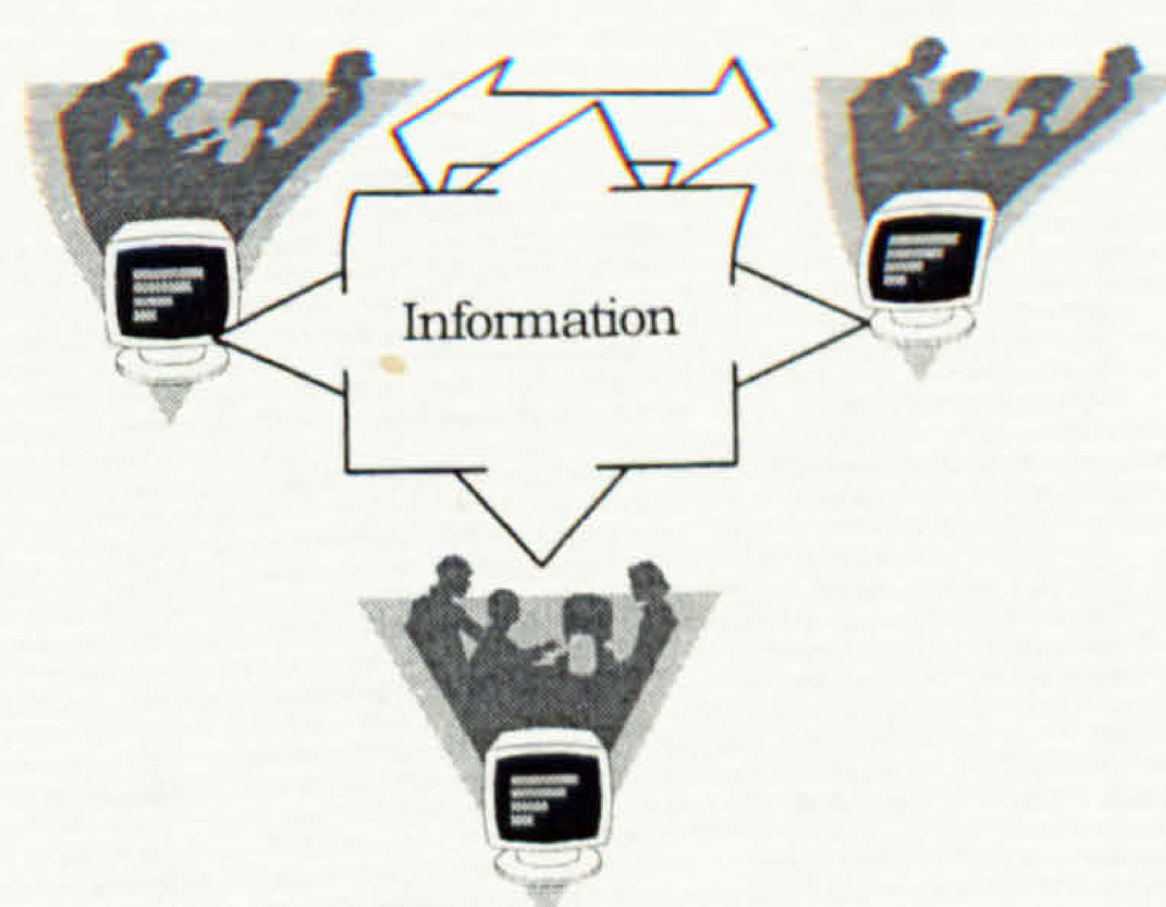
I am enclosing the results of the questionnaire showing the average *Desirability* and *Feasibility* ratings given by the first round respondents to the issues included in the questionnaire. For your convenience, your personal ratings from the first questionnaire are listed next to each issue. The rate is based on a 1 to 10 scale, where 10 indicates the most desirable/feasible issue(s) and 1 indicates the least desirable/feasible issue(s).

Given the average rating scored in the first round, please RE-RATE these issues or CONFIRM your score using the same 1 to 10 scale. Feel free to suggest amendments, argue in favour of or against issues or ask questions.

I would greatly appreciate if you return your questionnaire, even if not fully completed, at the earliest possible time using the enclosed addressed envelope.

Thank you kindly for your time.

Your participation means a lot for the success of this project.



Milena Bobeva
IS Group, Business School
Bournemouth University

The Business School Christchurch House Talbot Campus Fern Barrow Poole Dorset BH12 5BB UK
Telephone: +44 (0) 12 02 52 41 11 Fax: +44 (0) 12 02 59 57 18 email: business@bournemouth.ac.uk

Thank you for answering the questions related to information architecture. Please complete the following information about yourself and your company that will be help me to analyse the information you provided. For each question, please tick the appropriate answer.

- Does your department/group share* information across the organisation? ❐ No ❐ Yes, in electronic & paper format ❐ Yes, in paper format only
- Does your department/group share* information with other organisations? ❐ No ❐ Yes, in electronic & paper format ❐ Yes, in paper format only
- Does your department/group share* information with customers? ❐ No ❐ Yes, in electronic & paper format ❐ Yes, in paper format only

* *'Share' here is used in the sense of sharing the ownership, i.e. each of the parties could amend the information.*

Please enter your contact s details or attach a business card and return the questionnaire in the provided envelope.

Name:	Title:	Position: ....
Company:		Tel.: ....
Address: .... Post code:	E-mail address (if applicable): .... WWW URL (if applicable): .... Preferred method(s) of communicating: ❐ by e-mail ❐ via Web page ❐ by post	

Please indicate whether you would like a copy of the final results of the study: ❐ Yes ❐ No

Thank you warmly for taking the time to fill in the questionnaire. Should you have any queries regarding this study, please do not hesitate to contact me via e-mail on: *mbobeva@bournemouth.ac.uk*

Best wishes,

Milena Bobeva

	Things you want to know/need to know about the information you use	Your view on (Please mark: ① Least important – ⑩ Most important)		Your comments
	Brief description	Desirability	Feasibility	*Suggested changes, arguments, questions*
1	Knowing who **the source or recipient** of the information is;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
2	Knowing which **team/department/organisation** is the source/recipient of the information; Is it **internal or external** for the organisation;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
3	Knowing what is **the role of the source/recipient** within the project;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
4	Knowing what **processes** use this information;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
5	Knowing what **the importance of the information** (e.g. strategic/operational/ general; administrative; adding to organisational or personal knowledge) is;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
6	Knowing what **risks** exist related to this information; What **security measures** are needed for this information on the sender's/recipient's side;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
7	Knowing who **the "owner"/originator of this information** is;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
8	Knowing who **the controller of the quality/performance** of the information is;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
9	Knowing whether the information is **stable or dynamic**; How often it is upgraded;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
10	Knowing what is the **format of the information carrier** (e.g. text file, diagram, spreadsheet, presentation, document image, image);	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
11	Having **access to the information in electronic format**, rather than paper or verbally;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
12	Knowing what is the **style** of the information (e.g. formal, informal, personal); How structured is it;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	

M.Bobeva (mbobeva@bournemouth.ac.uk)
IS Group, Bournemouth University Business School

Things you want to know/need to know about the information you use		Your view on — Please mark ① Least important ⑩ Most important		Your comments
	Brief description	Desirability	Feasibility	Suggested changes, arguments, questions
13	Knowing the **level of aggregation**, i.e. how detailed or summarised the information is;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
14	Knowing how **current/up-to-date** the information is;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
15	Knowing **how the information is described** (e.g. what languages, models, tools are used to describe and process the information);	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
16	Knowing whether **templates** are available for this information and if so, **how to obtain** them;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
17	Knowing what **events** affect this information (e.g. year end);	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
18	Knowing What is the **type of information** (e.g. hidden, tacit, explicit, implicit);	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
19	*Knowing What is the **status** before and after any use;*	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
20	Having **measures of the quality** of the information; Knowing what the key performance indicators for this information are; Whether best practice is recorded;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
21	Knowing the **cost** of the information;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
22	Knowing whether there are any **ethical considerations** arising from the use/dissemination of the information, and if so what are they;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
23	Knowing whether there are any **legal considerations** related to the information in any stage of its lifecycle, and if so what are they;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
24	Knowing whether there are any **organisational considerations** (e.g. rules on using this information, strategic importance, confidentiality);	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
25	*Knowing what **other information** you use is related to/affected by this information;*	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
26	Knowing what **software** is used to process the information;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	

27	Knowing what **hardware** is used to process the information;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
28	Knowing what **communication media** is used to distribute/receive the information (e.g. protocols, network address, etc.);	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
29	Knowing **who is responsible for the design** of the system providing the information ;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
30	Knowing what **specific skills and competencie**s the processing of the information requires;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
31	Knowing what the **permitted values** for this information are (e.g. default values, synonyms) ;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
32	Knowing of any **incompatibilities** in advance;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
31	Knowing if the information used in a concurrently, *i.e. simultaneously* from different parties;	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	
32	Knowing what *should happen* to this information **after completion** of the task/ the project	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	① ③ ⑤ ⑦ ⑨ ② ④ ⑥ ⑧ ⑩	

Gazing into the Oracle

A Delphi Study on Information Architecture

Round 2

Dear Mr. Pascoe,

Thank you warmly for taking part in the Delphi study on information architecture for business networks. I highly appreciate the invested time and effort.

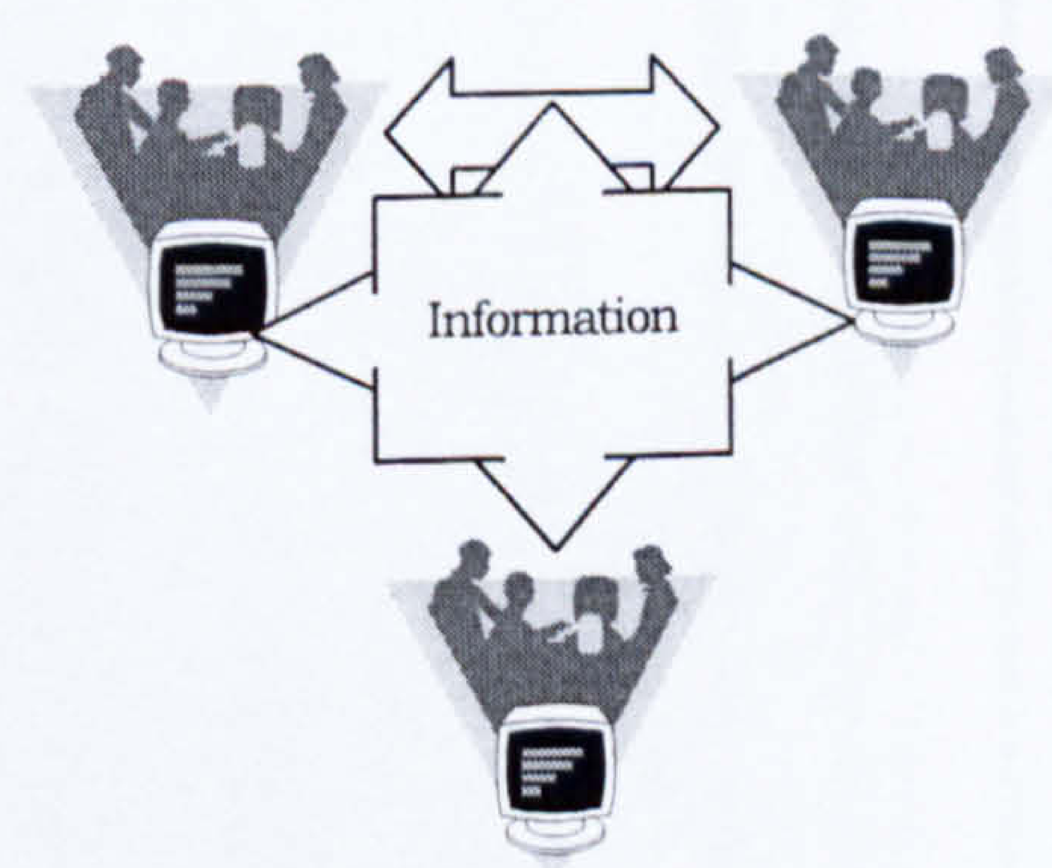
I am enclosing the results of the questionnaire showing the average *Desirability* and *Feasibility* ratings given by the first round respondents to the issues included in the questionnaire. For your convenience, your personal ratings from the first questionnaire are listed next to each issue. The rate is based on a 1 to 10 scale, where 10 indicates the most desirable/feasible issue(s) and 1 indicates the least desirable/feasible issue(s).

Given the average rating scored in the first round, please RE-RATE these issues or CONFIRM your score using the same 1 to 10 scale. Feel free to suggest amendments, argue in favour of or against issues or ask questions.

I would greatly appreciate if you return your questionnaire, even if not fully completed, at the earliest possible time using the enclosed addressed envelope.

Thank you kindly for your time.

Your participation means a lot for the success of this project.



Milena Bobeva

IS Group, Business School

Bournemouth University

	Things you want to know/need to know about the information you use	Desirability 1-least desirable; 10-most desirable			Feasibility 1-least feasible; 10-most feasible			Your comments
		Average score	Your score	New score*	Average score	Your score	New score*	
	Brief description	** Enter new figure or tick to agree*			** Enter new figure or tick to agree*			*Suggested changes et al.,*
1	Knowing who **the source or recipient** of the information is;	8.42			7.89			
2	Knowing which **team/department/organisation** is the source/recipient of the information; Is it **internal or external** for the organisation;	8.74			8.05			
3	Knowing what is **the role of the source/recipient** within the project;	7.56			7.78			
4	Knowing what **processes** use this information;	7.59			6.12			
5	Knowing what **the importance of the information** (e.g. strategic/operational/ general; administrative; adding to organisational or personal knowledge) is;	8.16			7.78			
6	Knowing what **risks** exist related to this information; What **security measures** are needed for this information on the sender's/recipient's side;	8.16			7.28			
7	Knowing who **the "owner"/originator of this information** is;	7.42			7.61			
8	Knowing who **the controller of the quality/performance** of the information is;	7.00			6.58			
9	Knowing whether the information is **stable or dynamic**; How often it is upgraded;	8.89			7.32			
10	Knowing what is the **format of the information carrier** (e.g. text file, diagram, spreadsheet, presentation, document image, image);	7.58			8.32			
11	Having **access to the information in electronic format**, rather than paper or verbally;	8.16			8.05			
12	Knowing what is the **style** of the information (e.g. formal, informal, personal); How structured is it;	6.26			7.11			
13	Knowing the **level of aggregation**, i.e. how detailed or summarised the information is;	7.00			6.68			
14	Knowing how **current/up-to-date** the information is;	8.79			8.26			
15	Knowing **how the information is described** (e.g. what languages, models, tools are used to describe and process the information);	7.06			6.65			
16	Knowing whether **templates** are available for this information and if so, **how to obtain** them;	6.44			7.22			
17	Knowing what **events** affect this information (e.g. year end);	8.88			7.59			

	Things you want to know/need to know about the information you use	Desirability *1-least desirable; 10-most desirable*			Feasibility *1-least feasible; 10-most feasible*			Your comments
		Average score	Your score	New score*	Average score	Your score	New score*	
	Brief description	** Enter new figure or tick to agree*			** Enter new figure or tick to agree*			*Suggested changes, arguments, questions*
18	Knowing What is the **type of information** (e.g. hidden, tacit, explicit, implicit);	6.58			6.11			
19	Knowing What is the **status** before and after any use;	7.00			6.05			
20	Having **measures of the quality** of the information; Knowing what the key performance indicators for this information are; Whether best practice is recorded;	7.47			6.58			
21	Knowing the **cost** of the information;	7.05			6.84			
22	Knowing whether there are any **ethical considerations** arising from the use/dissemination of the information, and if so what are they;	7.32			6.21			
23	Knowing whether there are any **legal considerations** related to the information in any stage of its lifecycle, and if so what are they;	9.00			7.58			
24	Knowing whether there are any **organisational considerations** (e.g. rules on using this information, strategic importance, confidentiality);	8.11			7.05			
25	Knowing what **other information** you use is related to/affected by this information;	7.53			5.74			
26	Knowing what **software** is used to process the information;	5.89			7.11			
27	Knowing what **hardware** is used to process the information;	5.32			7.00			
28	Knowing what **communication media** is used to distribute/receive the information (e.g. protocols, network address, etc.);	5.74			6.95			
29	Knowing **who is responsible for the design** of the system providing the information ;	5.68			6.79			
30	Knowing what **specific skills and competencie**s the processing of the information requires;	6.84			6.26			
31	Knowing what the **permitted values** for this information are (e.g. default values, synonyms) ;	6.67			6.56			
32	Knowing of any **incompatibilities** in advance;	7.79			5.89			
33	Knowing if the information used/changed concurrently, i.e. simultaneously from different parties;	6.72			5.47			
34	Knowing what should happen to this information **after completion** of the task/ the project	6.95			6.21			

Thank you for answering the questions related to information architecture. Please complete the following information about yourself and your company that will be help me to analyse the information you provided. For each question, please tick the appropriate answer.

Thank you warmly for taking the time to fill in the questionnaire. Should you have any queries regarding this study, please do not hesitate to contact me via e-mail on: *mbobeva@bournemouth.ac.uk*

Best wishes,

Milena Bobeva

Gazing into the Oracle

A Delphi Study on Information Architecture

Round 3

Dear

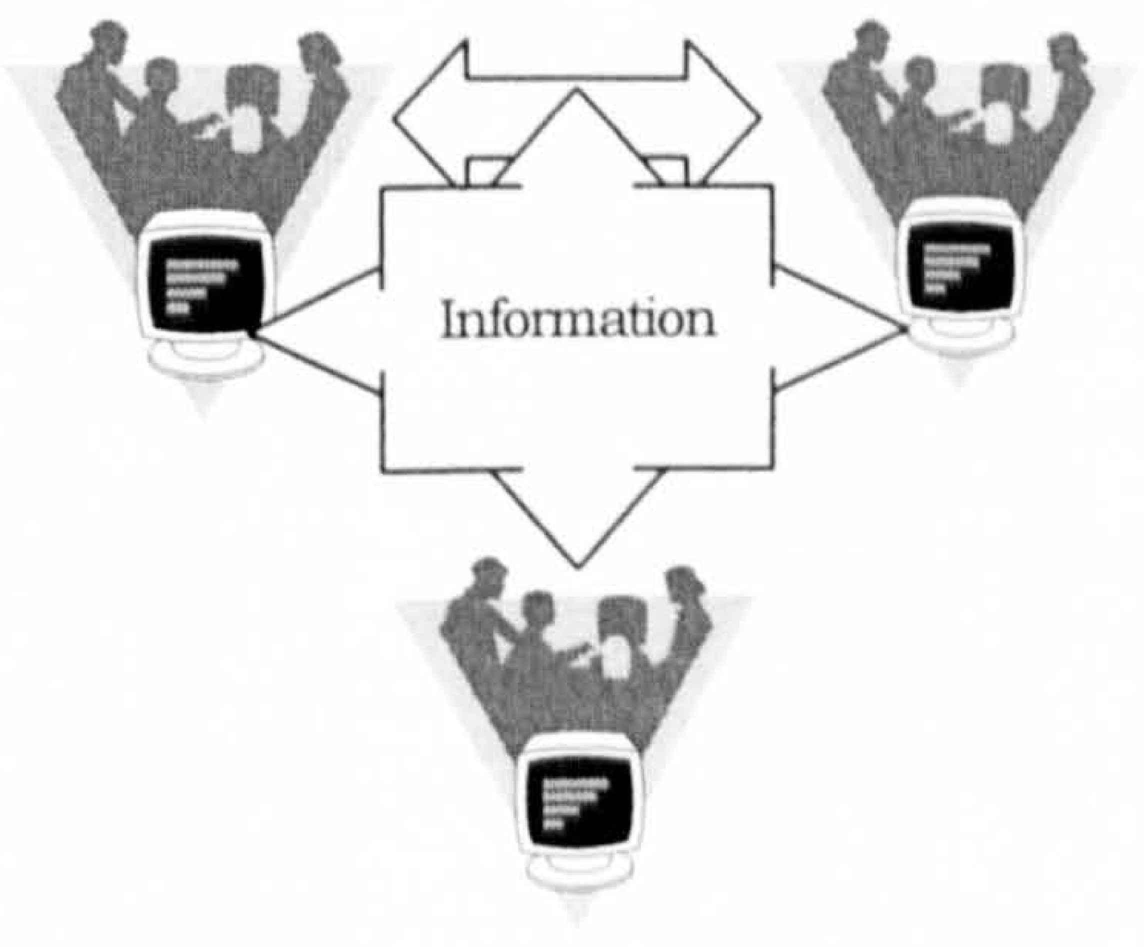
About a year ago you took part in the second round of a Delphi study on information architecture for business networks. I highly appreciate your views and the time and effort you invested in helping my research, thank you. The results indicate that there is a high level of convergence on the answers. However, the chosen research method, a Delphi study, suggests that to improve the quality of the research the results of the second round should also be presented to your attention.

The enclosed questionnaire shows the mean *Desirability* and *Feasibility* results from the second round and your ratings for each issue. The rate is based on a 1 to 10 scale, where 10 indicates the most desirable/feasible issue(s) and 1 indicates the least desirable/feasible issue(s).

Given the average rating scored in the second round, please review your score using the same 1 to 10 scale. Feel free to suggest amendments, argue in favour of or against issues or ask questions.

I would greatly appreciate if you return your questionnaire at the earliest possible time using the enclosed addressed envelope.

Thank you kindly for your time.
Your participation means a lot for the success of this project.



Milena Bobeva
IS Group, Business School
Bournemouth University

	Andy Spurrell, CAPITA Business Services Things you want to know/need to know about the information you use	Desirability *1-least desirable; 10-most desirable*			Feasibility *1-least feasible; 10-most feasible*			Your comments
		Average score	Your score	New score*	Average score	Your score	New score*	
	Brief description	** Enter new figure or tick to agree*			** Enter new figure or tick to agree*			*Suggested changes et al.,*
1	Knowing who **the source or recipient** of the information is;	7.83	10		7.83	10		
2	Knowing which **team/department/organisation** is the source/recipient of the information; Is it **internal or external** for the organisation;	8.83	10		8.33	10		
3	Knowing what is **the role of the source/recipient** within the project;	7.50	10		8.25	8		
4	Knowing what **processes** use this information;	7.82	10		5.73	8		
5	Knowing what **the importance of the information** (e.g. strategic/operational/ general; administrative; adding to organisational or personal knowledge) is;	8.75	10		7.92	9		
6	Knowing what **risks** exist related to this information; What **security measures** are needed for this information on the sender's/recipient's side;	8.17	10		6.92	8		
7	Knowing who **the "owner"/originator of this information** is;	7.33	9		7.83	8		
8	Knowing who **the controller of the quality/performance** of the information is;	7.08	10		6.17	6		
9	Knowing whether the information is **stable or dynamic**; How often it is upgraded;	9.17	10		7.25	7		
10	Knowing what is the **format of the information carrier** (e.g. text file, diagram, spreadsheet, presentation, document image, image);	7.42	6		8.25	10		
11	Having **access to the information in electronic format**, rather than paper or verbally;	8.00	10		7.75	9		
12	Knowing what is the **style** of the information (e.g. formal, informal, personal); How structured is it;	6.00	9		7.33	7		
13	Knowing the **level of aggregation**, i.e. how detailed or summarised the information is;	7.00	8		6.42	8		
14	Knowing how **current/up-to-date** the information is;	8.67	10		7.92	10		
15	Knowing **how the information is described** (e.g. what languages, models, tools are used to describe and process the information);	6.20	8		6.10	8		
16	Knowing whether **templates** are available for this information and if so, **how to obtain** them;	5.45	4		7.00	6		
17	Knowing what **events** affect this information (e.g. year end);	8.91	9		7.00			

	Andy Spurrell, CAPITA Business Services Things you want to know/need to know about the information you use	Desirability 1-least desirable; 10-most desirable			Feasibility 1-least feasible; 10-most feasible			Your comments
		Average score	Your score	New score*	Average score	Your score	New score*	
	Brief description	** Enter new figure or tick to agree*			** Enter new figure or tick to agree*			*Suggested changes et al.,*
18	Knowing What is the **type of information** (e.g. hidden, tacit, explicit, implicit);	5.83	3		5.75	3		
19	Knowing What is the **status** before and after any use;	6.75	9		5.42	9		
20	Having **measures of the quality** of the information; Knowing what the key performance indicators for this information are; Whether best practice is recorded;	7.33	4		6.17	7		
21	Knowing the **cost** of the information;	6.58	8		6.75	8		
22	Knowing whether there are any **ethical considerations** arising from the use/dissemination of the information, and if so what are they;	7.50	5		6.17	5		
23	Knowing whether there are any **legal considerations** related to the information in any stage of its lifecycle, and if so what are they;	9.08	9		7.33	7		
24	Knowing whether there are any **organisational considerations** (e.g. rules on using this information, strategic importance, confidentiality);	8.42	9		6.92	9		
25	Knowing what **other information** you use is related to/affected by this information;	7.33	7		5.58	7		
26	Knowing what **software** is used to process the information;	5.92	2		7.42	5		
27	Knowing what **hardware** is used to process the information;	4.92	2		6.42	5		
28	Knowing what **communication media** is used to distribute/receive the information (e.g. protocols, network address, etc.);	5.33	2		6.50	5		
29	Knowing **who is responsible for the design** of the system providing the information ;	5.42	1		6.17	5		
30	Knowing what **specific skills and competenci**es the processing of the information requires;	7.00	5		5.50	6		
31	Knowing what the **permitted values** for this information are (e.g. default values, synonyms) ;	5.83	0		5.83	0		
32	Knowing of any **incompatibilities** in advance;	7.33	9		5.83	5		
33	Knowing if the information used/changed concurrently, i.e. simultaneously from different parties;	5.50	6		4.42	6		
34	Knowing what should happen to this information **after completion** of the task/ the project	7.17	9		5.67	5		

Thank You !!!

From: Milena Bobeva
Sent: 11 July 2002 09:50
Subject: Information Architecture for Business Networks

Dear colleague,

As IS academics and practitioners we are well known for our multi-disciplinary view, recognising the diverse and complex nature of the world. However, sometimes, we find it difficult to agree on a common definition, even of core concepts. I want to challenge this perception of the IS community by inviting selected researchers and professionals in the field, such as yourself, to take part in designing the definition of the information architecture needed in networks of organisations. I am looking for the key constituents of an architecture that will ease the formation of dynamic alliances and will allow for seamless integration and sharing of information across global networks such as the Internet.

I would greatly appreciate if you take part in this survey. Your involvement could be only as much as to reply to complete the enclosed questionnaire.

If you are interested in the follow-up discussion of the issues and the ratings they received, please indicate your preferences and provide your e-mail address at the end of the form.

Electronic survey on IA.htm

I hope you enjoy the challenge. Looking forward to hearing from you,

Best regards,

Milena

Milena Bobeva
IS Group, Business School
Bournemouth University, UK
tel.(01202)595193
e-mail: mbobeva@bournemouth.ac.uk

From: Milena Bobeva
Sent: 12 July 2002 11:58
To: **********************
Subject: Information Architecture

Dear colleague,

Following my previous invitation for participation in the survey on information architecture, please find attached the web address for questionnaire.
http://business.bmth.ac.uk/mbobeva/Survey_on_Information_Architecture.htm

Thank you warmly to those of you who expressed interest in the research and let me know of the difficulties they experienced with filling in the form. I hope the version on the web site is more legible and avoids the problems with attachments.

Looking forward to hearing from you,

Best regards,

Milena

Electronic survey v4 - Microsoft Internet Explorer

Address: http://business.bmth.ac.uk/mbobeva/Survey_on_Information_Architecture.htm

INFORMATION ARCHITECTURE FOR BUSINESS NETWORKS

Aim: To define the constituents of the information architecture needed for electronically integrated business networks.

Information rchitecture	"The blueprint of the site upon which all other aspects are built - form, function, metaphor, navigation and interface, interaction, and visual design." HotWired
Business network	A coalition of separate firms or intra-organisational units that are voluntarily working together to achieve a common goal in a more efficient, effective and innovative way.

To give this a consistent context, **imagine** that your own local team is working on a project that also involves teams from other branches of your company and from two other companies, one of which is located abroad. You will be sharing information in the context of the project, using telephone and computer networks - including the Internet. You have had no previous contacts with any of the people making up the other teams and the likelihood of a face-to-face meeting during the project is very small. You want to specify a list of features that the system you are using should provide.

Please rate the desirability of each of the features listed below on a rating scale from 1 to 10, where 10 indicates the most important one(s) and 1 indicates the least important one(s). If you want to suggest amendments, argue in favour of or against issues or ask questions, please write your comments in the space provided after the feature.

The information architecture for the above type of e-business alliance could include:

Feature	Your rating (1-least desirable; 10 - most desirable)	Comments & questions
• The source and recipient of the information;	○ ○ ○ ○ ○ ○ ○ ○ ○ ○ 1 2 3 4 5 6 7 8 9 10	

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Electronic survey v4 - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Size Print Edit

Address http://business.bmth.ac.uk/mbobeva/Survey_on_Information_Architecture.htm Go Links

The information architecture for the above type of e-business alliance could include:

Feature	Your rating (1-least desirable; 10 - most desirable)	Comments & questions
• The source and recipient of the information;	1 2 3 4 5 6 7 8 9 10	
• the team/department/organisation that provide/receive the information; Knowing whether it is internal or external for the organisation;	1 2 3 4 5 6 7 8 9 10	
• the role of the source/recipient within the project;	1 2 3 4 5 6 7 8 9 10	
• the processes that use this information;	1 2 3 4 5 6 7 8 9 10	
• the importance of the information (e.g. strategic/operational/ general; administrative; adding to organisational or personal knowledge);	1 2 3 4 5 6 7 8 9 10	
• the risks related to this information; What security measures are needed for this information on the sender's/recipient's side;	1 2 3 4 5 6 7 8 9 10	
• the "owner"/originator of this information;	1 2 3 4 5 6 7 8 9 10	
• the controller of the quality/performance of the information;	1 2 3 4 5 6 7 8 9 10	
• the nature of the information: stable or dynamic; How often it is upgraded;	1 2 3 4 5 6 7 8 9 10	

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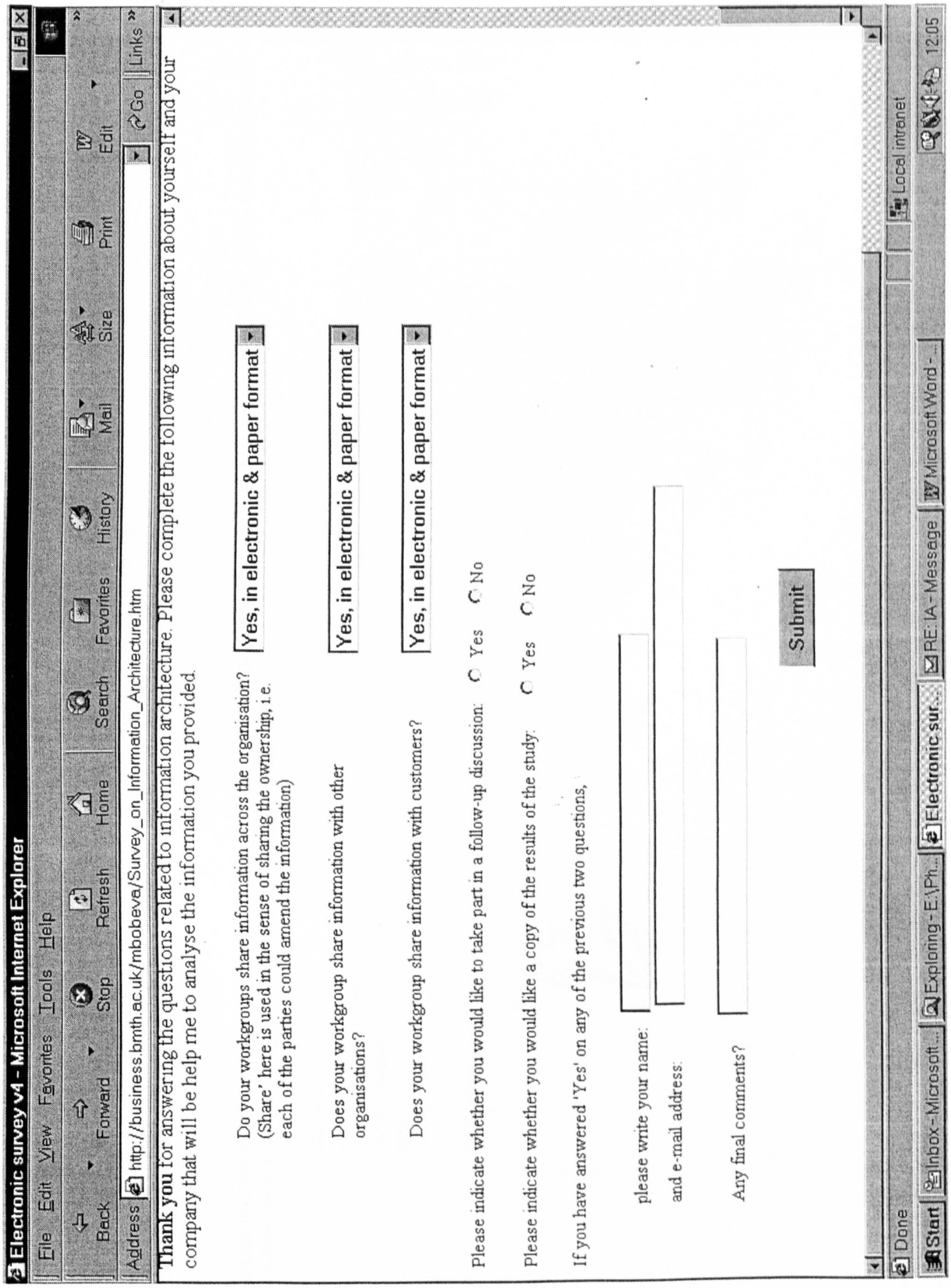
Electronic survey v4 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Size Print Edit
Address http://business.bmth.ac.uk/mbobeva/Survey_on_Information_Architecture.htm
Go Links
Thank you for answering the questions related to information architecture. Please complete the following information about yourself and your company that will be help me to analyse the information you provided.
Do your workgroups share information across the organisation? (Share' here is used in the sense of sharing the ownership, i.e. each of the parties could amend the information)
Yes, in electronic & paper format
Does your workgroup share information with other organisations?
Yes, in electronic & paper format
Does your workgroup share information with customers?
Yes, in electronic & paper format
Please indicate whether you would like to take part in a follow-up discussion: Yes No
Please indicate whether you would like a copy of the results of the study: Yes No
If you have answered 'Yes' on any of the previous two questions,
please write your name:
and e-mail address:
Any final comments?
Submit
Done
Local intranet
Start
Inbox - Microsoft...
Exploring - E:\Ph...
Electronic sur...
RE: IA - Message
Microsoft Word - ...
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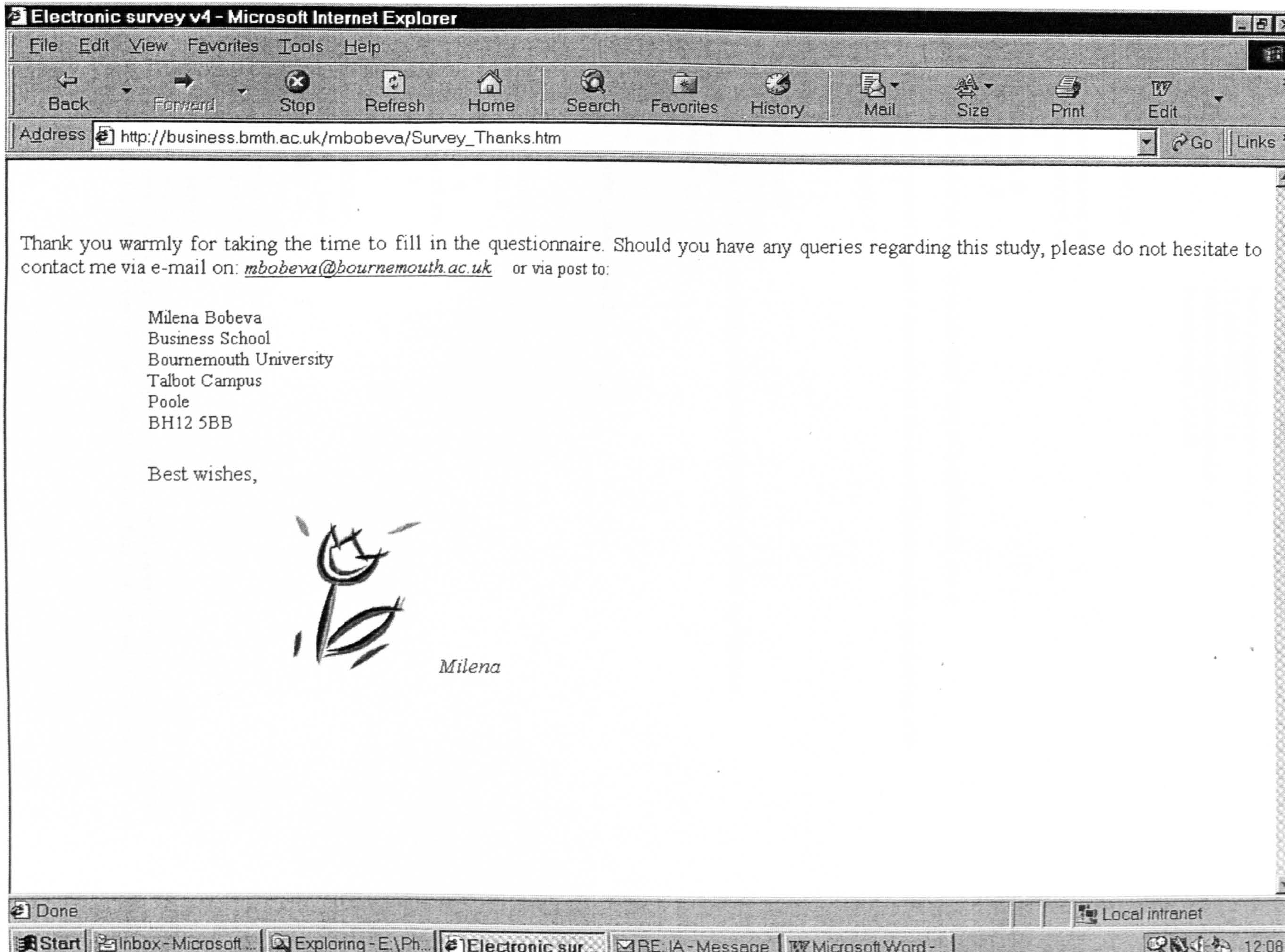

Thank you warmly for taking the time to fill in the questionnaire. Should you have any queries regarding this study, please do not hesitate to contact me via e-mail on: *mbobeva@bournemouth.ac.uk* or via post to:

Milena Bobeva
Business School
Bournemouth University
Talbot Campus
Poole
BH12 5BB

Best wishes,

Milena

From: Form.Handler@www.bournemouth.ac.uk
Sent: 11 July 2002 11:14
To: mbobeva@bournemouth.ac.uk
Subject: Survey reply UKAIS

Contents of form on

1. source/recipient: 8
2. organisation(s/r): 8
3. role: 8
4. processes: 9
5. importance: 9
6. risks: 5
   comments(risks): this depends what type of business we are in
7. owner: 5
   comments(owner): again it depends pn the type of business we are dealing with
8. controller: 7
9. stable/dynamic: 7
10. format: 3
11. e-access: 7
12. style: 6
13. aggregation: 7
14. current/up-to-date: 5
    comments(current/up-to-date): not exactly sure what is meant by 'version'.
15. languages: 6
16. templates: 8
17. events: 4
18. type: 6
19. status: 5
20. performance_measures: 7
21. cost: 8
22. ethical: 5
23. legal: 7
24. organisational: 8
25. related_info: 8
26. software: 6
27. hardware: 6
28. communications: 8
29. designer: 5
30. skills: 6
31. domain: 6
32. incompatibilities: 6
33. concurrent_use: 6
34. next_stage: 3

share_within: Yes_ep
share_with_organisations: Yes_ep
share_with_customers: Yes_ep
discussion: Yes
Name: Zorlu Senyucel
email: z.senyucel@mmu.ac.uk
Final_comments: The type of the business and the project have a great impact on the issue. therefore, validity of the survey resulsts need to be carefully considered. Thank you.

FE-BuS Evaluation: Frequency of the Codes

Dimension/ Information category	Freq.
L1: Primary	
D1: Types of information	1
V1: Business view	1
IC: Business function	1
IC: Business process (WFlow)	11
IC: Data	6
V2: Organisaitonal view	0
IC: Strategy	3
IC: Structure	8
V3: Technical view	1
IC: Application	4
IC: Interface	0
IC: Network	1
IC: Platform	0
L2: Contextual	
D2: Forms of existence	1
IC: Carrier	5
IC: Level of aggregation	1
IC: Nature	1
IC: Origin	1
IC: Presentation	6
IC: Stability	3
IC: Style	0
IC: Values	0
D3: Levels of understanding	0
IC: Definitions	4
IC: Models, Templates	7
IC: Theories	2
D4: Transitions	3
IC: Stages of capability/grow	2
IC: Status	3
IC: Version releases	7
D5: Types of IM processes	0
IC: IM processes	14
D6: Roles characteristics	0
IC: Role (with ref. to data)	24
IC: Role (with ref. to process	7
IC: Levels of competence, Skills	3
D7: Types of regulations	0
IC: Policies	9
IC: Regulations	3
IC: Standards	7
D8: Levels of granularity	0
IC: Level of granularity	0
A: Extended	5
A: Focal business unit	4
A: Global	0
A: Individual	0

Key to symbols:
L – Type of dimension
D – Dimension
V – View
IC – Information category
A - Attribute