# The Transfer of Technology:
# A Study of UK Cook Chill Catering Operations.

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For My Parents

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## Abstract

There have been a number of studies which have attempted to identify factors affecting successful technology transfer. However, empirical studies of technology transfer, at the level of the user, have been a much neglected area of research despite numerous promptings. Too much attention has been paid to single factor explanations of success, although it is widely accepted that success is a multi-faceted phenomenon. There is also an absence of a suitable definition of success which reflects its multi-dimensional character. This research, therefore, attempts to develop a suitable multi-faceted measure for success and an identification of factors affecting success in the study of the user uptake phase of a technology transfer process; namely the introduction of cook chill technology into catering operations in the UK.

A survey of 80 cook chill operations in the UK was undertaken and detailed information was collected from each. A multi-faceted measure of success was developed by using 10 carefully selected success criteria. Each cook chill operation in the sample was allocated a 'score' for each success factor. This process culminated in the formation of a 'success table' of cook chill operations in the sample which enabled the identification of those units which were the most successful and those which were the least successful throughout the technology transfer process.

There were numerous differences between the activities of the successful group and those of the unsuccessful group throughout the initiation, implementation and assessment phases of the technology transfer process. The findings of this research, therefore support the notion of success as being multi-faceted. Some of the major factors seen to affect success included: management stability, the extent, quality and efficiency of pre-cook chill development work, communication and involvement with employees and appropriate training, adherence to the technical requirements of the system and a research and development orientation. The overriding finding, however, was the tendency shown by the managers in the successful group to be proactive and those in the unsuccessful group to be reactive.

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# Chapter 1

# An Introduction to the Transfer of Technology

## 1.1 Introduction

Over the last fifteen to twenty years there has been considerable attention given to the technology transfer process. However, relatively little research has been done based on empirical evidence, despite numerous promptings for it (DOUDS,1971; FISCHER,1976; GOLD,1980). This Chapter seeks to explain, in detail, the technology transfer process and, in addition, review current technology transfer literature. It points out the areas where the existing literature base is weak. In particular, the urgent need for systematic research of the technology transfer process at the level of the user, will be shown as a major area for further research.

Why is the technology transfer process of so much interest? Perhaps the best answer to this question was given in a recent FINANCIAL TIMES (1986) survey on technology transfer:

> "Today's interest in technology transfer ...stems from several factors. Overriding everything is the widespread belief, in many parts of the world, that technology-based industries are the ones which will survive and prosper, creating wealth and employment and to some degree compensating for the decline in traditional manufacturing industries...There is an increased realisation that advances in technologies, such as computers, can play a crucial role in reshaping 'old' industries...which are certain to remain important". (FINANCIAL TIMES,1986,1).

Technological change is often seen to be important with regard to economic growth. ROTHWELL (1973) pointed out that technological change alone is not sufficient to guarantee such growth. There are numerous activities which need to be considered to enable successful technological change to occur. This evidence suggests that, *prima facie*.the technology transfer process is an extremely complex phenomenon.

The technology transfer process is often seen as a vital element in the advancement of any business or industry as it assists the increased use of existing technologies and furthers technological change and progression. These changes have been linked repeatedly with economic growth (MORTON,1967; QUINN,1969; ROTHWELL,1973; FISCHER,1976; MANSFIELD et al,1983; NEDO,1985).

## 1.2 Definition of Technology Transfer

In order to establish the full meaning of the technology transfer concept, an understanding of technology itself is desirable. A dictionary definition states that technology is,

> "the application of practical or mechanical sciences to industry or commerce; the methods, theory and practices governing such application; the knowledge and skills available to any human society for industry, art, science etc." (COLLINS,1983,1492).

It has been suggested that technology is directed towards a use rather than furthering the boundaries of knowledge and understanding, the latter being the principle concern of science (JAFFRAY,1981). Technology is often associated indivisibly with hardware (for example, machines and physical tools), whereas in reality, the software aspects (for example, the organisation and methods) are an integral part of technology.[1] Indeed, SCHON (1967) defined technology as:

> "Any tool or technique, any product or process, any physical equipment or method of doing or making by which human capability is extended" (SCHON,1967,11).

To transfer means "to change or cause to change or go from one thing, person, or point to another" (COLLINS,1983). Thus, it is accepted by commentators that the transfer of technology involves *applying technology to a new user or a new use which results in an alteration to the existing situation.* For example, BEIBER (1969) and SAGAL (1969) defined technology transfer as either the process by which research is directed towards a new use or the secondary application of existing technology. PRICE (1969) specified that a technology transfer programme was,

> "a purposive, conscious effort to move technical devices, materials, methods and/or information from the point of discovery or developments to new users" (PRICE, 1969,2).

His definition was supported by ETTLIE (1973), however, perhaps the fullest definition of technology transfer was given by BROOKS as early as 1967:

"Technology transfer is the process by which science and technology are diffused throughout human activity. Wherever systematic rational knowledge developed by one group or institution is embodied in a way of doing things by other institutions or groups, we have technology transfer. This can be either transfer from more basic scientific knowledge into technology, or adaptation of an existing technology to a new use. Technology transfer differs from ordinary scientific information transfer in the fact that to be really transferred it must be embodied in an actual operation of some kind" (BROOKS, 1967,54).

The common theme amongst the definitions of technology transfer so far has been the desire to convert knowledge found in the laboratory and literature into an understandable form and then place it into the hands of the users.

However, definitions invariably appear somewhat mechanistic and they ignore the essential *human* component of the technology transfer process. The human agency is an intrinsic part of the whole technology transfer process and inevitably, is involved in complex sets of human interactions, information flows and transfers, individual and organisational creativity, industrial and organisational risk-taking and decision making (GOLDHAR,1973).

MANSFIELD et al (1983) argued that although technological change resulted in widespread beneficial effects, it also caused a number of unwelcome ones. For example, whilst improved working conditions, reductions in the number of hours worked, numerous new products and greater productivity, are all worthwhile progressions, the human destruction made possible by advances in military technology, the range of air and water pollution which occurs as a direct result of changes in technology and the increase in unemployment as a result of certain industrial technologies leaves the overall need for technological change uncertain (MANSFIELD et al, 1983). Nevertheless, technological change is bound to continue and thus, the need for empirical research aimed at identifying the problematic areas of the technology transfer process, is essential.

## 1.3 Technology Transfer Versus Technological Innovation

Much of the literature on technological change seems to conflate definitions of technological innovation and technology transfer. This approach, as FISCHER (1976) pointed out, is open to question:

> "Is innovation, for example, really technology transfer? Certainly it is the essence of Brooks [definition of] transfer yet if this is the case why do we need another term when the term 'innovation' is useful and widely understood?" (FISCHER,1976,151).

Thus, to really understand the difference between innovation and technology transfer, the former must also be defined clearly. Strictly, innovation is "something newly introduced, such as a new method or device" (COLLINS,1983,754). Therefore, technological innovation must be the *first* introduction of a new technology. Indeed MANSFIELD et al (1983) supported this definition:

> "A technological innovation is defined as the first commercial introduction of new technology" (MANSFIELD et al,1983,5).

However, this simplistic definition does not provide a full solution to the definitional problem. Perhaps an important distinction needs to be made here. Technological innovation is concerned primarily with technological change, that is, the advance of technology, such as new methods of producing products, new products with important new characteristics, and new techniques of organisation. The emphasis is on *new*. Whilst the transfer of technology could also be used to describe the above, it is not confined to them. Technology transfer can also have taken place when a mere change in an old technique[2] occurs or when a technological change is passed from one source to another. Thus, technology can be said to have been transferred when a new way of working an old machine is implemented; there need not be a quantum leap in technological application for a transfer to take place. In addition, innovation implies nothing about transfer - a technological innovation may be generated and applied *within* a single system.

Although it is recognised that there are differences between technology transfer and technological innovation, for the current research, the latter will be subsumed under the umbrella term 'technology transfer', a concept which is fundamentally concerned with transferring technology from one user context to another, regardless of whether that technology is 'new' or 'old'.

## 1.4 Existing Models of the Technology Transfer Concept

The technology transfer concept has an established history. Evidently, Francis Bacon expressed thoughts on the subject 350 years ago and when speaking of the human

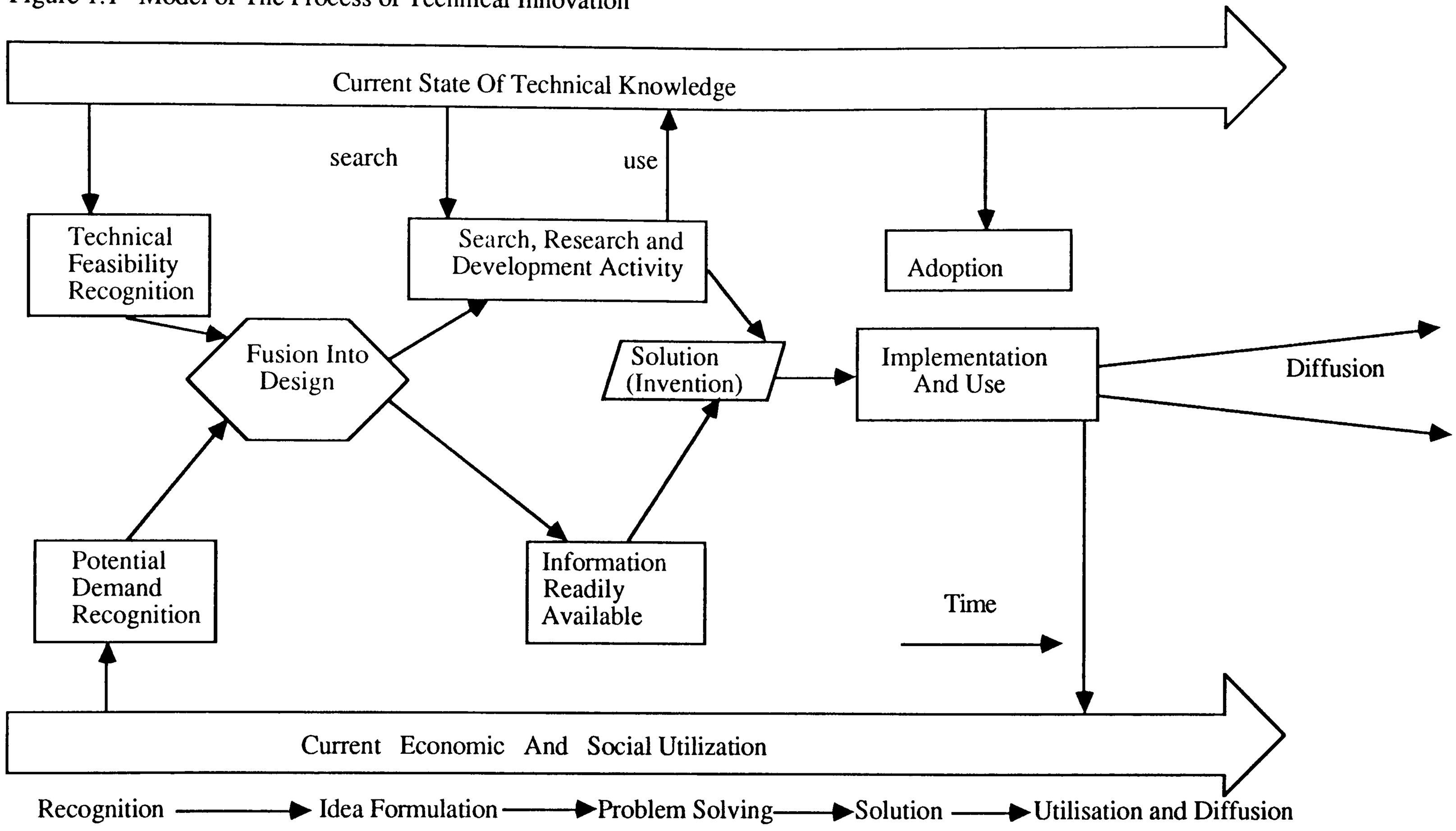
mind's ability to accept and use inventions, was incredulous that it had taken man so long to make discoveries. Furthermore, because they had taken so long, he suggested that many inventions remained to be deduced from the investigation of new methods and techniques and, more importantly from the technology transfer viewpoint, *transferring*, comparing and applying methods which were already in existence (see CETRON,1973).

More recently, the concept of technology transfer has made some progression. Early studies produced theoretical models of the whole transfer process. These models have been used extensively to study technology transfer and, in particular, the process of technological innovation; a phenomenon which has not helped the technological innovation/technology transfer definitional confusion. A typical model of technological innovation is shown in Figure 1.1 It demonstrates the process of bringing together current technical knowledge, recognition of its possible usage in the 'real world' and the development of this into a marketable source. At the same time, the need for such a product (or service) is recognised and a 'demand' satisfied. The model presents a somewhat idealistic process; it has no feedback mechanism and no error margins. Nevertheless, this model has been used extensively in studies of technological innovation (MYERS and MARQUIS,1969; UTTERBACK,1969; LANGRISH et al,1972).

Figure 1.2 shows a more complex model developed by GOLDHAR (1973). It includes more detailed interactions involved in the whole technology transfer process than in the original model. GOLDHAR stated that the model,

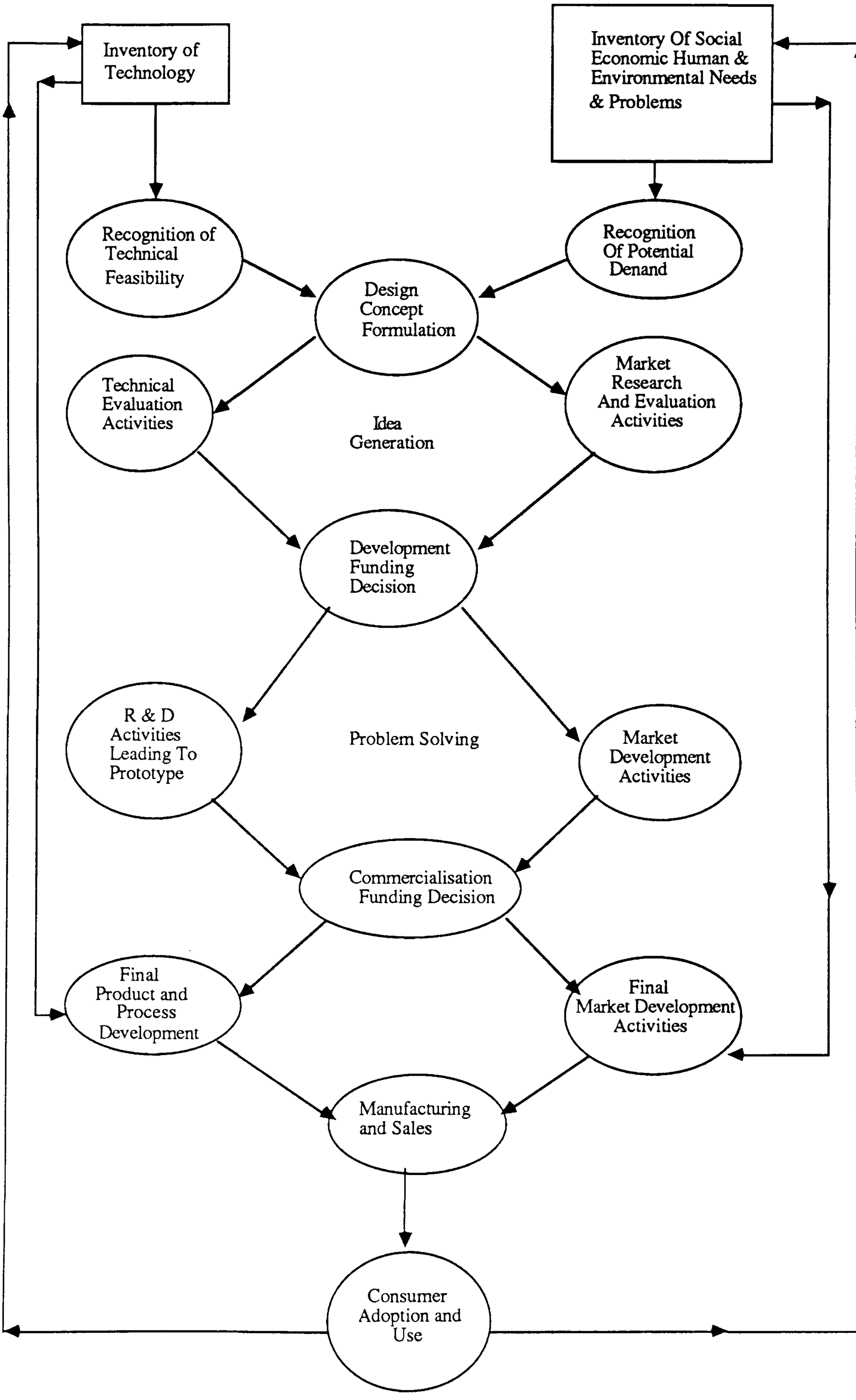
> "shows the parallel sequence of technical and market analysis and development and emphasises the points of interaction between technological and marketing activities: Design Concept Innovation, Development Funding Decision, Commercialisation Funding Decision and Manufacturing/Sales efforts. Each of these points represent a major decision and risk taking point for individuals and organisations. Each point also represents a combining and interpreting of data and information, usually by groups of people " (GOLDHAR,1973,41).

Figure 1.1 Model of The Process of Technical Innovation



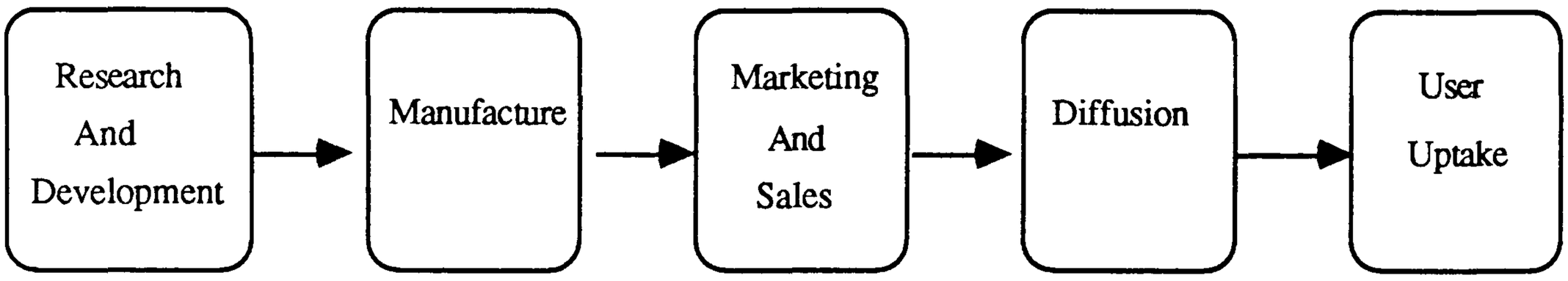

Source: MYERS and MARQUIS (1969)

Figure 1.2 The Process of Technical Innovation




Source: Goldhar (1973)

Figure 1.3 Main Stages in the Overall Technology Transfer Process




Of course, it is impossible to show the full complexity of the technology transfer process in diagrammatic form (otherwise this thesis would consist predominantly of diagrams!) The continual activity of receiving technical and market information, rejecting alternatives and the continual interactions of different sets of people, contribute to a highly iterative and involved process.

Although both of the above models indicate that there is always a recognition of the respective importance of both technical feasibility and demand it is not always clear from the literature which one predominantly stimulates the transfer process or equally, whether they both do (MYERS and MARQUIS,1969; PEARSON and RICKARDS,1973). However, despite this unresolved issue, a common thread amongst all the models used in studies of the technology transfer process (BAKER et al,1967; UTTERBACK,1969; BRAGAW,1970; LANGRISH et al,1972; ROTHWELL,1973) is shown simplistically in Figure 1.3. There are five main stages outlined in Figure 1.3 and each constitutes a sub-transfer of technology within the overall technology transfer process. The significance of these stages will be discussed later, at this point it is suffice to recognise their existence.

## 1.5 Types of Technology Transfer

Technological change is often associated with radical new inventions or discoveries which are important economic contributors to society. However, in practice this type of technological change is relatively uncommon. Technological change is frequently of a more subtle nature. Recognition and adaptation of *existing* technology is more common than the development of *new* ideas. In this sense technological innovation, in its strict definition, is far less common than technological transfer. Within the whole process, a

technology transfer can be either radical or incremental. A radical transfer describes a totally new technological outlook on something, or a development of a totally new product . More frequently, however, technology transfers are incremental in nature, that is, they are gradual improvements which can and do result in rewarding efforts (MYERS,1967).

Different people in different organisations may have different views on the nature of a particular technology transfer process. For example, a manufacturer may consider the alteration of a particular piece of equipment to be incremental, whereas to the user, the alteration may result in such a great improvement, the transfer of technology which has taken place is considered radical. Thus, to different sets of people, at different stages of the technology transfer process, technological changes can have different implications and definitions.

The technology transfer process has been referred, in the literature, as having two modes of integration - vertical and horizontal. Vertical transfer has been used to explain the transfer of technology from the general to the more specific, that is to say that common scientific laws have been harnessed in order to achieve a specific task. For example, BROOKS (1967) points out,

> "[vertical transfer] includes the process by which new scientific knowledge is incorporated into technology, and by which a "state of the art" becomes embodied in a system, and by which the confluence of several different, and apparently unrelated technologies, leads to a new technology" (BROOKS,1967,54).

Horizontal transfer, on the other hand, involves the utilization or adaptation of a technology for a new or different purpose. Many examples of horizontal transfer have been cited in the literature which include, the adaptation of military aircraft to transport civilians by air, the adaptation of the transistor to the Bell telephone, and the use of a sensor for medical purposes. Of course, within a total technology transfer process, both vertical and horizontal transfers can occur together. For example, technology can be adapted from one user context to another (horizontal transfer) and the new user context can then adapt to meet specific requirements of its own (vertical transfer).

Within a model of technology transfer, such as that shown in Figure 1.2, the main transfer activity taking place up to the point of diffusion is probably vertical. Beyond that however, horizontal transfer takes over and thus *between* different organisations

within an industry or inter-industry, horizontal transfer is more apparent than vertical transfer. Although once a technology becomes embedded into an organisation, vertical transfer may again be apparent.

## 1.6 Mechanisms of Transfer

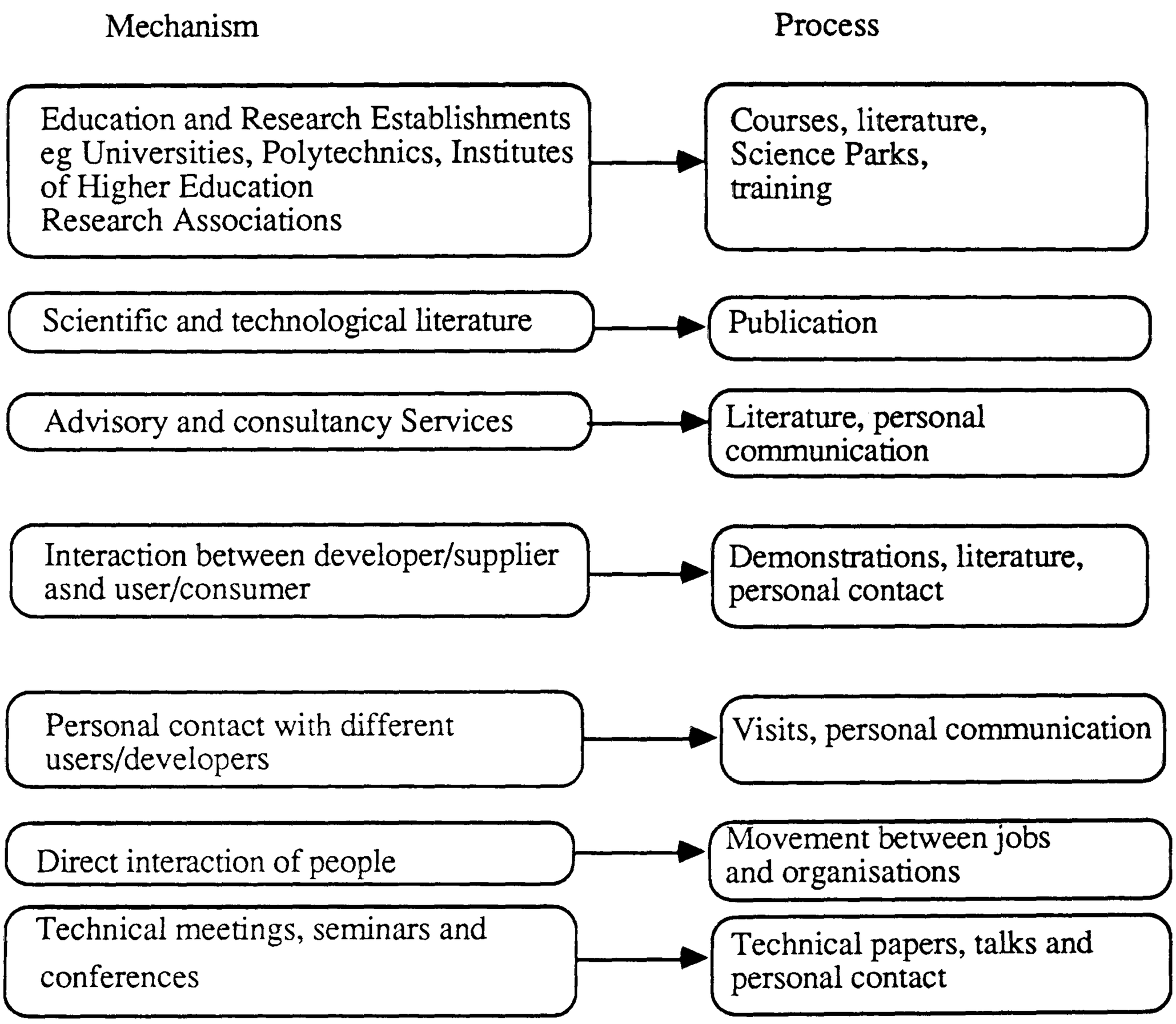
Technology is derived from research and development. Much research, however, is often completed without reference to its role in the 'real world' and thus, not all research is utilized to the benefit of technology. Frequently, this can result in industry following a circuitous and difficult route towards the discovery and implementation of new technology.

Technology is transferred through a variety of routes and originates from many sources. The occurrence of inaccurate or misinformed transfer at any stage is a distinct possibility. It is often inaccurate transfer of technology that causes a theoretical success to become a practical failure. This could be because of misleading information, bad communication or application into an inappropriate setting. Thus, it is most important to utilize relevant mechanisms for transferring technology.

Figure 1.4 shows that there are a number of different mechanisms used in the technology transfer process. First, many research and development organisations exist, some related to specific industries, which are aimed at improving the introduction of technology into those industries. These establishments include universities, polytechnics, institutes of higher education and research associations. Information is passed on from these institutions by various methods. For example, a few establishments have recently developed 'science parks' to aid the transfer of knowledge into the industrial world (FINANCIAL TIMES,1986). Theoretically, direct links between industry and academic establishments should encourage increased interest in commercial problems. This in turn may influence the amount of research topics selected for study which aim to be of practical relevance to specific needs of different industries. Given the economic importance placed on effective technology transfer, it is surprising that the move towards such academic/industrial liaison has been slow (BROOKS,1967; FINANCIAL TIMES,1986).

Second, publication and the dissemination of information through scientific and technological literature is an important mechanism for the transfer of technology. However, identification of the relevant or most useful publications, may cause problems. Publications are probably not the most important mechanism for transfer, but they may

Figure 1.4 Main Mechanisms of the Technology Transfer Process



certainly help in sparking off an idea, filling an information gap or being a valuable reference document.

Third, and perhaps the most important mechanism, is personal communication. This can take various forms and be between a number of different sets of people. For example, it may be formalised through, for example, conferences, seminars and consultancy services. Conferences and seminars have increased in their popularity as a mechanism for the transfer of information, knowledge, and technology. This is probably *not* so much for their technical papers, but more perhaps for the random personal contact in between papers by people attending them. Informal communication between people, constitutes a most effective means of transferring information whether it be between developer and consumer, visits to other users of a technology or the direct movement of people from one organisation to another.

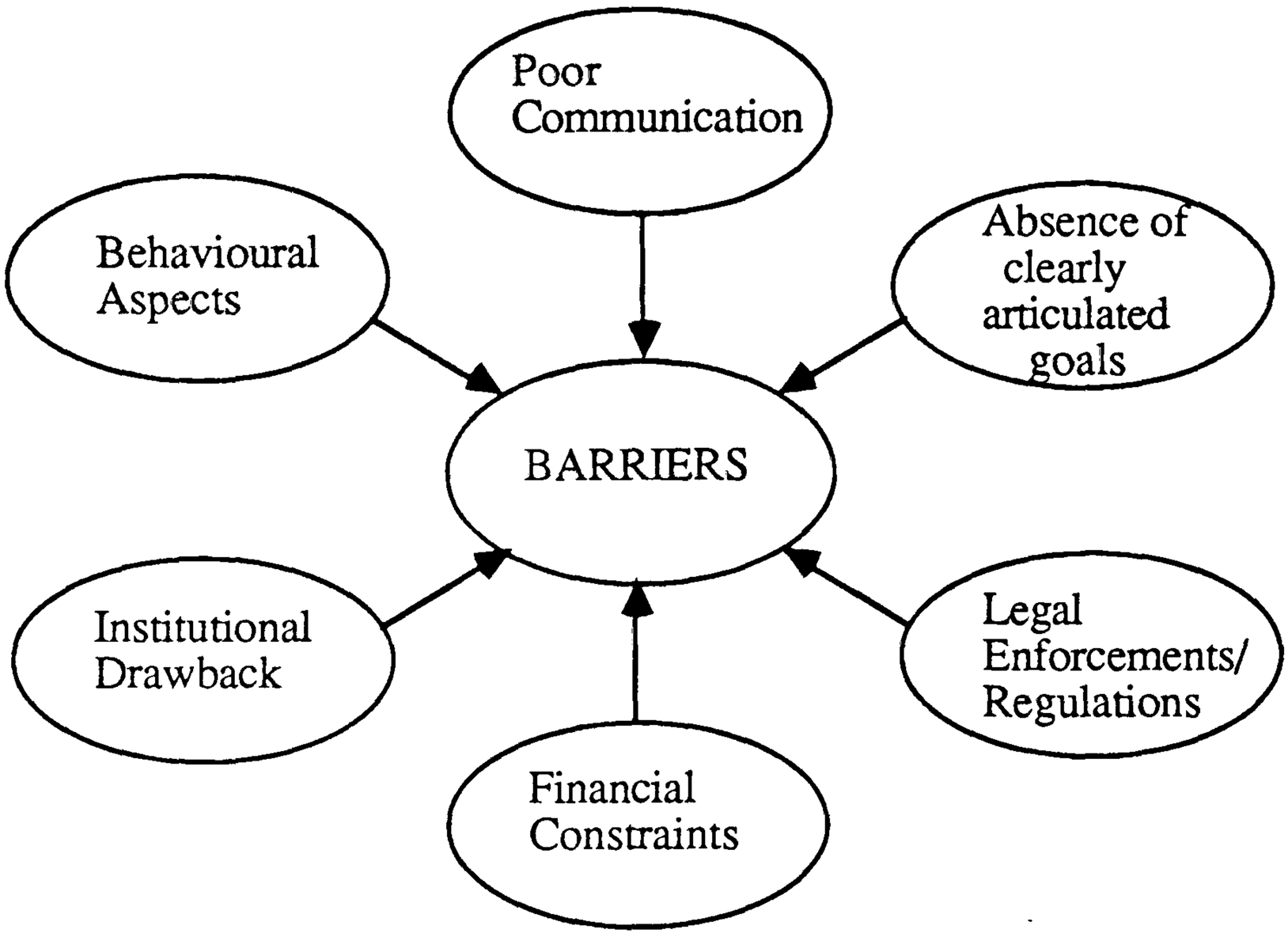
In short, there are many mechanisms used to transfer technology but perhaps the most effective methods are direct transfer of information between people, particularly when those people have personal experience of the technology in question. On a wider level research establishments and publications are an invaluable information source. It is suggested that the extent and use of relevant information sources or vehicles has a direct bearing on the success of the whole technology transfer process.

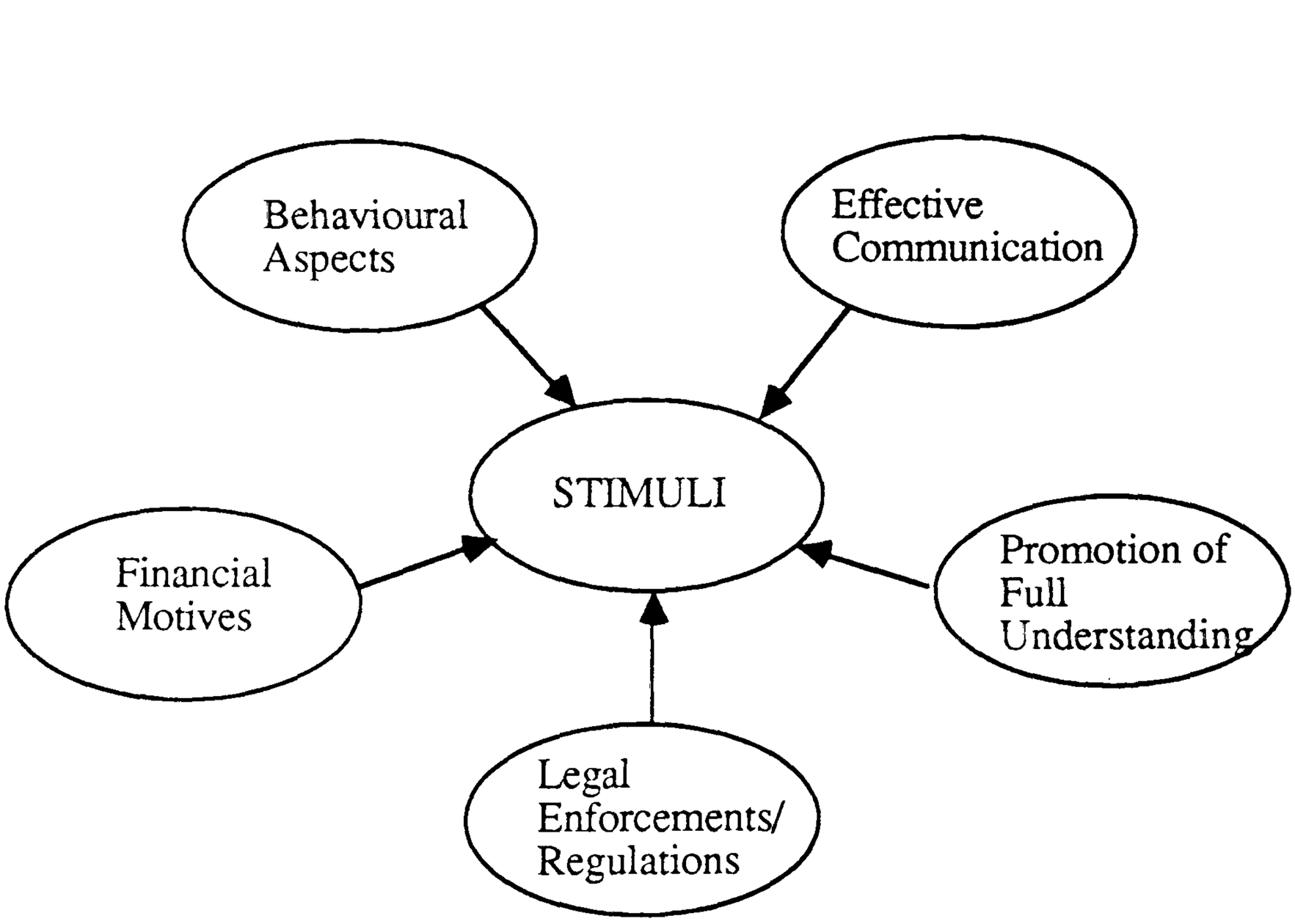
## 1.7 Barriers and Stimuli to Technology Transfer

Successful technology transfer not only requires adequate information but also an environment conducive to technological change. Thus, technology transfer should not be viewed simply as a transfer of information or knowledge, but also as the application and embodiment of that knowledge. At any point in a technology transfer sequence (technological development, marketing, management and use), the potential exists for barriers and stimuli to the transfer. Studies of barriers and incentives to technology transfer appear frequently, in various guises, in the current literature base. Amongst the masses of conflicting and confusing conclusions drawn on these issues, there are some useful suggestions of factors which act as barriers or stimuli during transfers of technology (see Figure 1.5).[3] Clearly, Figure 1.5 shows that the same medium (for example, communication or finance) could have the role of both a barrier or a stimulant depending on how effectively it is used.

Communication was suggested repeatedly as important both as a potential barrier or as a stimulus to successful transfer. PEARSON and RICKARDS (1973) put forward the

Figure 1.5 Suggested Barriers and Stimuli to the Transfer of Technology




Adapted and developed from: CETRON (1973),DEBREYNE (1973), PEARSON and RICKARDS (1973), HAWTHORNE (1978), BLACKLER and BROWN (1986).

notion that it was generally accepted that "most effective transfer takes place on the basis of an exchange of personnel or inter-personal transmission" (PEARSON and RICKARDS,1973,67). However, one of the major barriers which could hinder successful technology transfer was found to be,

> "...the difficulty experienced in communications between those with the knowledge of what is possible and those who may be able to put this knowledge to use, i.e. between the scientific and technological capability and the potential implementation. This barrier is often due to the inability of the former to communicate with the latter in a language he can understand" (PEARSON and RICKARDS,1973,67).

Poor communication amongst different groups within an organisation and between organisations has also been cited elsewhere as important to technology transfer (DOCTORS,1969; JERVIS and SINCLAIR,1973; SIEPERT and LIKERT,1973; BLACKLER and BROWN,1986) However, despite all this attention, ROTHWELL and ROBERTSON (1975) reported that even though a considerable body of empirical evidence suggested a positive relationship between good and efficient communication and successful industrial innovation, many firms did not take communication seriously and hence failed to transfer technology successfully. The communication channels and level of effectiveness are thus important in any study of the technology transfer process.

A further consideration intrinsically linked with successful technology transfer is the element of time. For example, the time taken on decision making or research and development may be critical to successful transfer. Excessive time allocation could cause as many problems as inadequate time allocation (RAY,1983). In addition, misjudged timing of the initiation of a technology transfer process, with regard to the development of an organisation, may result in a disastrous technology transfer (ROGERS,1983). It is suggested, therefore, that time aspects throughout the technology transfer process (for example, decision time and length of time spent on research and development) are crucial to successful technology transfer.

Understanding of the need for technological change is often cited as an important consideration in the discussion of barriers and stimuli to technological change. The absence of clearly articulated goals with regard to the introduction of technology may lead to confusion and hence, unrealistic assumptions concerning the reality of the intended technological change (GOLD,1980). The method of user participation described by BLACKLER and BROWN (1986) was shown to promote a more complete

understanding of the technology transfer process. In addition, ALLEN (1971) described the use of technological gatekeepers - informed personnel who transfer knowledge to other, less informed, personnel - as being conducive to successful transfer.

The law can sometimes exert a positive or negative influence on the technology transfer process. In some cases, legislation could lead to increased capital or revenue budget requirements, which could act as a further barrier for continuing the transfer process. On the other hand, certain taxation structures could act as an incentive for technological change.

The effect of financial requirements can sometimes run parallel to those of the law. As a barrier, the need for venture and investment capital required to pay for the total cost of expensive technology and resultant costs[4] may often raise difficulties. Alternatively, the reduction in the amount of expensive labour required, as a direct result of introducing technology, could, in many cases, act as an important incentive to technological change (CETRON,1973).

However, this very stimulus can lead to the formation of other barriers. LEONARD-BARTON and KRAUS (1985) showed that the most common reasons for an opposition to technological change resulted from the fear of deprecation in skills, power or personal benefit. Behavioural aspects therefore play another leading role as either barriers or stimulants to technology transfer. With regard to social constraints, HAWTHORNE (1978) argued:

> "Ignorance, indifference and pride are the underlying social influences which persuade individuals and groups to reject the diffusion of new technology from external sources. Ignorance is the result of lack of capability, education and experience. Indifference arises from the personal attitude of being content with things as they are and a lack of motivation to seek new ideas. Pride or conceit is best expressed by the well-run phrase of 'not invented here'. In each case, the information flowing through the diffusion mechanisms will not be used until external pressures become so strong that it can no longer be ignored" (HAWTHORNE,1978,71)

He goes on to say that behavioural barriers also arise from the need to satisfy such aspirations as political ambitions, commercial inability and job protection of personnel. He suggested that these desires are manifested in many ways; perhaps the most obvious

example being a resistance to technological change in the workplace.[5] HAWTHORNE's viewpoint with regard to the 'not invented here' syndrome supported work completed by PEARSON and RICKARDS (1973) who put forward the notion that the syndrome was a major preventor of successful technology transfer. This was mainly because of a threat to the reputations of key personnel caused by borrowing ideas, resources, and research and development results from other 'outside' innovators or users. Furthermore, the use of outside-developments was thought to encourage anxiety concerning the value of work completed elsewhere and the possible misapplication into new situations. More recently, however, this 'borrowing' of information has been seen as an *incentive* for increased transfer of technology (GOLD,1980; FINANCIAL TIMES,1986). It is argued that as ideas become utilized more widely their possibilities, advantages and disadvantages become popularised and, thus, transfer may progress more effectively. Other behavioural aspects which have been shown to aid innovative transfer include crisis management, entrepreneurial efforts, desire for change from consumers and desire for personal recognition (CETRON,1973).

The nature of firm size is generally accepted as a critical determinant of innovative procedures (CETRON,1973; ETTLIE,1983), since the smaller organisations often have difficulty funding major technological innovations. Other institutional considerations include the stability of a particular company and the research and development orientation. The House of Commons Select Committee on Science and Technology (1972) reported that the consideration of mechanisms by which technology is transferred at the micro level, is insufficient and that too little attention was at that time paid to the ways in which the process could be made more efficient. The same criticisms could still be made today.

In short, numerous barriers and stimuli were suggested in the literature as affecting the technology transfer process, however, there were often conflicting opinions as to which were barriers and which were stimuli. Nevertheless, communication, definition of goals, financial planning and a variety of behavioural aspects of personnel within the organisation were invariably included in such discussions. The key determinants of successful technology transfer were; the recognition of potential barriers and incentives, and the ability to overcome and utilise them in the most efficient way.

## 1.8 Summary of the Technology Transfer Concept

Much of the literature reviewed so far has focussed on a *theoretical* technology transfer concept. There have been conflicting views on certain aspects of the total technology transfer process. However, overall, there is general agreement on the basic definition of technology transfer, although several writers have expanded and developed the definition to fit into particular contexts. Most definitions follow the basic theme of getting the technology (in its fullest definition - concepts, processes or products) from one setting to another in an understandable and usable form.

Unfortunately, a number of questions concerning technology transfer remain unanswered. For example; 'What are the most important mechanisms for technology transfer?' 'What factors hinder the transfer process?' 'What factors enhance the transfer process?' 'Does the current conflict in the literature point to the existence of industry/technology specific mechanisms, barriers and enhancers?' More research is needed to answer these and other issues.

## 1.9 The Extent of Research on Technology Transfer

Although a plethora of studies of the technology transfer process[6] exist much of the literature base has been founded on speculative, impressionistic treatment or specific reports of case studies. There has been relatively little empirical work or replication studies. Indeed, DOUDS (1971) complained:

> "Discursive or 'wisdom' literature predominates...There are some case studies that provide insight into various aspects of the process, but there are few empirically based field studies. Apart from research on the diffusion of innovation and studies in other allied areas, little theory building with accompanying field tests of propositions has been done". (DOUDS,1971,125).

He goes on to describe the existing literature base as containing,

> "a wide variety of material serving many purposes - speeches, conference papers, progress reports, etc. Much wisdom garnered from the practical experience of managers and administrators is contained in it. In their writings many interesting propositions are expressed or implied. But as these propositions are collected from various sources

> in the 'wisdom literature', one finds many inconsistencies and contradictions...Unfortunately, these interesting and potentially useful propositions derived from experience are immersed in a mass of other propositions stemming from non-experimentally based sources - observations of 'experience' that do not accord with what actually took place, wishful thinking, rhetoric etc.."

Although he concedes that this type of literature is useful for drawing attention to and for stimulating research in the field, with regard to the production of systematic verifiable knowledge, he categorizes the existing literature as 'soft'. He stressed the need for more empirically based information. Whilst there are case studies which do investigate the technology transfer process he emphasised,

> "that the field is immature from a behavioural science viewpoint. If one attempts to bring together and relate the 'truths', i.e., the propositions, from all these [case studies] they cannot be articulated" (DOUDS,1971,130).

Seemingly, all that the case studies have done, at the time of DOUDS review, was to cause more confusion. Little of the case study material lent itself to generalisations for the total population. Outcomes reported were usually unusual cases, often with unique qualities. Thus, generalisations made from such peculiarities were highly questionable.

DOUDS (1971) clearly pointed to a yawning gap in the literature base for systematic, empirically based studies of technology transfer. But four years later, FISCHER (1975) reported that, although much attention had been "lavished" on the technology transfer concept,

> "a careful review of the literature is a disappointing experience. In the first place, even a casual perusal of the relevant literature indicates that severe problems of definition beset the knowledge in the field. Furthermore, the literature on 'technology transfer' has apparently been unable to grow beyond being a collection of anecdotes, so that its utility...has been quite limited. Finally, in those instances where conceptualisations of transfer experiences have been offered, empirical testing has not followed, thus neglecting possible avenues for increased understanding" (FISCHER,1976,151).

His review of the existing empirically-based literature led him to conclude:

> "The literature surveyed shows that the area offers fruitful avenues for research...it would appear that there is good reason to believe, based on the surveyed literature, that technology transfer is presently capable of making major advances in the state of knowledge through empirical approaches" (FISCHER,1976,156).

FISCHER (1976) found himself in complete agreement with DOUDS (1971) that continued speculation was only likely to increase the disorderly nature of the theoretical base. The way forward lay in field studies and experiments in order to reduce the entropy that was clearly apparent.

A review of the conceptual issues in the study of innovation by DOWNS and MOHR (1976) reinforced the view that a number of these issues remained unresolved; moreover, there was found to be a certain instability amongst the existing empirical studies. For example, they found that whilst in some studies it was firms known to be successful which were predominant in introducing technological change, in other studies it was found to be firms known to be unsuccessful. They hypothesised:

> "Perhaps the most straightforward way of accounting for this empirical instability and theoretical confusion is to reject the notion that a unitary theory of innovation exists and postulate the existence of distinct types of innovations where adoption can best be explained by a number of correspondingly distinct theories" (DOWNS and MOHR,1976,701).

DOWNS and MOHR (1976) also stressed the dangers of making generalisations from studies of multiple innovations or multiple industry studies. Their findings reinforced the suggestion that in order to further the theoretical knowledge of the total technology transfer process, more emphasis should be placed on industry-specific innovations.

Not unexpectedly, given the low base figure, since DOUDS (1971) and FISCHER (1976) urgently called for more empirical research, there has been a substantial increase in the number of empirical studies carried out. Nevertheless, the quality and depth of this research is patchy ROGERS (1983), for example, expressed concern at the unacceptable degree of variability in the findings of the empirical studies done to date. In short, there still remains today, a dearth of empirical studies of the technology transfer concept, particularly with regard to industry/technology specific factors. It is suggested

therefore that not all empirical findings can approximate to generalisations and that many industry/technology specific factors exist which must be accounted for.

## 1.10 The Scope of Current Literature on Technology Transfer

Most of the research studies carried out to date have focussed, *a priori*, on stages of the technology transfer process prior to user uptake (see Figure 1.3). In doing so they have concentrated on the conduct, management and strategy of stages 1 to 3 of the technology transfer process shown in Figure 1.3. Moreover these studies,

> "are frequently limited to describing a new device or technique from one field of application and reporting the scientific concepts or technological artifacts from other fields serving as inputs to the new unit of technology. These brief cases with their focus solely tracing technological concept inputs to a new concept or device give the impression that the input information directly stimulated the output. This might be characterised as the technological 'stimulus-response' mode of reporting; roughly analogous to the stimulus-response theories in psychology.....More lengthy cases often appear in a form that can be characterized as 'technological chronologies; wherein the emphasis is on chains of concepts, discoveries, successes and failures described in terms of the science and technology involved, more so than the people, management and organisational factors involved" (DOUDS,1971,126).

It is perhaps with regard to the people, management and organisational factors, that is, activities of user uptake, where the current literature is weakest. Before this weakness is discussed in detail, however, a brief review of empirical studies of Stages 1 to 3 of the technology transfer process will be reviewed. Most of these studies concern themselves with factors which affect the success of technology transfer or technological innovation.

Not only did the majority of studies converge on what were judged as 'successful' technology transfers rather than an equal consideration of failed ones, but amongst these studies, there was little agreement on the criteria for the assessment of success. Moreover, the criteria used were often based on somewhat questionable foundations. In particular, a number of studies relied heavily on reputational measures of success. For example, organisations who received industrial awards for a single technological achievement were often selected as being 'successful' despite a minimal knowledge of their real status, away from the publicity and hype. The most common method for the

selection of 'successful' organisations, however, related to financial performance. Although, ultimately, assessment of success may hinge on financial performance, it is often unclear whether an organisation under scrutiny has reached that 'ultimately'. Thus, in comparisons of success versus failure, the reliance on a single financial criteria of success may be misleading. Moreover, in studies of successful and unsuccessful technology transfer to date, the exact financial criteria to use (market share, profit levels, or a combination) has been left open to debate. More practical, multi-factor approaches towards the assessment of success are rare. Apart from ETTLIE (1973), who judged successful utilisation using a range of pertinent factors, the only other attempt at this type of approach was a tentative exploration by ROTHWELL et al (1974). However, although he improved on his previous rather inadequate criteria of success, it remained primarily a judgement of financial success. Clearly, a systematic, multi-factor approach to the assessment of success, at whatever stage of the technology transfer process, is required.

Many of the early studies of the technology transfer process were primarily concerned with investigating three main areas of interest. These were; the factors which led an organisation to embark on a technology transfer project, the type of technology transfer conducted and the major factors which affected commercial success. The need for a receptive climate for new ideas and a recognition of a demand for them (as opposed to their technical potential),was a common theme. In addition, technological change was, to a significant extent, based on the cumulative effect of small, incremental innovations, rather than radical ones. Commercial success was associated with personal experience and personal contacts as principle sources of information, and adopted innovations as well as those which originated in the firm (MYERS and MARQUIS,1969). Although an empirical, but purely descriptive study of successful technological innovations in the USA, MYERS and MARQUIS's study (1969) provided a suitable base upon which to focus future research.

An investigation of factors which affect technology transfer was a recurring theme of later studies (BRAGAW,1971; ROTHWELL,1972; ROTHWELL et al,1974; SZAKASITS,1974; LEONARD-BARTON and KRAUS,1985). For example, BRAGAW (1970) developed a three phase model from the literature, in his study of technological innovations. The model integrated three phases of technological change; *idea generation, problem solution* and *implementation* and took an interdisciplinary view of the total technology transfer process. In addition, he investigated how an idea eventually becomes a product or process which can be then utilized in the economy. He

commented that rationale is an attempt to gain some,

> "learnings, feelings, understanding and appreciation how technological innovation is spawned, nurtured, financed and managed" (BRAGAW,1970,xi).

Amongst his most significant findings with regard to technological success were the importance of literature, experience, discussion, analysis and experimentation, the prominence of each varied depending on the stage in the model. For example, literature and experience were used more frequently during idea generation whilst analysis and experimentation came to the fore during problem solution. Although he discovered some important similarities amongst these successful innovations, he paid attention only to the early stages of his model and paid only fleeting attention to the actual integration and use of these innovations.

A similar model to that used by BRAGAW (1970) was also utilised by UTTERBACK (1971), in his investigation of the information stimuli of innovations and the contribution they made to the development of new products. UTTERBACK found that the majority of information stimuli came from outside the firm during idea generation, but that internal sources were used more heavily during problem solving. Communication was usually through word-of-mouth and that as the process progressed the search for information became more formalised and structured. However, generalisations from his results were limited by the small number of cases studied (32 out of a total population of 500) and that the study was confined to a single regional industry.

Perhaps the major criticism of work carried out to this date (1971) is that there was too much emphasis on one factor, and it was therefore concluded that the particular factor studied was the prime cause for success. For example, BRAGAW (1970) and UTTERBACK (1971) argued that information sources were *the* prime factor affecting success amongst the firms studied. This conclusion is questionable when it is considered that only successful innovations[7] were studied and failed ones ignored. In contrast, one of the first studies to approach the subject of technological innovation from a multi-faceted viewpoint was conducted by ROTHWELL (1972). His study was designed as a "systematic attempt to identify and evaluate the factors which distinguished innovations which have achieved commercial success from those which have not" (ROTHWELL,1972,4). Project SAPPHO[8], as it was called, attempted to break the earlier study trends by not only treating the process of technological innovation as complex but *also* carrying out an investigation of failures as well as successes.[9]

Examples were drawn from two industries (chemical and scientific instruments) and, by investigation of their history and subsequent statistical analysis, the major differences between successful and unsuccessful innovations were concluded. Overall, five underlying factors which contributed towards success or failure were discovered:

> "1) Successful innovations were seen to have a much better understanding of user needs.
> 2) Successful innovations pay more attention to marketing
> 3) Successful innovations perform their development work more efficiently than failures but not necessarily more quickly.
> 4) Successful innovators make more effective use of outside technology and scientific advice.
> 5) The responsible individuals in the successful attempts are usually more senior and have greater authority than their counterparts who fail" (ROTHWELL,1972,5).

An overriding finding, however, was that no single factor can by itself explain the success-failure difference. This was a significant breakthrough in thinking with regard to general technology transfer theory.

Two years later, in SAPPHO Phase II, the study was extended to cover an increased number of paired (successful and unsuccessful) technological innovations. Not only were the findings of Phase I of project SAPPHO confirmed, but also a number of additional measures emerged as significant factors for success. In particular, inter-industry differences emerged as important (ROTHWELL et al,1974). The net result of these findings was the clear need for further empirical research paying particular attention to industry-specific factors.

SZAKASITS (1974) adopted the procedures developed by ROTHWELL (1972) and ROTHWELL et al (1974) to investigate factors which influenced a success or failure of technological innovation in the Hungarian electronics industry. He recognised that amongst successful and unsuccessful technological innovations the role of *some* factors were identical. He also discovered a number of distinct factors that were important to success, the lack of which, in general, led to failure. The major ones included:

i) Good internal and external communications network,
ii) Sound knowledge of an economic environment

iii) Good scientific and technological co-operation with extra-mural scientific and technological organisations in addition to economic ones.
iv) Good marketing policy
v) Adequate preparation of consumers.

In addition SZAKASITS (1974) highlighted some significant factors which gave rise to failure:

> "The lack of co-operation both within the country and abroad with other institutions in solving research and development problems, and the extremely low percentage of engineers with considerable experience in development work....Further factors leading to failure were the lack of contact between research and production, inadequate information about competitors, the neglect of guaranteeing technological conditions necessary for production and defective marketing activity" (SZAKASITS,1974,26).

Despite the example set by ROTHWELL (1972), ROTHWELL et al (1974) and SZAKASITS (1974), few other researchers viewed the technology transfer process from a multi-faceted viewpoint. Rather, further studies reverted back to the discussion of single factor casual explanation. For example, KELLEY (1976) maintained that the success or failure of innovative ventures depended largely upon gaining and holding the support of organisational elites. Whereas COOPER and BRUNO (1977) concluded that the success of high-technology firms rested upon whether they were founded by groups which left larger organisations and set up businesses which used the same technology and served the same markets. They qualified this rather sweeping statement by mentioning briefly that other factors contributed to success or failure, but the main thrust of their research ignored them.

Whilst studies of single affectors of success made some contribution to the overall understanding of factors which affected successful technology transfer, it is dangerous to rely on individual studies of single-factor explanations. Not least because of the lack of agreement amongst studies as to *the* single factor on which success hinges.

In short, apart from a few outstanding studies of technology transfer (ROTHWELL,1972; ROTHWELL et al,1974; ETTLIE,1973; and SZAKASITS,1974),

and important critical reviews (GOLD,1980; and SCHEIRER,1983), a review of the technology transfer empirical base is still a disappointing experience.

Recently, however, LEONARD-BARTON and KRAUS (1985) asked explicitly: What does it take to implement new technology successfully? Their findings rejected the single-factor notion giving weight to the earlier views of ROTHWELL (1972), ROTHWELL et al (1974) and SZAKASITS (1974) that successful technology transfer must be viewed as a multi-faceted set of phenomena. It is suggested that all further studies of the technology transfer process follow a multi-faceted approach in order to avoid misinterpretation of factors affecting success.

A major failing of all of these studies,[10] however, is their total preoccupation with the research, development and manufacturing stages of the technology transfer process. Studies of the technology transfer process of the interface with the users are *rare*. Furthermore, most of these studies have concentrated on *new* technological innovations which, to be successful, must achieve a percentage share of the market. There are numerous instances where the transfer of *existing* technology takes place and numerous instances of it failing (LEONARD-BARTON and KRAUS, 1985), a phenomenon which strongly suggests that the user uptake phase is a much neglected area of research. A review of the albeit minimal literature which relates to user uptake confirms this view.

## 1.11 Empirical Studies of the User Uptake Phase

Despite the complexity of the total technology transfer process (as shown in, for example, Figure 1.2), few studies of the user uptake phase have treated it as such. Rather, the majority of the studies completed on user uptake (of which there are few), focus on single-factor effects. Furthermore, there is little agreement between studies on the single most important factor affecting success.

What is apparent, however, is the contribution many of the individual factors, singled out in what could be termed 'narrow-focus' studies, can have towards a multi-faceted effect on successful or unsuccessful technology transfer. Examples, in 'narrow-focus' studies, such as pressures to reduce costs (CHANG,1971), communication and involvement of all levels of the workforce (HAMMOND,1980) were included as contributors in multi-factor studies of success (RAY,1969,1983; ETTLIE,1973,1983; RYAN,1979).

In his initial study RAY (1983) analysed the introduction and diffusion of ten processes in nine different industries. Although most of the findings were suggestive rather than definitive, they formed a notable breakthrough in the existing knowledge base. What was so valuable about the work of RAY was his follow-up study (1983) which assessed and analysed the technological processes studied in the original research. One of his findings pointed to a previously neglected aspect - time - as being a factor instrumental in affecting success. At the onset of his second study most of the 'new technologies' were still experiencing a growing diffusion curve - mainly because of increased competition during the then recession[11] or the process of contracting out by individual companies to ones which were more technologically equipped. In addition he found a time-lag in users' adoption of an innovation and that major innovations took longer to spread through industries than smaller ones.

A number of studies completed to date have stressed the importance of the financial aspects on the success of a technology transfer (CHANG,1971; RYAN,1979; RAY,1983). On one hand, it was a strong link between justification of a capital expenditure (on new technology) and size of organisation (RAY,1983), which stimulated successful technology transfer, whereas on the other hand, it was simply a pressure to reduce overall running costs (CHANG,1971). It is suggested, however, that too much emphasis has been placed on the effects of cost efficiency on technology transfer. This has resulted in an often blinkered view of the total process with little regard to the technical and operational effects on success, a view supported by RYAN (1979).

Perhaps the most diverse study on user uptake to date was carried out by ETTLIE (1973). He investigated the implementation phase of the technology transfer process with particular regard to organisations that were relatively successful and those who were relatively unsuccessful in the implementation of numerically controlled (NC) machine tools. Success was judged on the extent the 'new' technology (NC machine tool) was utilised (technological success) rather than economic success.[12] In fact, he cited 26 factors significant in affecting the success or failure of the implementation of NC machine tools (see Appendix 1a Figure 1). Amongst the most important variables ranked were the location of the machines within the work flow of the shop; the extent of commitment to the purchase of NC tools of both the organisations *and* the people directly involved with them (the users); all round training of employees directly involved with NC (operators, programmers, maintenance men and supervisors); support from top and middle management; and above all effective communication between management and operatives, a finding reinforced by HAMMOND (1980). The findings of ETTLIE

(1973) suggest that all aspects of the technology transfer process are important from both the source *and* user organisation in order to achieve successful user uptake.

In spite of these notable exceptions described above, however, there are relatively few other studies which concentrate on user uptake. In 1969, the study of technology transfer was considered an immature field, a notion supported by a lack of sound empirically-based studies which investigated technology transfer in practice (RUBENSTEIN and DOUDS,1969). Since then, a number of studies (cited in the previous section as well as this one) have investigated aspects of the technology transfer process and, whilst progress has been made, attention has focussed on activities prior to user uptake. Thus, apart from a few valuable contributions, the existing literature base, with regard to user uptake, is weak. This view was given support by GOLD (1980) who pointed out that most studies of technological innovation had,

> "failed to identify the group of prospective adopters realistically. Unfortunately, however, most of these [studies of the user uptake phase] have provided only very limited, and even misleading insights into the determinants of actual decisions about specific innovations in real firms. Such inadequacies seem to have been due in large measure to a crippling premature emphasis on the formulation of broadly applicable generalisations" (GOLD,1980,55).

This attack on the existing literature base lends strength to the notion that the need for further in-depth studies of user uptake is vital for the advancement of theoretical understanding of the total technology transfer process.

Notwithstanding the overall rather gloomy picture with regard to studies of user uptake, a few studies have been described earlier which have attempted to address this issue. Apart from RAY (1969,1983) and ETTLIE (1973,1983), however, these studies have been limited to case studies of a few selected industries (SAGAL,1969; RYAN,1979; HAMMOND,1980; NEDO,1985). In addition, there was a tendency for these studies to fall into the trap of assuming a single factor or single area (for example, communication, time or size) as significant in causing a successful or unsuccessful technology transfer, even though a multi-factor approach was called for as early as 1969:

> "The effectiveness of technology transfer within a large corporate structure depends upon the planning and implementation of a development and marketing strategy emphasising co-operative effort,

> involvement of the central laboratory through an appropriate scale of developments and the provision of adequate warranty. Movement of people on carefully planned temporary assignments between the laboratory and the factory can significantly aid in mutual understanding and in cross-fertilisation of technical background and experience" (SAGAL,1969,35).

But despite this prompting by SAGAL, 'narrow-focus' studies of user uptake predominate. In addition, there is little agreement between individual 'narrow-focus' studies on the single most important influence on success or failure of a technology transfer. This may in part be the result of the inadequacy of a universal model for successful technology transfer, but more realistically, given the complexity of the technology transfer models (Figures 1.1 and 1.2), there are a multiplicity of factors which affect success and to concentrate on one is unjustified. Indeed, concentration on one particular factor fails to take into account the effects of other factors on the one being studied.

In summary, a review of studies of the user uptake phase has revealed four major deficiencies. First and foremost, there is a distinct lack of studies which look at user uptake. Second, of those that do exist, attention is focussed entirely on the manufacturing industry. Third, with the exception of ETTLIE (1973) investigations of user uptake tend to use a case study approach. Whilst the value of case studies is accepted, small sample sizes restrict wider theoretical statements and render generalisations questionable. For example, perhaps a particular case represents an exception rather than a rule. Finally, as with studies of the technology transfer process *prior* to user uptake, there is a tendency to concentrate on single-factor explanations of success, despite the numerous findings which have destroyed the notion of single-factor theories of success.

## 1.12 The Transfer of Technology and its Effect on the Workforce.

One of the key issues of the technology transfer process, which so far has received little attention in this review, concerns the workforce. Although it is not intended that a full review of technological change and its effect on the labourforce be given here, a discussion of some of the most pertinent issues for the purpose of the current research, will be addressed.[13]

It is suggested that the majority of technological change involves employment loss. Indeed, consideration of Kondratiev's long-wave theory[14] tends to support this view. With regard to employment loss and Kondratiev, ROTHWELL and ZEGVELD (1979) point out,

> "...not all technical change is employment generating. It might be that in the early stages, following Schumpeterian bunching of major innovations, there is an increase in investment accompanied by the creation of new industries producing new products and processes, and generating many new employment opportunities. As the industries mature, the nature of innovation changes towards a regime of standardisation and cost-reduction with a resultant fall in employment as more and more labour-saving devices and techniques are introduced into the production process" (ROTHWELL and ZEGVELD,1979,28).

Thus, inevitably, the transfer of technology has the potential to affect the labourforce extensively by a reduction in the need for manpower, skills or both. MASSEY and MEEGAN (1982) elaborated:

> "In sixteen of the thirty-one industries we looked at, employment decline in Britain was accompanied by heavy net capital investment. This investment was usually in the kind of major reorganisation of the production process that resulted in a fairly substantial reduction in the amount of labour required for any given level of output. Labour-saving is, in most cases, achieved both by reducing the time not actually devoted to productive activity and by mechanization of the productive activity itself" (MASSEY and MEEGAN,1982,63-64).

Despite widespread discussion of technology transfer, there is little data available on the effects that new technology has, in particular, on the workforce. Moreover, in many studies, success is most often determined by levels of profitability and market success with little regard given to the position of the workforce (operational success). Involvement with staff at all levels has been shown, in a number of studies, to be extremely productive as far as successful technology transfer was concerned (RYAN,1979; MASSEY and MEEGAN,1982). For example, in one successful company investigated by RYAN, employees had received up-to-date information regarding the introduction of the particular technology in question and that management level had received feedback from employees. Consequently, there had been participation

in the decision making process at all levels which was seen as an important contributory factor to their subsequent success:

> "The company has now been working for three years under its [new] system and is satisfied with the standard of work being done. The transition to the new equipment went smoothly - helped by the fact that affected employees were involved in, and informed of, the installation well before the event" (RYAN,1979,17).

Finally, he concluded:

> "These studies therefore demonstrate that technological change may have implications for the employment levels, skill levels, work structures and work roles in the situations where it is introduced. Organisations should take these considerations carefully into account when changes of a technical nature are being planned and implemented. Furthermore, they must ensure that the employees who will be affected are involved in and consulted about the changes that will occur" (RYAN,1979,18).

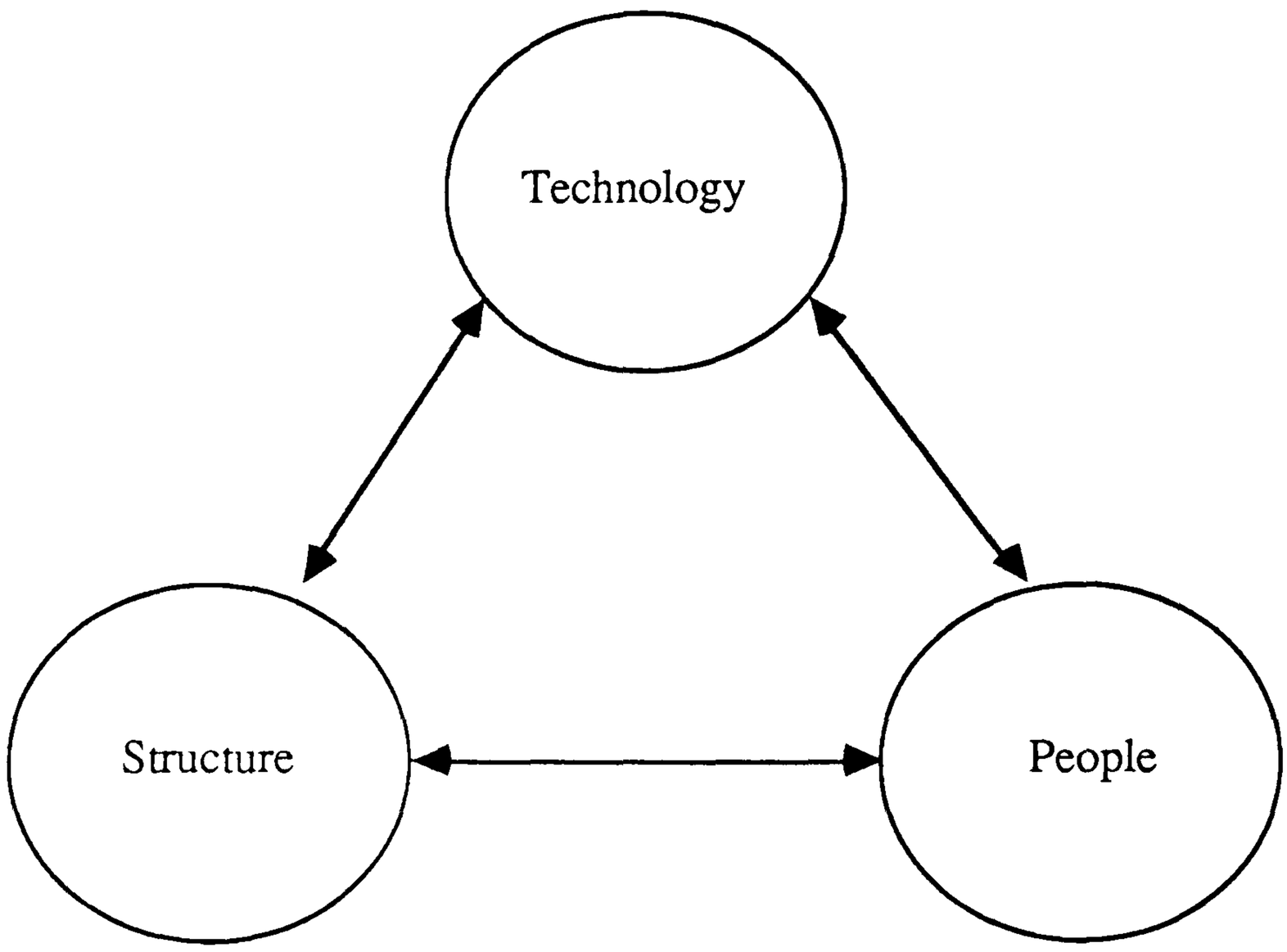
In summary, it is suggested that the involvement of employees in the decision making process, through communication and training, in particular, is critical for the achievement of successful technology transfer. The neglect of studies of the effects of technology transfer is undoubtedly linked to the dearth in studies of the user uptake phase. Thus, this further fuels the argument for more systematic research in this area.

## 1.13 The Need for Further Studies of the User Uptake Phase

A review of the current literature of the technology transfer process has been a mixed experience. On the one hand there have been a number of extremely useful studies of all stages of the technology transfer process. Notably, RUBENSTEIN and DOUDS (1969), ROTHWELL (1972,1973), ROTHWELL et al (1974), ETTLIE (1973), SZAKASITS (1974), RAY (1969,1983) and RYAN (1979). However, despite the continued prompts for a greater degree of empirical research (DOUDS, 1971; FISCHER,1976; GOLD,1980; ROGERS,1983) the overall picture is disappointing. As far as the user uptake phase is concerned, the current literature base is weak but what the literature has shown is that the transfer of technology, at the level of the user, is complex, multi-faceted and often problematic.

The user uptake phase is about the transfer of technology into an organisation. In much the same way as the earlier diagrams of the overall process of innovation, the user uptake phase can be viewed as a series of inter-related activities (initiation, adoption, implementation and use, and evaluation). An organisation in itself is a complex entity of structures, goals, legal requirements, tasks and people. With regard to the introduction of technology it is suggested that there are three key inter-related parts of an organisation, following the depiction by MOORHEAD (1985). Figure 1.6 illustrates these three central issues and demonstrates the inter-related activity between them.

Figure 1.6 Inter-relationship of the Three Key Parts of an Organisation




Source: MOORHEAD (1985, p22).

The outstanding feature of the diagram shown in Figure 1.6 is that it does not just confine the effects of technology onto the *formal systems* of an organisation (for example, financial aspects). It recognises that the social interaction of people are crucial to the technology transfer process. Similarly, FISCHER (1976) commented:

> "What would appear useful however is the consideration of behavioural, social and political variables as well as economic variables in refining diffusion models" (FISCHER,1976,156).

Thus, a logical corollary to this would be to consider an investigation of the total technology transfer process from initiation of an idea through implementation and use to evaluation at three organisational levels. First at the *functional* level of the organisation (for example, information sources, background research, capital expenditure). Second, at the *technical* level (that is, the technology itself, equipment problems, research and development) and finally, at the *social* level (for example, communication with all grades of the workforce, training, management issues and consumer involvement). It is suggested that this approach would provide a holistic and meaningful view of the total technology transfer process at the user uptake phase. Furthermore, it will enable many unanswered questions to be addressed which have been raised throughout the course of this literature review.

Certainly, there appears to be lack of agreement amongst the literature for a suitable definition of success. Although perhaps a universal definition of success is inappropriate, a move towards a systematic, robust method for defining success is required. Especially since the use of financial criteria are not always possible nor appropriate. Neither has there been sufficient comparisons of success and failure based on reliable measurements of success. It is dangerous to make generalisations of factors which affect success when the activities of only successful organisations are considered. At best, studies of failed technological innovations have been limited to qualitative studies (ROTHWELL et al,1974). Hence, few unequivocal comparisons between successful and unsuccessful technology transfers have been made.

Finally, there has been an almost exclusive concentration of empirical studies on the manufacturing industries. Studies of technology transfer in the service sector have been noticeably lacking. This is a surprising ommision given their growing importance in the general economy (GEMMELL,1987; QUINN et al,1987; RUYSSEN,1987). Moreover, the stereotypical view of the service sector being relatively low-tech, labour intensive and small-scale has been shown to be ill-founded,

> "many service industries are as large-scale, capital intensive and as thoroughly grounded in technology as manufacturing. Our statistical data bases and case studies also demonstrate that new technologies can effect entire servic industries intensely, and indeed restructure them, with consequences that radiate throughout the economy" (QUINN et al,1987,24).

Perhaps one of the reasons for the dearth of studies of technology transfer in the service sector is the inherent difficulty in finding comparable measurements between different organisations. For example, QUINN et al (1987) pointed out:

> "Productivity in services is notoriously difficult to measure. For most services, it is harder to identify a unit of output than it is in manufacturing, not only because there are no physical goods to count or weigh but also because output must be defined with reference to quality too, and that is even more ephemeral in services than in manufacturing" (QUINN et al,1987,27).

In addition, the consumer is much closer to the point of production in the service sector than in the manufacturing industry, a view supported by RUYSSEN (1987). This may have important implications for successful technology transfer, for if the consumer is not considered, problems may occur. Thus, given the potential importance of the service industries on the general economy of the country in the future, and the increasing use of technology in these industries, it leads to the conclusion that a study of the user uptake phase within the service industries is now both appropriate and necessary.

In conclusion, there are four main areas which have so far been neglected in the literature with regard to the technology transfer process. First, there is a need to develop a robust, systematic method for the measurement of 'success' from a multi-faceted viewpoint. Second, also from a multi-faceted point of view, there is a need for an in-depth study of both successful *and* unsuccessful technology transfers. Third, this study needs to be conducted at the user uptake phase of the technology transfer process and finally, such a study in the service sector is long overdue. The current research then, aims to fulfil these four objectives in its in-depth study of cook chill operations in the catering industry.

## Footnotes to Chapter 1

1 For further discussion see BROOKS (1967) p.53-54.

2 A technique is a utilized method of production and thus a change in technique occurs when there is a change in character of the equipment, products and organisation which are actually in use.

3 For an alternative classification see HAWTHORNE (1978).

4 For example, relocation or retraining of labour and research and development costs.

5 These issues will be addressed in Chapters 4,5 and 6.

6 In particular studies of technological innovation.

7 Even though their success criteria (receivers of Industrial Research Award for technological innovation) was somewhat nebulous.

8 SAPPHO stands for Scientific Activity Predictor from Patterns with Heuristic Origins.

9 Even though the criteria for judging success or failure was not ideal.

10 For a full discussion of these studies see ROTHWELL (1976,1977).

11 RAY (1983) reported that in times of slack demand competition becomes keener and those who already have the advantage of the reduction in costs resulting from the installation of up-to-date technology leave all the others handicapped.

12 which has often been used as the sole determinant of success.

13 For a detailed discussion of the theoretical aspects of technical change and employment see ROTHWELL and ZEGVELD (1979 Chapter 2) and MANSFIELD (1969,Chapter V).

14 Kondratiev, in the 1920's suggested the existence of long waves in the world economy (Kondratiev waves). These waves lasted approximately 50-60 years and were explained (by Kondratiev) in terms of the durability of investments such as buildings, transport, changes in price-levels, availability of credit, etc.. Schumpeter in the late 1930;s expanded the notion of long waves and introduced the idea of technological revolutions as the driving force of Kondratiev cycles. For example, during the first Kondratiev wave steam power was introduced, during the second, electrical power and during the third, the automobile.

# Chapter 2

# Aims and Methodology

## 2.1 Introduction

This Chapter explains the nature of the study undertaken and its methodology. It introduces cook chill catering as a technological system. Cook chill catering systems are, therefore, used as a 'vehicle' for investigating the technology transfer process at the user uptake phase. There are ample studies of technology transfer up to the point of diffusion. However, a relatively neglected area in the literature on the technology transfer process is analysis of the actual use and impact of technological innovations at the level of the organisation, namely the *user uptake phase*. Furthermore, the introduction of technology is still associated with 'improvement' and as a result many studies have been confined to successful technology transfers. As such they have totally ignored those transfers which have failed. Empirical examination of the adoption, implementation and use of both successful and unsuccessful technology transfer at the user uptake stage, is a logical extension to studies of the technology transfer process.

In addition, the theoretical value of research into technology transfer carried out so far is limited. There are four main reasons for this. First, too much attention has been paid to single factor explanations of success and given that technology transfer is a highly complex process, the use of multi-factor explanations is more appropriate. Second, insufficient attention has been paid to differences *between* industries or technology transfers. Consequently, over-generalisation have been made which may not apply to all technology transfers in all sectors of industry.[1] Third, there is an absence of a suitable universal definition of 'success'. Rarely have two studies used similar definitions of 'success'. Finally, there is little agreement on the factors found to be important influences on successful technology transfer; factors found to be important influences on success for one study are found to be considerably less important, not important at all, or even inversely important in another study (ROGERS and SHOEMAKER,1971). Obviously, this encourages the notion that technology transfer theory should *not* be viewed as a unitary discipline. Rather, it should be seen as a multi-faceted field of enquiry where the criteria for success can be explained by a number of technology-specific theories. These theories may contain similar and distinct explanations of successful technology transfer while assuming different inter-relationships among them and different effects on the total technology transfer process.

The deficiencies in the existing knowledge of the technology transfer process exemplify the need for a survey based on its complex, multi-faceted nature, at the user uptake phase. One focus of this Chapter is to describe in detail, the methodology adopted for

the present research. The aims, concepts and principles used in the study will also be clarified.

## 2.2 The Catering Industry and Its Use of Technology.

Studies of the introduction and effects of new technology have been a particularly neglected area of research in the catering industry. This may be surprising considering that in total the industry employs in excess of 2,500,000 people (HCITB,1983) or approximately 10% of the total working population in the UK. However, it is only recently that the industry has found uses for technology and technological systems. Furthermore the use of new technology is now intensifying. Historically, the use of technology in the catering industry has been fairly insignificant and the speed of its uptake slow, mainly because of the past availability of cheap labour (DRONFIELD and SOTO,1980; LOW PAY UNIT,1984,1986; GLC,1985; CATERER AND HOTELKEEPER,1986a).

A number of key factors have been instrumental in effecting change within the industry; probably the most important of which has been the improved working conditions and pay levels of workers in the industry. In 1979 gross weekly earnings were lower in the hotel industry than in any other industry in the UK. The UK inspectorate found that almost half the hotel and catering firms inspected were paying less than the legal minimum (DRONFIELD and SOTO,1980).

Table 2.1 Pay Levels and Hours Worked by Employees in the Hotel and Catering Industry for 1980 and 1986.

| | Average Weekly Pay (£) | | Average Hours Worked Over Year | | % Increase Over Year | | % Inflation (average) | |
|---|---|---|---|---|---|---|---|---|
| | 1980 | 1986 | 1980 | 1986 | 1980 | 1986 | 1980 | 1986 |
| F/T manual male | 77.5 | 125.1 | | | 42.7 | 42.8 | 18.0 | 4.0 |
| F/T non-manual male | 98.0 | 188.8 | | | 43.2 | 41.6 | 18.0 | 4.0 |
| F/T manual female | 56.4 | 88.3 | | | 39.6 | 38.2 | 18.0 | 4.0 |
| F/T non-manual female | 68.7 | 116.9 | | | 39.4 | 39.3 | 18.0 | 4.0 |

Source: EMPLOYMENT GAZETTE (1986); NEW EARNINGS SURVEY (1980,1987).

Table 2.1 shows the differences in pay and hours worked by employees in the hotel and catering industry (Standard Industrial Classification 66) for 1980 and 1986. Over this period, pay and conditions have shown slight improvements. The average hours worked have remained virtually the same with pay increasing above the level of inflation. The highest increases have been for non-manual workers, for example, non-manual male employees have experienced a 25% increase over 6 years *above* inflation (EMPLOYMENT GAZETTE,1986)[2]. These improvements can be attributed in part to the activities of Wage Councils[3] and Trade Unions, who have protected the interests of workers in the industry. However, for all employee categories, the hotel and catering industry remains amongst the lowest paid industries in the country[4] (NEW EARNINGS SURVEY,1987).

One consequence of low wage rates has been that, until recently, the uptake of new technology within the catering industry as a whole, has been low. On the one hand, labour has become more organised, successfully pressing for higher wages and better working conditions. On the other, the new technologies enable catering firms to increase their profit margins. These two differing factors have precipitated an increase in the use of technology and therefore the capitalisation of the industry. Combined, these two major factors have led to a drive for the introduction of production methods based on more sophisticated technology.

Although to a certain extent, the traditional craft based, labour intensive industry which utilized only relatively simple technology, still exists, a number of catering organisations, for a variety of reasons, have invested in new technology and technologically based systems. Technological change in the catering industry is often motivated, as in most industries, by cost considerations. In the public sector, the potential threat of a privatisation of catering services (OBSERVER,1987) has acted as a catalyst for technological change[5]. Similarly, in the private sector, as a result of difficulties faced by the manufacturing industry, there has been a shift from subsidised canteens to the use of catering outlets which must be commercially viable - a move which has again effected increased use of technology. Although the motivation for technological change in the catering industry is not just a result of economic necessity, the reduction of overall expenditure, in the present climate, is of paramount importance. In labour-intensive catering operations, utilising relatively little technology, labour is ultimately the most expensive commodity, therefore its reduction is often an obvious choice for reducing costs. In order for such reduction to be possible, the catering system itself may need modification. This modification may be achieved in relatively simple ways (for example, the use of labour saving equipment or convenience products) or may require

alteration of the whole catering system in a more fundamental manner - namely to introduce catering systems, such as cook freeze, cook chill or sous-vide, which divorce production from service and use some form of preservation in the process (respectively freezing, chilling and chilling with vacuum packing).

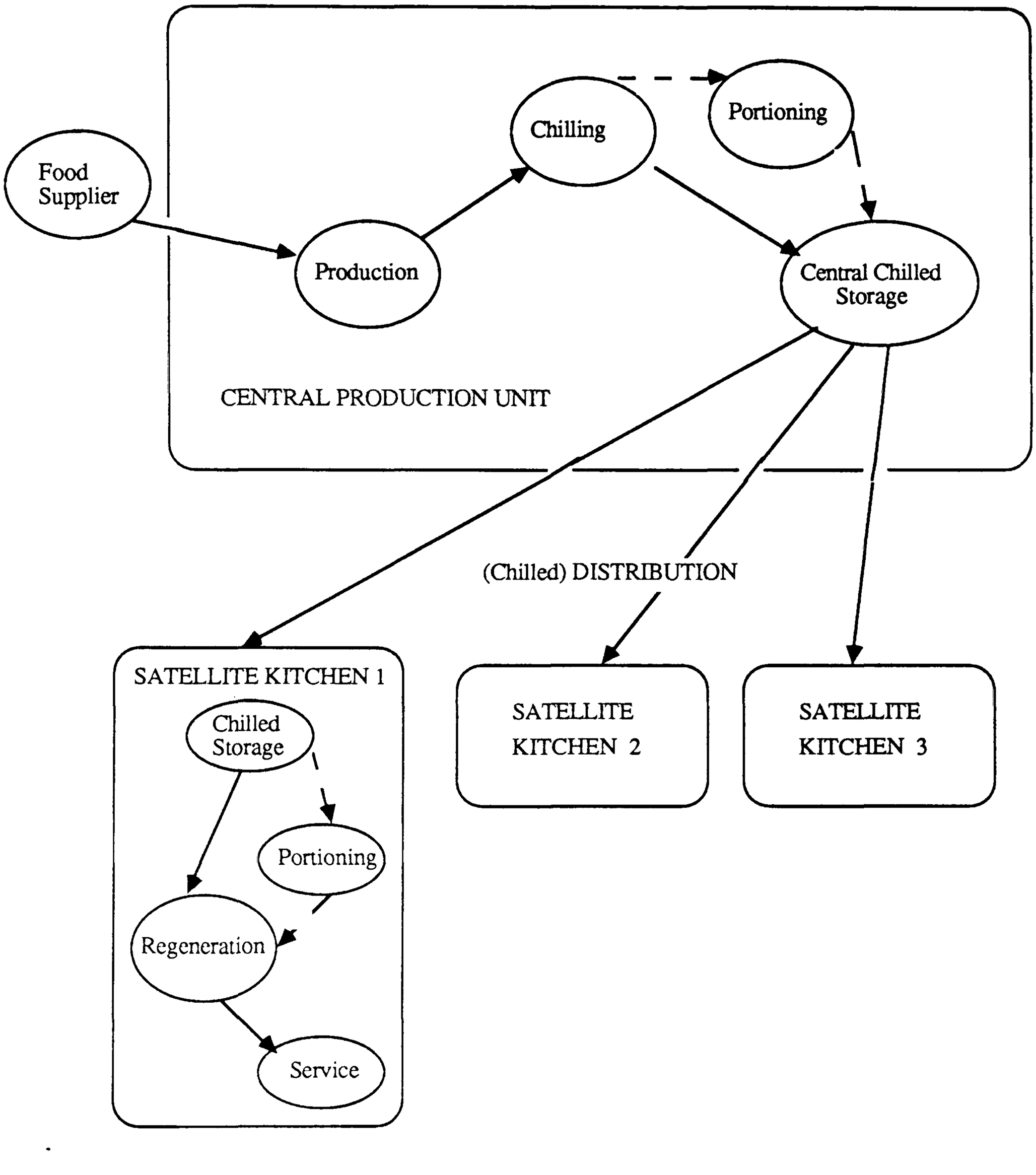
The use of cook chill as a vehicle for studying the transfer of technology in the catering industry is particularly pertinent. There is currently an escalating interest in the use of cook chill systems within all sectors of the catering industry and amidst recent evidence of its drawbacks and deficiencies (SHEPPARD,1987; GUARDIAN,1987; DAILY TELEGRAPH,1987) is a most appropriate area for study.

## 2.3 Cook Chill

The essentials of cook chill systems have been described on many occasions (see, for example, DHSS,1980; ,GLEW,1980,1985,1986; ARMSTRONG,1986; LIGHT,1986). Cook chill is a system of mass catering, which divorces production from service by rapidly chilling the food immediately after it has been cooked and then storing it at temperatures between 0° and 3° C. The food must then be reheated to a temperature of 70°C (DHSS,1980), immediately prior to service.

Figure 2.1 shows the layout of a typical cook chill operation. The initial phases of a cook chill system appear similar to conventional catering system in that the menu is planned, the food is prepared and then prime cooked.[6] The similarity ends here. The procedure and technology used in cook chill enables a maximisation of labour resources by the introduction of production-line techniques. The system utilizes more technologically 'sophisticated' equipment such as blast chillers, temperature controlled chilled storage areas, temperature control equipment and specialist regeneration equipment. It may also allow for the use of other labour saving equipment such as bratt pans and automatic pastry rollers, which are rarely found in conventional catering systems. The chilling process requires control to avoid microbiological activity and resultant food spoilage. This necessitates users obtaining an understanding of both the principles of chilling and microbiological control. The DHSS guidelines (1980) outline the process and microbiological risks associated with cook chill. In particular, it lists critical times and temperatures required to maximise microbiological and organoleptic quality of the final food product.[7] Although the DHSS document is necessary for the safety aspects of the introduction of a cook chill system, its usefulness as a full guide to

Figure 2.1 Diagram of a Typical Cook Chill Unit



the implementation of a successful cook chill unit is limited. The DHSS guidelines do not attempt to cover the necessary requirements for the practical initiation, implementation or use of a cook chill operation. Thus, they have a restricted contribution to the overall technology transfer process.

The introduction of cook chill is often described as a simple process (especially in manufacturers sales literature). However, in reality, its introduction is complex. One obvious effect of cook chill is that it alters the total concept of the catering organisation because of its innovative technological base. Thus the extent to which catering organisations are able to adapt to new technologies requires careful consideration. Unfortunately the effects of the introduction of cook chill may be dampened because of difficulties experienced by some users in incorporating new technologies into their operations, particularly with regard to the human aspects of the new technology.[8] This may have important ramifications in terms of their stability and future use of cook chill. A survey of cook chill organisations, therefore, must include a critical investigation of cook chill as a *total* system paying particular attention to the 'human interface'. It is important to take into consideration the effects on people because it is often this area which is critical regarding eventual success or failure. Therefore, the full technology transfer process from initiation, implementation and evaluation needs examination. There needs to be careful emphasis on both quantitative and qualitative methods of approaching particular issues and in order to obtain a 'total picture' information must be gathered from a number of sources. No systematic, reliable research has yet been carried out which addresses the transfer of cook chill technology in these terms. Given the current accelerating interest in cook chill, the results of such a systematic approach should be of wide interest.

Extensive exploratory work[9] clarified the main research issues and led to a major hypothesis of the study; *the activities of successful cook chill units, at all phases of the technology transfer process, differ from the activities of unsuccessful cook chill units.*

## 2.4 The Need for a Survey

Extensive information was required in order to obtain a full realistic insight into the activities of both successful and unsuccessful cook chill units throughout the user uptake phase of the technology transfer process. Thus, masses of answers on subjects which could not readily be explained by documentary research or observation alone were needed. In addition, the survey had to be large enough to ensure adequate representation of a range of both successful and unsuccessful cook chill technology transfers, plus

adequate representation of cases in sub-cells resulting from subsequent data analysis. Thus, examination of the technology transfer process in a large number of cook chill operations required mass attitude, opinion and factual data, which could only reasonably be obtained through a survey. A survey enables variety in the types of questions explored and with the variety of survey designs available is a flexible method to suit many needs (WEISBERG and BOWEN,1977; MARSH,1982). In short, it was apparent that a survey (hereafter called the cook chill survey) was the most appropriate method of obtaining the depth and range of information required to cover the research issue.

In fact, three surveys were conducted as it was recognised that information from a variety of respondents would be the most effective way of obtaining a picture of the total technology transfer process. A collection of such information enables the researcher to understand fully, the dimensions of the process in a meaningful way. It was most important to ensure that information was obtained from the 'right' people. For example, the people who had actually been involved in aspects of the technology transfer process from management through to kitchen porters. TULL and ALBAUM (1973) stressed that respondents must be able to formulate the information desired and therefore respondents must have experiences, intentions, factual knowledge, opinions, attitudes and above all memory of the issue in question. Thus, in the present research, information was collected from a variety of informants - the catering manager, cook chill operatives and consumers of cook chill food - in order to obtain a full picture of activities at different levels, from different viewpoints, throughout the transfer process.

## 2.5 Defining the Population

It is most important to define the population to be covered (MOSER and KALTON,1979). There was no available data base which listed the total cook chill population in the UK at the time of the cook chill survey. Thus, an early stage of the research was to compile such a list. A number of methods were used to ascertain the total number of users:

a) a comprehensive search of manufacturing sales lists for companies purchasing cook chill equipment
b) a postal survey (see Appendix 2a)
c) personal contacts.

Initially, this produced a list of 300 eating establishments throughout the UK which were likely to be using cook chill. Further investigation refined the list to 240 *actual* users of cook chill at the end of 1985.[10]

For an organisation to qualify as a cook chill 'user', it had to produce cooked food which then *deliberately* underwent chilling for reheating at a later stage. Thus, organisations who were involved in haphazard practices of reheating cold leftovers were not considered.[11]

## 2.6 Obtaining a Sample

Rarely is it possible to survey a complete population, thus, sampling is an essential ingredient of the survey process. The sample selected must be representative of the total population for meaningful conclusions to be drawn from the data analysis.
Three major factors were taken into consideration for obtaining a suitable sample size for the cook chill survey. First and foremost, the sample had to be large enough to answer the questions posed and large enough to produce data amenable to important forms of statistical analysis, such as chi-squared. Second, the costs of conducting a series of interviews at cook chill units throughout the UK had to be assessed. The average cost of a visit was determined during the pilot study. The maximum number of interviews affordable was then calculated. Third, time limitations had to be considered. The survey had to be completed during 1986, and given that certain times of the year would be difficult to obtain interviews,[12] a total of 9 months were available for interviewing.

After taking these three criteria into account, 80 cook chill units were sampled. The sample was selected from the total population by the use of a stratified random sample. The total population was split into four sectors of the industry (hotels and leisure, education and welfare, hospitals and industrial catering). In addition, the cook chill survey was limited to those catering organisations which broadly fell into the these categories:

a) Hotels and Leisure (including restaurants, conferences centres)
b) Education and Welfare
c) National Health Service
d) Industrial Catering

This separation was based on the assumption that there would be different requirements of cook chill for each sector. Given that the total population included 240 different cook

chill units, every third unit in the list was selected to obtain the sample of 80. A high response rate was critical in order to minimise any bias through non-response and, thus, to ensure that the sample was representative.

For each cook chill unit in the sample, the following process was followed to maximise the chances of gaining a high response rate.

a) Introductory letter mailed to the Catering Manager. This letter introduced the research project and invited participation (see Appendix 2b).

b) Follow-up Phone Call. Several days after mailing the letter, the catering manager was approached by telephone. Clarification of the use of cook chill was obtained at this stage and any other information which concerned the survey was offered. Interviews were arranged with willing respondents.

c) Interviews with catering managers and operatives conducted. Responses from consumers requested.

In total, the final number of cook chill units approached was 85. With five refusals, the response rate obtained was 94.1%.

It is important, in survey research, to ensure the sampling error is kept to a minimum. Almost inevitably a sample will differ from the total population. Therefore sample results should be regarded as approximations not as absolute results. However, the smaller the sampling error, the more accurate any approximations become. The sampling error is calculated as:

$$\pm t \sqrt{\frac{p\,(1-p-p)}{(N-1)}}\;(1-f)$$

Source: WEISBERG and BOWEN, (1977).

t approaches 1.96 for a 95% confidence interval

f = sampling fraction (sample size/population size)

p = sample proportion

N = sample size

Most of the variables in social science surveys have considerable variation, hence sampling eror should theoretically be calculated individually for each variable. However, this exercise would be impractical for the present survey since there were 766 individual variables. However, the maximum error obtainable would be when the sample proportion = 0.5. For example, if half the sample said yes to a particular question and the other half said no. Hence for this study the maximum possible sampling error was:

$$\pm 1.96 \sqrt{\frac{0.5\ (1 - 0.5)}{79}} \text{ X } (1 - 0.3)$$

$$= \pm 1.96 \sqrt{0.003} \text{ X } 0.67$$

$$= \pm 0.09$$

The least possible sampling error would be if the sample proportion was 0.97 (79 responses, the same) and 0.03 (1 response, different). Hence, the sampling error would then be:

$$\pm 1.96 \sqrt{\frac{0.97\ (1 - 0.97)}{79}} \text{ X } 0.67 \quad \underline{\text{or}} \quad \pm 1.96 \sqrt{\frac{0.03\ (1 - 0.03)}{79}} \text{ X } 0.67$$

$$= \pm 1.96 \text{ x } 0.016$$

$$= \pm 0.03$$

Therefore, when interpreting the results of this survey, there is a 95% chance that, for a given variable, the survey sample will reflect the total population within, at worst ± 9% and at best ± 3% (WEISBERG and BOWEN,1977;KALTON,1983).

## 2.7 Methods of Data Collection

Early exploratory work (literature review and visits to cook chill units) helped to focus those areas which needed consideration for a study of cook chill technology transfer. These were grouped into three broad categories (see Figure 2.2). At each phase (initiation, implementation and evaluation) issues at the three levels shown in the diagram (functional, technical and social) needed to be addressed. Three sets of respondents had to be approached in order to obtain the range of information required. First, detailed information was needed from the main decision maker, usually the catering manager on

activites leading up to, during and after the introduction of cook chill. Such was the level of detailed information required, that the catering manager (or equivalent) was regarded as a key *informant* rather than a respondent. For example, the catering manager was seen as giving detailed information about the process of transferring cook chill technology into the particular catering organisation in question, rather than merely reacting to a question stimulus from the interviewer. Second, it was considered essential that information was obtained from the actual *users* of the cook chill system - i.e. the operatives. Particularly in the light of comments made by LEONARD-BARTON (1982) that the *chooser* of a new technology or technological system, was frequently not the *user* of it. Third, it was imperative to ascertain the levels of consumer satisfaction for the food served in each cook chill operation. Hence, it was necessary to employ a method of data collection which was appropriate for each set of respondents.

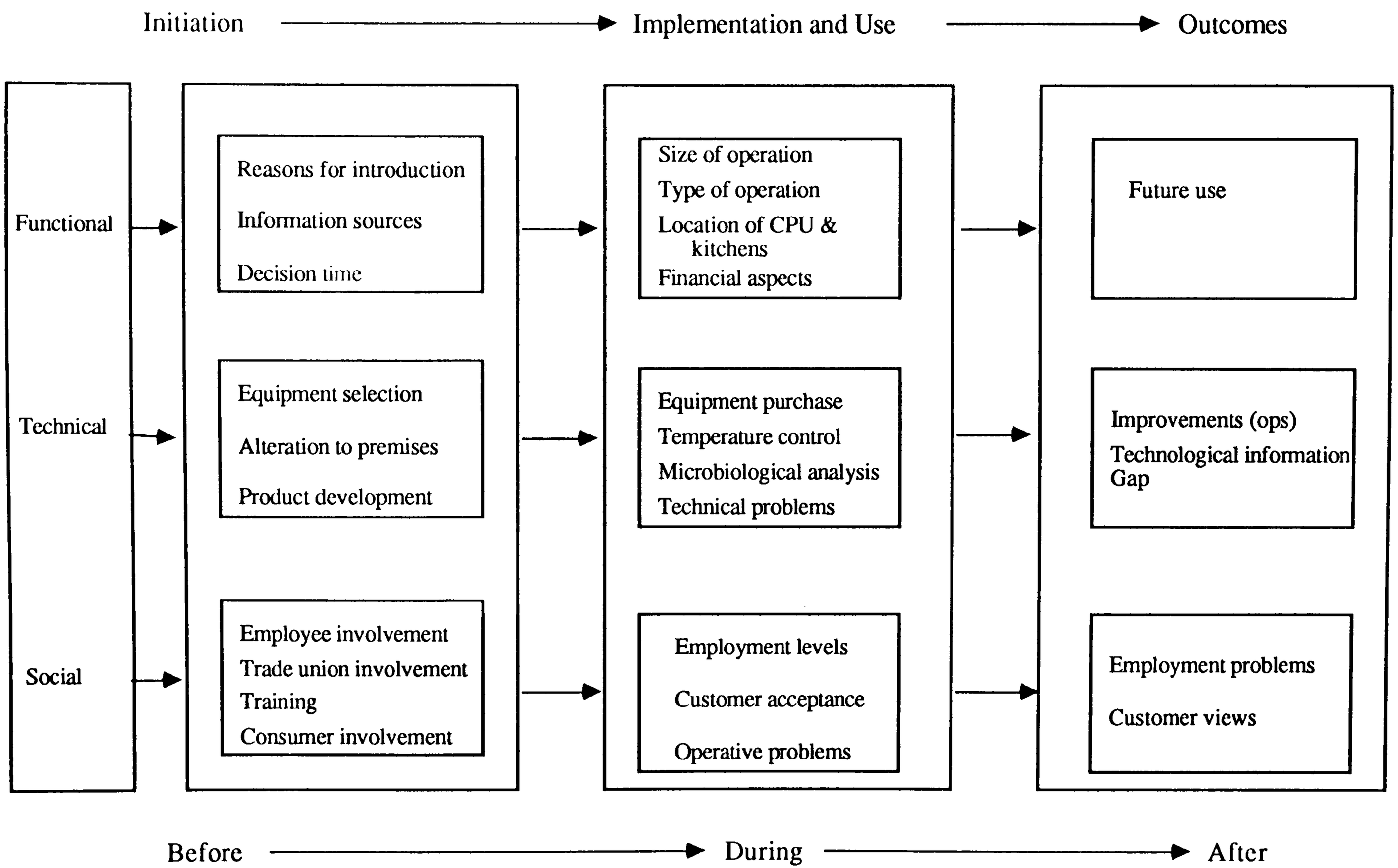
MOSER and KALTON (1979) distinguish the following principal methods of data collection:

a) Documentary sources
b) Observation
c) Mail questionnaire
d) Interviewing (including telephone interviews)

a) Documentary sources are often used to supplement data obtained by observation, mail questionnaire and interviewing. For example, historical documents, statistical reports and records of institutions, could provide information about the studied population. Within the current research, the use of documentary sources was not widespread, but in particular cases proved useful. For example, The New Earnings Survey (1980,1987) helped provide background information on wage levels and hours worked in the catering industry.

b) In general, observational methods in survey research have limited use but, in some instances, they can be used to great advantage. For example, observational techniques are most effective when used to obtain information which is likely to be inaccurate or distorted by direct questioning. In addition, observation can serve as a checking procedure to compare answers given to questions. It would have been impossible to obtain all the data needed for the current survey by the use of observation techniques alone. However, observation was used to great effect in conjunction with 'covert interviews' with operatives. This involved 'casually' conversing with operatives in an organisation whilst focussing on activities which were taking place in the kitchen at that

Figure 2.2 Key Factors in the Transfer of Cook Chill Technology



moment and drawing these into the conversation. This method helped elicit information which exposed procedures unique to the operation in question. In addition, a series of selected 'topics' which were uniform to the whole survey were discussed.

c) The main advantage of using a mail questionnaire is that it is usually cheaper than other methods, particularly when the population is scattered. Although mail questionnaires have other qualities which are favourable in some research situations, they were largely dismissed as inappropriate in the cook chill survey. The overriding reason being the need to obtain extensive in-depth information from each cook chill operation. This necessitated the use of a lengthy questionnaire. Also a high response rate was essential and given the low response rate often associated with mail questionnaires, the use of these was quickly abandoned for the main questionnaire. Furthermore, other disadvantages ruled out the use of mail questionnaires.

i) Respondents answers are final. No probing is possible and there is no chance of overcoming a respondents 'unwillingness' to answer particular questions.

ii) As the respondents are aware of the sequence of questions, answers cannot be viewed as independent of one another.

iii) It is difficult to ensure that the questionnaire is completed by the person at whom it was aimed.

iv) There is no opportunity to supplement the questionnaire with observation.

In short, the use of mail questionnaires for collecting the main body of data was inappropriate because of their relative inflexiblity. An adapted mail questionnaire was used, however, to collect information from consumers. Time and cost limitations dictated that personal interviews were an inefficient method for ascertaining information from consumers. Furthermore, the type of information required from consumers could be elicited easily by the use of self-completion questionnaires. These questionnaires were given to the catering manager of the unit visited at interview, for distribution to consumers at their convenience. Completed questionnaires were mailed back to the interviewer by the catering manager. Unfortunately, the number of units accepting consumer questionnaires was low (26 operations, 32.5%). However, in organisations where the consumer questionnaires were accepted for use, response rate from consumers was satisfactory at an average of 25 returns per organisation.

d) The use of telephone interviews in survey research is becoming more popular as a quicker and cheaper alternative to personal interviewing. The growing percentage of the population possessing a telephone has allowed this method of data collection to flourish. Telephone interviews are used mainly for short, sharp surveys such as opinion polls or follow-up surveys. Telephone surveys have a number of distinct disadvantages. For example, they are unsuitable for surveys where a lot of detailed information is required. The optimum length for telephone interviews is short, approximately 20 minutes maximum (BELSON,1985). In addition, respondents are often unwilling to disclose 'sensitive' information over the telephone to an 'unknown' interviewer. Visual aids, such as answer cards cannot be used and reading out lists of possible responses is tedious, relying on the attention and memory of the respondent. The commitment of the respondent to answer questions may be lessened by other distractions in the workplace. Furthermore, bad telephone lines and noise interference may lead to excess repetition which could in turn cause disinterest and irritation on the part of the respondent and perhaps, in extreme cases, the interviewer. The prime reason however, for disregarding the use of telephone interviews as the main method of data collection was the need to approach a number of people (including the catering manager and a sample of operatives) within an organisation. Coupled with this, the information required was both lengthy and , some questions were of a sensitive nature (for example, financial data).[13] Thus, telephone interviews are inappropraite for in-depth surveys such as those required for the current research.

Most of the information therefore was collected through *personal interviews*. The main purpose of the cook chill survey was to elicit detailed information concerning the *cook chill technology transfer process* in a sample of organisations. Personal interviews enabled comprehensive information to be obtained to complete the necessary data analysis required. Two of the major advantages of the interview technique for the current research were flexibility and allowance for greater complexity in the questionnaire. Interviews allowed for spontaneous probing and enabled the interviewer to repeat, or re-word a question when a response indicated that the respondent had misunderstood. In addition, face to face interviews allowed a much more detailed questionnaire than mail or telephone surveys. The questionnaire utilised both structured and open questions effectively. Other advantages of using an interview approach are that they can provide the interviewer with extra information, (for example, by viewing the organisation at work), and facilitate the development of a rapport between the respondent and interviewer (perhaps enabling the use of follow-up visits). Response rates are usually higher using interviews than mail questionnaires. HEALEY (1983) reports a response rate of 60% or more for interviews against 30% or less for postal

methods. High response rates are important to avoid bias towards 'responsive' firms, which invalidates any generalisations from the findings. Finally, the interview approach ensures that the appropriate person is interviewed and allows for a certain degree of control over the precision of the answers.

Useful though face to face interviews are, users of them should not become blind to their inherent disadvantages. First, they tend to be more expensive than other methods of data collection, in terms of time and transport costs. This was a prime consideration for the current research as the geographical scope of the cook chill survey covered the whole of the UK. Second, interview bias could be a problem, for example, respondents reaction to age, colour, sex and general appearance of the interviewer, may affect the type of views proffered. However, the disadvantages were outweighed by the depth and quality of information which was expected from the personal interview and therefore this method was chosen as the primary method of data collection.

Three questionnaires were required in order to obtain information from the catering manager, operatives and consumers respectively. A number of methods were adopted for collecting the necessary data.

i) *The Main Questionnaire* - personal interviews were conducted with catering managers (or equivalent) in order to obtain in-depth information about the cook chill technology transfer process. A detailed interview schedule (questionnaire) was used to ensure uniformity throughout the survey.

ii) *The Operatives Questionnaire* - personal interviews were conducted with operatives and these were combined with observations. A research schedule was used but most of the information was obtained by *'covert'* interviewing.

iii) *The Consumer Questionnaire* - a mailed questionnaire was used to obtain information from consumers. The questionnaires were distributed with the help of the catering managers and were returned by post in a pre-paid envelope.

## 2.8 Designing the Questionnaires

Questionnaire design is of critical importance (MOSER and KALTON,1979; TULL and HAWKINS,1976; BELSON,1985; BAILEY,1987). For example MOSER and KALTON (1979) point out,

> ".. no matter how efficient the sample design or sophisticated the analysis, ambiguous questions will produce non-comparable answers, leading questions, biased answers and vague questions, vague answers...It is fair to say that question design is the survey director's most persistent headache, particularly since it is still so largely a matter of art rather than science" (MOSER and KALTON,1979,308).

Extensive exploratory work which included a review of the literature, visiting a number of cook chill units and attendance at relevant seminars and conferences contributed to the process of questionnaire design. Development of the questionnaires followed a similar process to that used by BLACKBURN (1987) outlined in Figure 2.3. The ideas questionnaire was divided into three sets of information:

i) 'Musts' - included the information necessary for answering the basic questions of the study shown in Figure 2.2

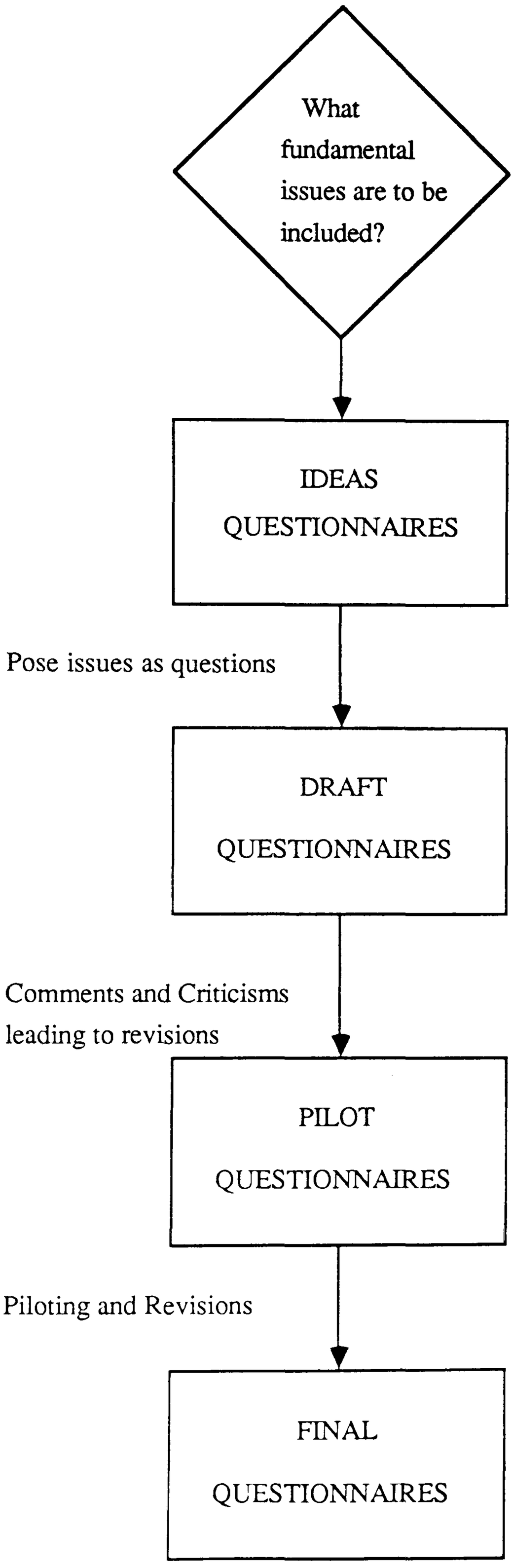
ii) 'Shoulds' - included information which, although not integral to the fundamental issues, should be included in order to obtain a more complete overall view.

iii) 'Coulds' - included information which, although not essential, would provide invaluable supportative information to the underlying issues.

These criteria helped to distinguish essential from non-essential information and avoided the development of an over-lengthy questionnaire. The 'musts, 'shoulds' and 'coulds' were converted into structured and open response questions the latter coupled with clarification or probing.

Structured questions are better suited to gathering data which are nominal (for example, type of cook chill), ordinal (for example, reasons for introducing cook chill) or intervally measured but collapsed into relatively few ordinal categories (for example, the use of age bands 1-10, 11-20, 21-30 years.). With regard to collapsing variables, BAILEY explains:

Figure 2.3 Questionnaire Development Process



> "The disadvantage of collapsing is that the researcher stands to lose a lot of information if his or her categories are too broad, or if they are split at the wrong points" (BAILEY,1987,121).

For this reason the use of structured questions with collapsed categories was avoided. However, in many instances pre-coded questions were invaluable for recording factual answers. Answer cards were utilized effectively where a number of categories were used. Structured questions were also used as filters for open ended questions and provided some control over time and content.

Open-ended questions are useful for complex questions that cannot be answered in a few simple categories, but require detail and elaboration. They are especially helpful in eliciting respondents' unique views, philosophies, or goals. They provide insight and depth into a problem and gather qualitative evidence which cannot be structured or quantified easily. Open-ended questions were used exclusively during the exploratory stage to devise structured questionnaires for the survey proper, and to a lesser extent at the pilot and final questionnaire stage. Although, if used effectively, both structured and open questions provide detailed and varied information, there are drawbacks to both methods. In particular, structured questions can induce a respondent who does not know, or has no opinion to guess the appropriate answer or even to answer randomly. The respondent may feel that their answer is not covered by the categories listed or is not provided for in sufficient detail; a problem which can be overcome by combining them with open questions and probing. In addition, variations in answers among different respondents may be eliminated artifically by forced-choice responses.

The main problem with open questions is that responses may be non-comparable, unusable or irrelevant to the study. However, this problem can be minimised by clarification and probing. A combination of structured and open-questions therefore, provides direction, control and flexibility in the survey schedule.

In general, question wording should be short, simple and concrete. This view is supported widely in the literature (TULL and HAWKINS,1976; MOSER and KALTON,1979; BELSON,1981; HOINVILLE, JOWELL et al,1983). For example, HOINVILLE, JOWELL et al state:

> "A good questionnaire has to be designed specifically to suit the study's aims and the nature of its respondents. It needs to have some of the same

properties as a good law: to be clear, unambiguous and uniformly workable" (HOINVILLE, JOWELL et al,1983,27).

Hence the wording of questions must avoid:

unfamiliar/big words
negative implications
the use of a lot of 'information carrying' words in one question
vagueness
ambiguity
questions that offer long alternatives as 'choice of answers'
leading questions
presuming questions
hypothetical questions
questions which involve a lot of effort by respondents, for example, memory dependent
questions, questions involving calculation. (MOSER and KALTON,1979; BELSON,1985).

Thus, during questionnaire development, question wording, as far as possible, used words in common, everyday use and question length was kept as short and precise as possible. Where a lot of information was required on a particular topic, a series of smaller questions were introduced.

Three different questionnaires were required to elicit the necessary information from:

i) Managers
ii) Operatives
iii) Consumers.

Although each questionnaire included both structured and open questions, the operative questionnaire was predominantly open questions, the consumer questionnaire predominantly structured and the managers questionnaire a mixture of both.

The main bulk of information was ascertained from the managers. Inevitably, this resulted in the use of a lengthy questionnaire. Questions were kept as simple and concise as possible. Where questions offered a choice of answers, answer cards were used. As the study was largely retrospective, the use of memory dependent questions

could not be avoided.[14] The 'musts', 'shoulds' and 'coulds' system was extremely useful in keeping the questionnaires to a minimum, whilst maintaining the depth of information required to answer the research issues.

In the operative questionnaires, the information was based around broad concepts rather than individual questions. This was for practical reasons. The majority of operatives had to be approached whilst they were working and the use of pre-coded answers and answer cards would have been inappropriate and awkward. Thus, the interview schedule was more of a checklist than a questionnaire, eliciting information around a number of broad concepts, which were uniform throughout the survey. The nature of the information collected was, therefore, essentially qualitative.

The consumer questionnaire, above all, had to be worded carefully to avoid any misunderstanding from the questionnaires. Unlike the interview situation, for the managers and operative questionnaires, there was no opportunity to identify any ambiguous points to the consumers. In particular, the consumer questionnaire needed to be an attractive, well routed questionnaire, which avoided questions that could be spoiled by collaboration or peer pressures.

At this stage the questions in each questionnaire were tested (on colleagues) before piloting to filter out or alter any questions which appeared to confuse or fall down in practice. The most informative check though was through the pilot survey.

## 2.9 The Pilot Survey

The pilot survey acts as a field test for a questionnaire. It is essential as a guide to the general manageability and acceptability of the questionnaire. Specifically, any deficiencies with wording, ordering lay-out and filtering can be highlighted during piloting. It is also useful in identifying redundant, ambiguous or even missing questions. As to size and design of the pilot survey, MOSER and KALTON suggest that it:

> "..is a matter of convenience, time and money. It should be large enough to fulfill the [essential] functions, and the sample should be of a comparable structure to that of the main survey" (MOSER and KALTON,1979,51).

Five pilot interviews on each questionnaire were carried out. Besides testing the suitability of the questionnaire (wording, length, manageability), the pilot survey clarified the feasibility of conducting a lengthy interview with the catering manager, followed by a number of interviews with operatives, plus initiating the distribution of consumer questionnaires. In addition, the pilot survey tested the usefulness of the introductory letter and follow-up phone call. Following the pilot survey, a few minor changes were made to question wording and the order of questions was altered slightly in the main questionnaire. Copies of the final questionnaires are shown in Appendix 2c. The introductory letter worked successfully and contacting the appropriate person proved a relatively simple process. However, some questions had to be omitted from the final questionnaire because they were too reliant upon the respondent's memory.[15] In short, the pilot survey proved an essential and valuable process which showed that the methods chosen were going to yield useful *and* usable data.

## 2.10 Conducting the Survey

Two practical problems which were not identified in the pilot survey, but which became apparent as the main survey progressed were the response rate for the consumer questionnaire and the non-disclosure of financial information. The major problem with the consumer questionnaire was in obtaining permission to distribute questionnaires for customer completion. In many cases, the catering manager was unable to or refused to do so. A number of reasons were given for this. It was:

i) inappropriate for use in situations such as banquetting or 'high-quality' restaurants

ii) unacceptable because of 'delicate' situations with the general workforce[16]

iii) refused in situations where the catering operation was run by contract caterers who were often unwilling to approach their clients for permission to distribute the questionnaire.

In a few isolated cases, the consumer questionnaire was simply refused and no reason was given.

The problem of obtaining financial information was, in some cases, less to do with its sensitive nature and more to do with the respondents lack of the relevant knowledge. For example, detailed financial information may not have been the responsibility of the catering manager and, thus, the final capital expenditure on their cook chill system may

not have been disclosed. Alternatively, perhaps breakdowns of what items capital was spent on was not detailed to the catering manager. In addition, the system may have been introduced so long ago that the information was no longer to hand. These problems frequently arose where the catering unit was run by contractors, because financial expenditure on capital equipment was often the responsibility of the client rather than the contractors. In some cases, information gaps could be remedied by follow-up phone calls or letters, which gave the informant an opportunity to gain the relevant information or indicate who the information may be obtained from.

Despite these two problems, the questionnaires, generally fostered a good rapport between interviewer and respondent and in many cases 'extra' information was proffered. For example, copies of feasibility studies, recipe schedules, information booklets and video tapes.were provided.[17] Perhaps the most useful aspect of the pilot survey, however, was to allow the interviewer practice at the skill of interviewing.

## 2.11 Conclusion

There has been a profusion of research on the technology transfer process but this has stopped short at the diffusion of such technology. Very little work has been completed on activites during the user uptake phase. Furthermore, different requirements have been found to exist for different industries and different technology transfers. The use of cook chill as a vehicle for a study of technology transfer in the catering industry has been shown to be most pertinent.

The need for a survey which involves approaching different groups of people will provide detailed information from a range of sources. This will contribute towards a holistic view of the technology transfer process from idea generation through the introduction process to implementation, use and assessment of outcomes from a variety of angles (managers, operatives and consumers).

An analysis of the results will first identify the relative success of each organisation surveyed. The activities of the most successful group of cook chill users can then be compared with the activites of the unsuccessful group. The differences uncovered between the two groups will provide invaluable knowledge for theorists on the technology transfer process. Perhaps more importantly, this knowledge will guide technology *users* towards a successful transfer of (specifically) cook chill technology.

## Footnotes to Chapter 2

1 For further discussion of this point see ROTHWELL,1972; and FISCHER,1976.

2 However this has resulted in only a marginal decrease in the gap between catering and other, higher paid industries. (EMPLOYMENT GAZETTE,1986).

3 Although it has been noted that since their abolition catering workers have been the victims of further exploitation (SHEPPARD,1987).

4 Along with hairdressing (SIC 98, 982) and the retail clothing industry (SIC 453, 4536).

5 Similar threats to in-house commercial caterers of contracting-out catering sources may also exist.

6 However, recipe and method modification is often required.

7 The main points made in the guidelines are that the food should be:
a) Subjected to an initial cooking treatment which will ensure destruction of the vegetative stages of any pathogenic micro organisms present.
b) The chilling process should commence within 30 minutes of leaving the cooker. The food should be chilled to 3°C within a further 1.5 hours.
c) The food should be controlled carefully during distribution.
d) Temperature should be controlled carefully during distribution.
e) Reheating should be done as soon as the food comes out of the chiller and the food should reach an internal temperature of at least 70°C.
f) Food should be consumed as soon as possible after reheating. Unconsumed reheated food should be discarded.

8 For discussion of difficulties in incorporating new technology into organisations see ROTHWELL and ZEGVELD (1982).

9 This included a review of relevant literature, observation, field visits and attendance of cook chill seminars.

10 It is expected that this number has increased dramatically since 1985.

11 No technological system was utilized in these operations and therefore was of no interest to this study.

12 It was assumed that summer (holidays) and Christmas would be 'difficult' periods for the caterer.

13 In a few isolated cases, telephone inteviews were carried out with operatives, because, at the time of interview, it was not possible to interview them direct.

14 Where respondent could not remember the question was either treated as 'missing data' or a follow-up phone call was made in an attempt to ascertain the information after the informant had had a chance to find the required information.

15 Specifically, these questions referred to the grades of staff employed prior to the introduction of cook chill and the wage rates. In many cases the information given was scant and uninformative. The questions were thus omitted.

16 Particularly in industrial locations where '"pieces of paper asking questions" were associated with job loss by the respondents.

17 One company had produced a promotional video. A copy of which was supplied to the interviewer.

# Chapter Three

# Establishing Success Criteria

## 3.1 Introduction

This Chapter will investigate factors used to assess the relative success of each operation in the sample, with regard to the transfer of cook chill technology. In addition, it will show how these factors were analysed. This will provide the basis for a comparison of successful and unsuccessful cook chill operations to be made in Chapters 4 to 6. It must be stressed at the outset, that the overall success of the organisation implementing cook chill was not in question nor relevant to the interests of the study. In many cases, the transfer of cook chill technology referred to a relatively minor part of the activities of the organisation in question, and as such its success or failure bore little resemblance to the performance of the organisation as a whole. Success here relates to the *transfer of technology*.

Which were the most successful and the least successful technology transfers in the cook chill operations surveyed? This question must be answered before an examination of the activities of successful and unsuccessful cook chill operations can be undertaken. Thus, in order to compare the differences between the activities followed by the successful group and those followed by the unsuccessful group, during the technology transfer process, it is first necessary to develop a robust measure of 'relative success'. There are, however, three major difficulties with the concept of 'relative success' which need to be overcome. These are its multi-dimensional character, its potential for subjectivity and its contingent character.

It is possible for an operation to manifest success in one way whilst at the same time be unsuccessful in another. For example, an operation could be financially more successful after the introduction of new technology but operationally less successful. Conversely, an organisation could be technically successful whilst failing to achieve financial targets. Thus, it is important to define 'success' in an overall context which captures the balance between different dimensions of success.

An important aspect which also merits consideration is, 'From whose viewpoint is the judgement of success being made?' CHILD (1974) stressed the significance of deciding whose interests should be served, whether from the organisations view of success - judged in terms of achieving organisational goals - or a set of externally imposed criteria for an assessment of success. For the purpose of this study it would be inappropriate to judge success on the criteria laid down by an individual organisation alone, as it is likely that these would differ between organisations and measure the achievement of organisational goals rather than *successful technology transfer*. Not unnaturally, within

an organisation, technology transfer is often seen as a means to an end, not an end in itself. Therefore, it was essential to evolve an overall measure, using carefully selected criteria, to give an assessment of successful technology transfer for each operation in the sample.

However, there is an in-built difficulty in globally assessing success. The characteristics of different industry sectors, or even different organisations within a sector, may vary. For example, the priority given to capital expenditure in the catering department may differ between, on the one hand, hotels, restaurants and contract caterers and on the other, hospital catering, school meals and industrial catering. In the former, the main business is catering and, therefore, if the investment is seen as profit-generating, the likelihood is that such capital expenditure will be given the given the go-ahead. In the latter, however, the catering department is part of a much wider organisation - a hospital complex, an educational system or, for example, a manufacturing company. As a result, other departments within the organisation may have a greater claim to any capital expenditure than the catering department, even though the investment may be economically justifiable.

## 3.2 Definitions of Success

A suitable definition of 'success', appropriate for the measurement of successful technology transfer needed to be established. This definition had to take a number of factors into account which included; what is being judged as successful, from whose viewpoint, and what dimensions led to that success. A dictionary definition of success states that it is:

> "The favourable outcome of something attempted, the attainment of wealth, fame, etc., an action, performance etc. that is characterised by success" (COLLINS ENGLISH DICTIONARY, 1983).

However, this is a purely formal definition and it does not specify the *content* of a "favourable outcome" or "something attempted". Therefore, for the purpose of this study, the definition given above had to be developed.

ROTHWELL et al (1974) attempted to define two different types of success. The first, technical success, were those cases which,

> "...function satisfactorily from a technical point of view but do not however, achieve commercial success." (ROTHWELL et al,1974,259).

Whilst the second type of success, commercial, was defined as,

> "...the acquisition of a worthwhile monetary gain and/or market share" (ROTHWELL et al,1974, 269).

With regard to commercial success, ROTHWELL et al (1974) stated,

> "...provided the necessary data is available, the measurement of success is straightforward. The real situation, though is not so simple and the overall success of an innovation must be measured by the total impact of the innovation on the innovating organisation" (ROTHWELL et al,1974,269).

In order to make any measurement of the total impact of an innovation, every factor that contributes to that innovation must be taken into consideration. The measurement of overall success of an innovation causes problems because a multi-faceted measurement is often difficult to achieve. A review of the literature concerned with successful technology transfer showed that it lacked a holistic definition of success (see Chapter 1). Reliance on single factor success measurements which, in general, related to commercial or financial success, were common. To overcome this deficiency in current knowledge, the present research concentrates on a multi-dimensional measurement of success.

It is important to note that in this and subsequent Chapters, 'success' is relative rather than absolute. In other words, the overall degree of success of each operation was measured against the overall degree of success in all the other operations in the sample. It is possible for *all* of the operations in the sample to achieve a certain degree of success, conversely, it is also possible for *none* of the operations to achieve any degree of success. Both of these situations were unlikely, but the point is that each organisation will necessarily be judged on its success relative to the success of all the other operations in sample. This measure then becomes one of *overall relative success*.

Many previous reports have described factors which affect successful technology transfer within organisations, but few attempts have been made to explain the methods used to quantify the extent of this success. Thus, factors which could constitute success in the current research needed to be identified. Only then could the extent of success be determined.

Various studies (mainly in the manufacturing industry), have looked at factors which influenced success and failure in innovation or technology transfer. Some of these studies looked at organisations *predetermined* as successful (with no consideration for those organisations which failed), for example, organisations which received an award for technological achievement from a relevant external body. In contrast, others utilized financial or more complex methods of defining success. However, all of these studies suffered from the common fault of only a vague reference to the actual criteria used to define success. The methods of defining success which were used in these studies can be broadly categorised as:

i) Reputational definitions
ii) Uni-factor definitions
iii) Multi-factor definitions

## i) Reputational Definitions

Reputational definitions of success are those which indicate that the operation in question is successful and use some form of external measurement, usually an award given by a relevant body or specialist organisation. For example, LITTLE (1963) used several criteria to select a sample of firms from a set predetermined as successful in the 'IR 100 Award'[1] for the previous year. The criteria used to determine whether a firm should achieve this award included: economic importance, technological significance and the degree of change in capital equipment, organisation and training required to implement it. Similarly, LANGRISH et al (1972) identified successful organisations as those which had won the 'Queens Award for Technical Innovation' (1966 and 1967),[2] in his study of successful technology transfers. Awards were based on recommendations by a panel of 'experts'. However, one of the dangers of this type of award is the vulnerability of the decision by successful corporate publicity or 'hype'.

In the catering industry however, there is no relevant award scheme which encompasses all sub-sectors of the industry that could be used as a measure for technological success. Therefore, for the purposes of the present research, it was not possible to use this type of success definition.

## ii) Uni-factor Definitions

The majority of studies which relied on single factor definitions of success concentrated on financial measurements. These measurements usually related to profit/loss data or

achievements in the market. For example, MYERS and MARQUIS (1969) used the criterion of 'commercial' success as, "achieving a certain percentage of the market share", a method shared by DEBREYNE (1973). Whereas SZAKASITS (1974) looked at successful innovation in the Hungarian electronics industry based on the SAPPHO[3] project (ROTHWELL,1972) and defined success as the return on the product output less the input. Research and development was considered unsuccessful when the return was negative.

The studies outlined above showed that reliance on single factor success measurements were justified in investigations of innovation in the manufacturing industry, because the measure of whether that new product or technology achieved a specific market share or profit was a good indication of the success of a product or technology. It is argued that, for the purpose of this study the use of the financial criterion alone would be unsatisfactory, not least, because of the existence of 'not-for-profit' organisations within the catering industry. In addition, as this was a measure of sucessful *technology transfer,* there was a need to go beyond a 'narrow' financial criterion. Success or failure is a multi-faceted concept and, as finance is an important aspect in most organisations, it will be included in this assessment of success. Whilst, ultimately, all other criteria impact upon financial efficiency, this project was restricted to a fixed timescale and could not wait until the impact of technology transfer on financial performance had fully worked through. In addition, there was a practical problem in obtaining reliable financial information. A number of organisations, particularly in the private sector, were unwilling to disclose financial data. Also, the impact of introducing cook chill on finance may be subsumed in an operations' overall accounting and therefore, even if figures were available for capital expenditure, it may be difficult to isolate financial revenues or profit changes from cook chill. Thus, it was neither useful nor practical to judge success using this single criteria alone.

In general, there were a number of key arguments which decided against the use of single criteria measurements. First, and possibly most important ,was: Which criteria to use? Although financial or profit related criteria were often cited in the literature, there was no *universal* agreement on the best criteria to use or even the best measurement of an agreed criteria. Second, it was difficult to isolate the impact of cook chill on particular measures from the impact of the organisation as a whole.[4] It is suggested therefore, that a more comprehensive method of assessing success is required.

Results of other studies (BRAGAW,1970; LANGRISH ET AL,1972; ROTHWELL,1972; ROTHWELL et al,1974; ETTLIE 1973,1983) further demonstrated

the inadequacy of the use of single factor success measurements, even in competitive industrial innovations. However, BRAGAW (1970) commented that:

> "Technological innovation is not a single action but a total process of inter-related sub-processes" (BRAGAW,1970,48).

### iii) Multi-factor Definitions

The process of technology transfer is complex (see Chapters 1 and 2), whihc means that any measure of its success must reflect this complexity. In addition, the existence of possible factors specific to a technology transfer must be accounted for. Thus, a single factor judgement of success was considered to be inadequate and a complex multi-faceted approach was developed.

LANGRISH et al (1972) acknowledged that a multiplicity of factors existed which affected success and that before success could be attained there were many complications to overcome before any benefits were noticed.

ROTHWELL (1972), however, was more specific in his definition of success in project SAPPHO. In the initial study the criterion for success was purely commercial. However, in his follow up study (1974), he acknowledged that this measure was insufficient and that success must be gauged by the *total* impact of the innovation on the innovating organisation. He suggested that success must be judged on 3 factors:

> "1. Net direct monetary gain accruing from the sale and/or licensing of the innovation and from the sale of technical know-how generated through the innovation.
> 2. Market share in terms of numbers of units sold and average sales per unit.
> 3. Alignment with company strategy - 'company strategy' is a loose term which takes account of how well the innovation aligned with the overall planning of the company and any scientific, technical or other spin-off. In fact, anything other than direct monetary gain and market share" (ROTHWELL et al,1974,269).

Scores were allocated for each innovation investigated, which resulted in an improved indication of relative success. However, the three factor model was not rigidly adhered to. Where success could not be defined clearly using factors one and two alone, then

factor three was introduced purely as an interpretive element (ROTHWELL et al,1974). Although, *prima facie,* evidence indicated a more rigorous, multi-faceted approach, further investigation suggested that only a small improvement in the definition of success had been made.

ETTLIE's (1973) survey of 10 numerically controlled (NC) machine tool installations sought to answer the core question. What were the differences between organisations which were relatively successful and those which were relatively unsuccessful in implementing new technologies? His absolute definition of success was fairly vague, but concentrated on a dependent variable - 'utilisation'. He used several factors to measure utilisation and later hypothesised that 26 factors were important indicators of relative success or failure in the uptake of new technologies. In a later evaluation he used two measures of technological utilization to measure success:

> "The first was a self report estimate of the weekly percentage of the time the machine was producing parts based on a 24 hour day. This was provided by respondents in weekly telephone conversations with the researcher.....The second was an unobtrusive indicator obtained by examination of photographs which were taken of the machine on the first visit (P1) and the last visit (P2). Colour photographs were taken from eight compass points....The unobtrusive indicator employed was the amount of wood dust accretion on the machine (ETTLIE,1977,124).

Although this was an improvement on other definitions of success mentioned earlier and was an interesting approach to overcoming the problem of success determination, it was still an unsuitable measure for success in the present research, given the inherent difficulty anticipated for obtaining reliable, unobtrusive measurements of utilisation in a cook chill situation. Ettlie himself, encountered much difficulty in measurement of the use of stationary NC machine tools[5]. Thus, the reliability of this type of evidence in the cook chill survey would have been suspect. For example, the amount and extent of the photography required to monitor the successful utilisation of a complex cook chill system and the amount of time spent in its assessment, was unrealistic even to contemplate. In particular, there was the knotty question of what, exactly, to photograph.

In summary, studies which used uni-factor definitions, most commonly relied upon financial efficiency as the chief criterion of success. The difference between success and failure was, in many cases, fairly arbitrary in that any organisation which achieved a profit or a "worthwhile" market share, was classified as 'successful'. In some cases the

measurement was even more unrealistic with the division between success and failure simply being determined by a single years profit or loss figures. This type of 'black and white' method for success measurement would have yielded only superficial results with no indication of the degree of *relative* success achieved by a particular organisation. For example, no differentiation was made between those operations which made a huge profit and those who only made a small profit. Similarly, those organisations who made a small profit were classed as successful and those who broke even or made a slight loss were considered unsuccessful, when perhaps in reality the two organisations in the second example were closer in their performances than the two organisations in the first example. ROTHWELL et al (1974) reinforced this argument by stating that "Few innovations can be termed a complete success [or failure]" (1974,268). The use of multi-faceted success measurements have to date been scarce, despite the fact that the inadequacies of uni-factor measurements have been accepted. This raises the question: Why has the use of multi-faceted success measurements been, as yet, little used? Undoubtedly, the main reason has been because of the difficulty in obtaining suitable, reliable measures. Obviously, appropriate measurements of success vary with the specific definition of success used. The majority of studies cited so far have used one of three definitions (reputational, uni-factor or multi-factor) in order to judge the success of the organisation or technology transfer investigated. Clearly, the time is ripe for the introduction of a more rigorous, multi-faceted approach to the measurement of success.

## 3.3 Identification of 'Success' Factors

Given that success is a construct derived from other observed variables, it was essential to make sure that the factors chosen related to *indicators*of success rather than factors *affecting* success. Each factor therefore, was one of a series of key points which were selected in judgement of *overall relative success* for the particular technology transfer under investigation.

RHODES and WIELD (1985) stated that the investment in a technological system has both technical and social components,

"...the technical part consisting of decision rules and techniques for assessing projects, forecasting the availability of funds, formal control procedures etc.,...the social processes, including the development of attitudes and patterns of behaviour, are perhaps less obvious but their existence can be detected most easily in the way ideas occur" (RHODES and WIELD,1985,275).

It was important to identify the significance of areas specific to the transfer of cook chill technology in the selection of success criteria. It is suggested that technology specific factors have a potential level of uniqueness which makes general understanding and explanations difficult to define meaningfully in general terms. This suggestion was supported by MACDONALD (1985) who discussed the tendency to perceive technology in a narrow way which is essentially rooted in machines with a consequent lack of understanding of technological processes. He argued for a much broader view of technology which did not necessarily include machines but which considered the body of knowledge which was compulsory for 'getting things done'. This directed attention towards some of the more nebulous aspects in the technology transfer process, for example, relationships between technical experts and commercial experts. These aspects were often ignored despite their possible significance to success or failure because of their intangible nature. This also indicated that the entire environment of technological change needed careful examination since many of the less tangible factors were ultimately located in the product market or elsewhere.

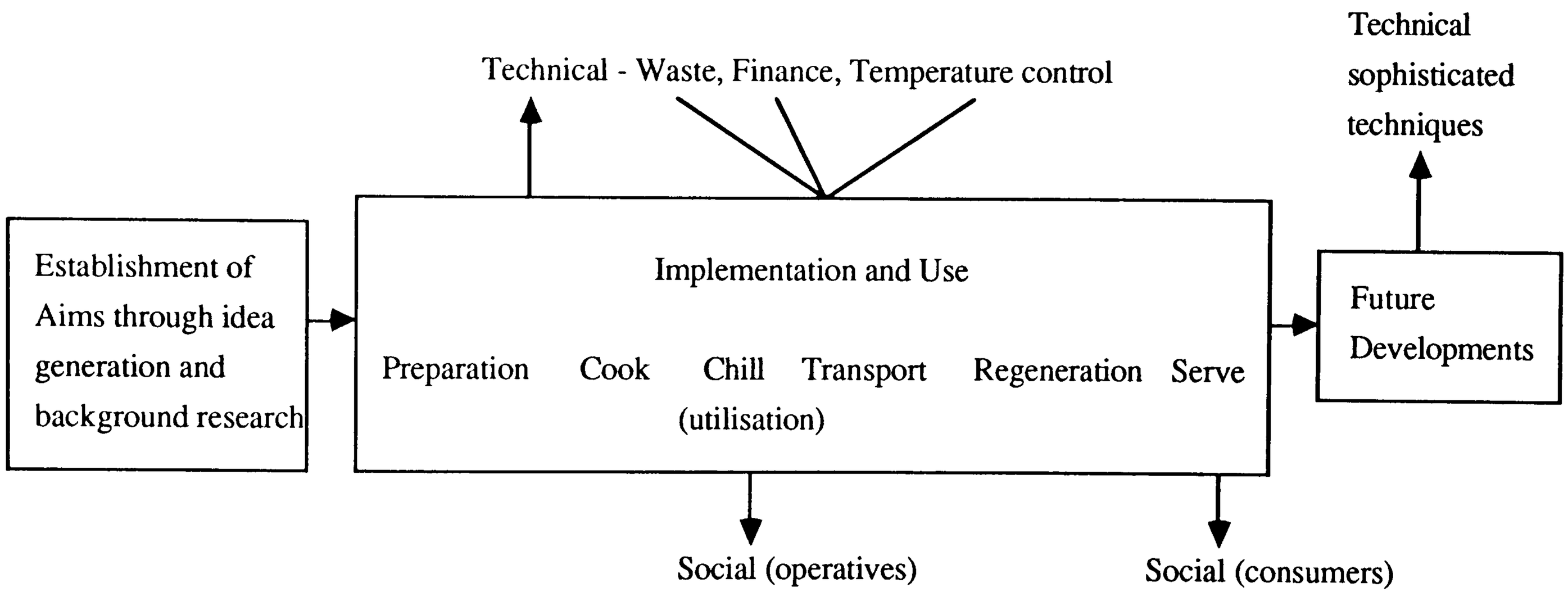
Therefore, the factors used to assess the successful transfer of cook chill technology not only related to the functional aspects , but also reflected both technical and social components of the system. Figure 3.1 shows a simplified adaptation of the cook chill transfer process. Each box represents a stage in the transfer process which must be undertaken for a successful transfer of technology to result. In conjunction with the main flow of the diagram (functional aspects), other inter-related activities (both technical and social) occur which have a direct influence on the success of the technology transfer and therefore were used in a measurement of success.

The set of factors used for the determination of successful transfer of cook chill technology were developed from key aspects of the total cook chill system shown in Figure 3.1. Each success factor was carefully selected with both cook chill specific as well as general aspects under consideration. A detailed discussion of the selected success factors will be given in a later section, however a brief description is given here.

### i) Functional factors

First, an initial functional factor was selected which gave an overview of actual use of the system which separated users, at the time of interview, from non-users. Since much of the literature describes cook chill as a 'total catering system' (GLEW,1985; ARMSTRONG,1986)[6] *utilisation* of cook chill was considered a factor indicative of success. It was measured as an overall score of efficient utilisation in terms of the

Figure 3.1 Simplified Diagram of Points in the Cook Chill Technology Transfer Process Where Success May Hinge



percentage of total food output accounted for by cook chill and the efficiency of its utilisation, in terms of maximising the use of available capacity. A further functional factor took into account any problems which occurred during the implementation and use phase of the technology transfer process. The use of this factor was important as it indicated the ease which the overall cook chill operation was implemented. Obviously, no system can be totally problem-free but the amount and extent of problems which occurred varied between organisations. Therefore, its inclusion as a factor for a measurement of relative success was appropriate.

Cost benefits were constantly associated with the introduction of cook chill and, as discussed earlier (Chapter 2), were an essential component of an assessment of success. Although, ultimately, the financial achievement of an organisation illustrates the level of success attained, this may not always be immediately evident[7] or may be hidden by the effects of other factors. Thus, the use of financial achievement in this assessment of success was used *in conjunction* with other relevant factors.

### ii) Technical factors

Two technology-specific factors were identified as appropriate for inclusion. The first, temperature control was more a measure of 'proper use' than 'success' per se, however, its inclusion was justified because of the potential problems which could run counter to success if temperature control was inadequate. Second, a waste factor gave an objective assessment of both the technical merit of portion control and the level of acceptance by the consumer in terms of plate waste , although differentiation between the two indicators was not made.

### iii) Social factors

Social factors were relatively easy to isolate as they included two sets of people who were directly affected by the introduction of cook chill - namely the employees (operatives) and the consumers. Two factors measured the acceptance and satisfaction of both employees and consumers with regard to the introduction of cook chill, but the measurements differed in a fundamental manner. The employee measurement referred to the operational aspects of the use of the system whereas the consumers' related to the 'end-product experience' which indicated their acceptance of cook chill food.

The social factor concluded the selection of factors used to determine the relative success of the transfer of cook chill technology for each operation in the sample. These factors

are shown in Figure 3.2. A detailed breakdown of the eight sub-groups identifies the variables which contributed to the measurement of each success factor (see Figure 3.3). Not all of these factors were simple, straightforward measurements. Indeed, several factors consisted of highly complex measurements from a number of inter-related variables. A method for obtaining measurements for these factors was investigated.

Figure 3.2 Factors Selected for Assessment of Success

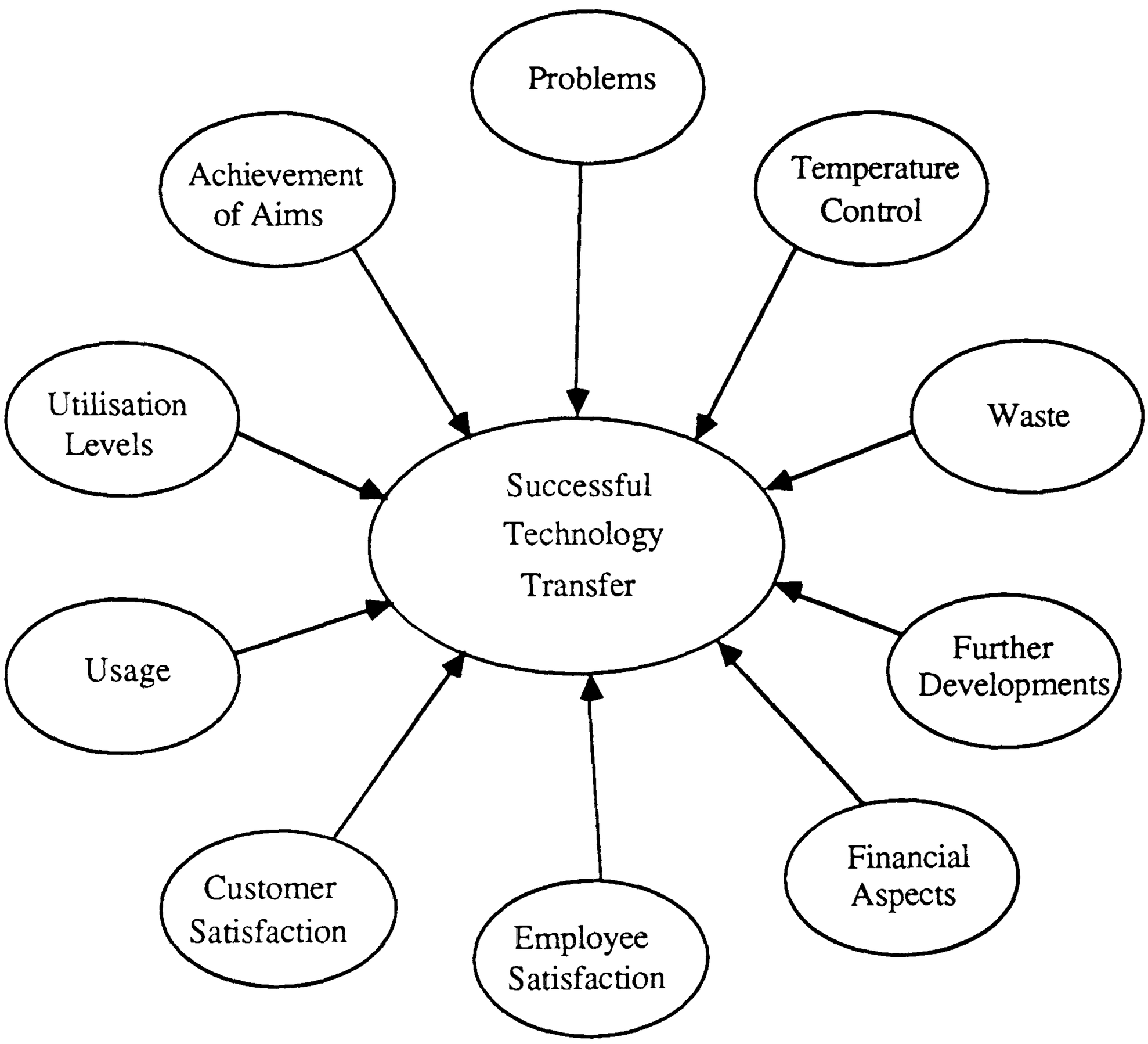
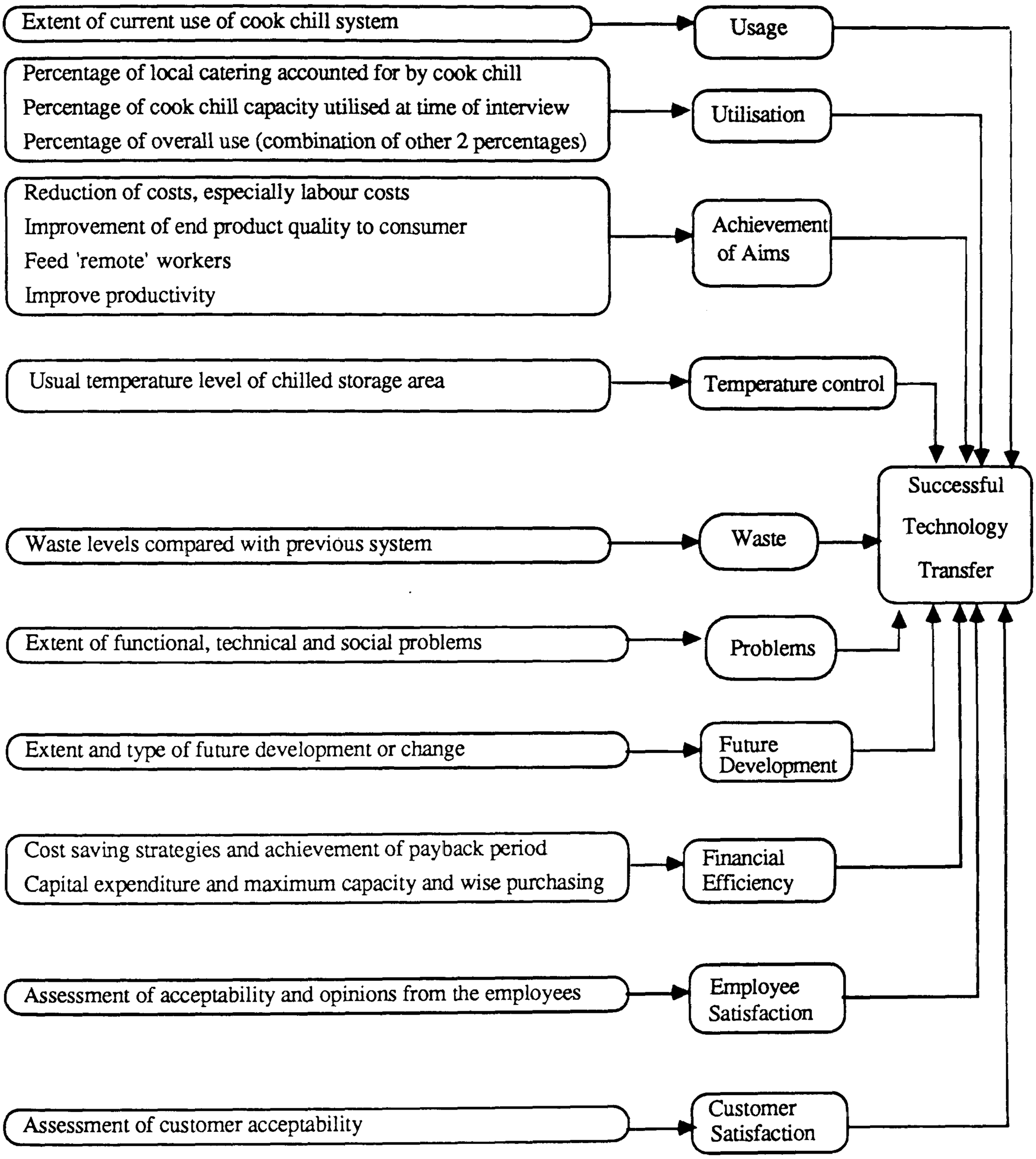


Figure 3.3 Factors for the Assessment of Successful Transfer of Cook Chill Technology



## 3.4 Determination of Methods for the Measurement of Success Factors

An appropriate multi-factor analysis was achieved by the use of a scoring technique. Each factor was seen as an important contributor to the judgement of overall success and, in order to ascertain which operations were the most successful, each factor had to be given a 'score'. Scoring techniques have been well established as a tool for the evaluation of sets of determined criteria. For example, GILLINGHAM (1980) used a method of scoring in his comparison of attribute profiles of profitable and unprofitable companies in the UK and Canada. His work attempted an investigation of some of the complex and inter-related influences at work in a firm. His major hypothesis suggested distinct differences in the attribute profiles, of profitable and unprofitable companies. These profiles consisted of management style, organisational attributes and managerial attitudes of each company. Each attribute was assigned a measure between 0 and 1. He found profiles for profitable and unprofitable firms differed significantly on 41 attributes. He then used multi-variate models to further examine these differences. This enabled production of a model of attributes associated with profitable companies (see Appendix 3a, Figure 1).

In their study of entrepreneurial characteristics and the development of new manufacturing enterprises, NICHOLSON and BRINKLEY (1982) established criteria for a classification of founders of such organisations and another set of criteria based on the strategic behaviour of these companies. Each individual criterion was awarded a score of -1, 0 or +1, dependent on the founders' response. Examples of selected criteria and typical responses are shown in Appendix 3a, Figure 2. The respondent was asked a series of questions and the responses given were categorised. Replies were scored according to the category into which they fell. Once all the factors for each company had been scored, an overall score was calculated by the addition of each of the factor scores. The methods utilised by GILLINGHAM (1980) and NICHOLSON and BRINKLEY (1982) were adapted for use in the present research for the allocation of factor scores, especially where the factor measurements were qualitative rather than quantitative.

ETTLIE (1983) evaluated the installation of computer NC machine tools and used a method of scoring data which was a little more complex than those described above. He established 26 variables which indicated a successful utilization of NC machine tools and produced scores for each variable and for each organisation. Each organisation was then ranked from the scores thus produced. The scores were obtained by the use of correlation coefficients which showed the degree of association between the variables. These scores were assembled into a symmetrical matrix which showed the correlation

coefficients between the 26 variables. This matrix was used in further comparisons of organisations which were relatively successful against those which were relatively unsuccessful with regard to technological utilisation rates.[8]

The criteria used to measure the selected success factors were of paramount importance and thus, also required careful selection. Obviously, the more specific and precise the data relative to these factors, the better the measure. Potentially, imprecise elements would have produced weak, poorly defined constructs and hence, may not have been a reliable basis for further analysis and comparison. However, important factors were included and their effect on overall success taken into account (see later).

After factor selection, scores for each factor were allocated for every operation in sample. The 'scores' thus generated were collated into success tables. Each operation obtained an overall score for the transfer of cook chill technology for each operation in the sample. Bearing in mind the subjective nature of any method of success assessment, this measurement was not *absolute* but nevertheless gave a useful indication of *relative* success. Moreover, this approach was much more definitive than the inadequate measures referred to in other studies.

## 3.5 Description and Scoring of Success Factors

Variations of scoring techniques, described in the previous section, were used to score each factor. The data for each of the factors listed in Figure 3.3 fell into two main categories, numeric response data and alternative response data. For the purpose of this study, a maximum score out of '4' was found to be most compatible with the data. For example, scores for those factors which fell into the numeric category were achieved using quartiles. In such cases, the appropriate data from each operation was listed in order and each operation was allocated a score out of '4' depending on which quartile fell into. That is, for those operations which fell into the upper quartile for a particular factor, a maximum score of '4' was given, those operations falling into the second quartile received a score of '3', those in the third quartile a score of '2' and finally, those in the lowest quartile a score of '1'.

For those factors which fell into the alternative response category, the method for scoring was based on the technique used by NICHOLSON and BRINKLEY (1982). Relevant responses for each factor were categorised into four groups. Two different methods were used to allocate scores, the method used depended on the type of response. If the responses were ordinal in kind, that is the four categories could be easily placed in some

logical order of success, categories were simply allocated a score (1 to 4) according to which category a response fell into. Otherwise, if the four categories could not be arranged in this way - in other words, were nominal in kind - each category response was awarded a '1' or '0' sub-score, depending on the content of the response. In cases where the sub-score was '0' for all four categories, a final default score of '1' was allocated to the operation in question. On the completion of scoring all factors shown in Figure 3.3, 'success tables' were developed which ranked each operation according to their total score.

Each factor used in this assessment of success will be discussed in turn with justification for its inclusion as a factor and a detailed explanation of how the score for each individual factor was achieved.

## Factor 1 Usage

This factor gave an overview of cook chill usage within the operation at the time of interview. It gave no other information other than whether the cook chill system was being used to provide meals at the time of interview. Although it distinguished between full cook chill operations, pilot cook chill operations and intended future commitment, it did so irrespective of the percentage contribution of cook chill to the overall catering operation. It was an obvious inclusion in the judgement of success as it gave a simplistic global picture of the first step of an assessment of success.

Each respondent was asked the current state of use of their cook chill operation. The responses were categorised and scored as follows:

| | Response | Score |
|---|---|---|
| i | current user of a full cook chill operation | 4 |
| ii | current user of pilot system with definite plans for a full system in the near future | 3 |
| iii | current user with view to becoming non-user | 2 |
| iv | current non-user | 1 |

This method of scoring therefore, gave credit to those operations which managed to introduce and actually use a full cook chill operation. The differentiation between a non-user (scoring 1) and a current user with a view to becoming a non-user (scoring 2) is justified in that the non-user at the time of interview was unable to manage and use the cook chill operation at all, whereas those in category (iii) were at least attempting use of

the system, if somewhat unsatisfactorily, and were therefore classed as relatively more successful than absolute non-users.

## Factor 2 Utilisation

Utilisation as a group differed from Factor 1 (Usage) in that it was more precise. Usage gave only superficial information on whether cook chill was in use or not, whereas utilisation gave more detailed information on percentage utilisation levels of cook chill. Why then was Factor 1 included as a success factor? Its main use was the separation of 'users' from 'non-users'. Non-users were sifted out after Factor 1 and immediately classed as unsuccessful. Hence, they were placed automatically at the bottom of the 'success table' Thus, for all subsequent success factors, non-users scored '1' (in some cases, however, even *users* could score '1' for subsequent factors). The inclusion of both Factors 1 (usage) and 2 (utilisation) eliminated potential confusion in later success factors, because respondents in the non-user category answered the majority of questions in the questionnaire as if their cook chill unit was still in operation.[9]

Much of the literature available on cook chill describes its advantages as a total system enabling caterers to utilize it for their whole catering system (FAST FOOD,1983; GLEW,1985; ARMSTRONG,1986). STEWART (1982) suggested that economies of scale could be achieved if the system was installed for *total* catering operations. Elsewhere it has been stated that the attraction of cook chill is its versatility to handle any type of food whilst at the same time maintaining end-product quality (FROZEN and CHILLED FOOD,1984; CATERER and HOTELKEEPER,1986b). In other words, the higher the percentage of total catering output accounted for by cook chill, the more successful the operation in the utilisation of the system to its maximum potential. Thus, utilisation levels were a good indication of successful transfer.

In order to assess the extent of efficient utilisation, two initial measures were taken; the percentage of the total catering output deriving from cook chill (its scope), and how *fully* that capacity was used (its density). These two sub-factors were combined in order to calculate a score for overall efficient utilisation. First, the scope was measured from data obtained directly from each respondent (between 0% and 100%). A number of operations used cook chill for either 0% (2 operations) or 100% (5 operations) of their total catering and the majority (52 operations, 65%) used it for less than 50% of their total catering output. Closer examination of the values for the scope revealed an overall tendency in the surveyed operations towards a relatively low percentage contribution from cook chill, with half the operations visited utilising cook chill for 29% or less of

their total catering output. Thus, this result contradicts much of the cook chill literature which recommended its use for the majority of the catering system. Obviously, more detailed analysis is required of all the operations in sample before any conclusions can be drawn (see later chapters) but *prima facie* evidence points to a situation which was not conducive to total cook chill systems.

The initial scope measurement gave no indication of how fully the available capacity of the cook chill operation was used. Obviously, a system which was in operation close to its maximum was more successful, with regard to the transfer of cook chill technology, than one with a large amount of spare capacity. Thus, a measure of percentage utilisation was taken. It was calculated as:

$$\text{Cook chill density} = \frac{\text{Actual capacity used}}{\text{Maximum capacity}} \times 100$$

For the purposes of scoring, the two measurements outlined above were used to obtain an overall utilisation figure:

$$\text{Overall utilisation} = \frac{\text{(scope ofcook chill X cook chill density)}}{100}$$

The results from this calculation were distributed into quartiles and scored accordingly:

| Quartile | Range | Score |
|---|---|---|
| Upper | 35.7+ | 4 |
| Second | 15.9-35.7 | 3 |
| Third | 3.6-15.9 | 2 |
| Lower | less than 3.6 | 1 |

## Factor 3 Achievement of Aims

The original reasons for the introduction of cook chill differed between respondents. However, in order to achieve an accurate and comprehensive assessment of overall success, a measure of the achievement of the individual aims of each operation was required. The achievement of aims factor, therefore, investigated the extent to which each operation achieved its original *main* aim for the introduction of cook chill. Scoring

this factor turned out to be quite involved, simply because the main aims for introducing cook chill differed between operations in the sample.

The manager in each operation was asked to state (in order) their main reasons for introducing cook chill. Each operations' foremost reason was used for scoring purposes because the majority of operations had, in general, only one overriding reason for the introduction of cook chill. The original aims of the operation in question were categorised:

i) Reduction of overall costs (52 units)
ii) Improvement of end quality of product (9 units)
iii) Optimising work production[10] (9 units)
iv) Feeding nightshift or 'remote' consumers[11] (8 units)
v) Other (2 units)

Obviously each category required unique treatment with regard to allocation of scores and will, therefore, be dealt with in turn.

### (i) Reduction of Costs

Fifty-two (65%) of the operations surveyed stated that cost reduction was the main reason for the introduction of cook chill. Overwhelmingly, labour costs were seen as the most important cost to reduce. Although, in a few cases, other cost savings were mentioned (energy and food purchasing for example) they were viewed as minor savings compared with those possible through reductions in labour costs. With this in mind, an analysis for this factor score was completed on the basis that cost reduction was achieved primarily through reduction in labour.

Calculation of a score for achievement of this aim was complicated, not least because of the number of variables involved. The most satisfactory method was a three step approach, which incorporated employment change, capital expenditure and capital payback periods. Initial investigation assessed the extent of employment change by a comparison of the employment levels immediately before and after the introduction of cook chill. However, a danger in this superficial approach was that such an assessment did not account for external influences on labour reduction, apart from the introduction of new technology. For example, one operation appeared to reduce its staffing levels substantially after cook chill had been installed. However, other information revealed that the introduction of the system coincided with a redundancy programme in the

company as a whole (of which the catering operation was only a part). Thus, the effects of the introduction of cook chill on employment levels were hidden by the main redundancy programme and the singular effects of cook chill on employment levels could not be demonstrated. An introduction of a correction factor to counteract these effects would probably have further complicated matters because the extent to which a main redundancy programme, in the organisation as a whole, masked the effects of the introduction of cook chill was not fully known. It was, however, thought to be small because the redundancy levels within an organisation as a whole were usually reflected by a change in capacity levels of an operation (covered in a subsequent part of the questionnaire). Furthermore, any redundancies which were not attributable to cook chill were highlighted, in general, by the interviewees. Hence, fewer meals provided by fewer catering staff did not affect efficiency substantially.

In addition, there was a further potential problem with the use of net employment change figures[12] in its failure to reflect the effect of staff grades on cost reduction. For example, if the majority of labour reduction constituted skilled labour then the savings would have been greater than if the reduction was made up of largely unskilled labour. However, closer iscrutiny of the data suggested that staff losses were not, in general, restricted to either skilled or unskilled labour. Thus data which showed labour reduction in terms of full-time equivalents only was utilised.

The extent of successful achievement of labour costs reduction was measured as the percentage employment change after installation of cook chill. This was calculated as:

$$\text{Percentage employment change} = \frac{\text{employment levels post-cook chill} - \text{employment levels pre-cook chill}}{\text{employment levels pre-cook chill}} \times 100$$

Thus, each operation which intended to reduce costs had a value for percentage employment change ranging from -86.5 (maximum employment loss within the sample) to 185.7 (highest employment gain within the sample). The list of percentage employment change figures were divided into quartiles as follows:

| Quartile | Range | Sub-Score |
|---|---|---|
| Lower | less than -40.8 | 4 |
| Third | -16.5 to -40.8 | 3 |
| Second | 0.001 to -16.5 | 2 |
| Upper | more than 0.001 | 1 |

Although the measure of employment change percentage gave a sound basis for assessment of successful cost reduction, it was, in itself, insufficient for the allocation of a factor score. The effects of capital expenditure on cost reduction also needed consideration. If capital expenditure were not recouped from labour cost savings then the operation failed to achieve its overall aim of cost reduction. Therefore this success factor also incorporated whether or not the capital payback period was achieved in the estimated time period.

Each operation visited was asked to indicate whether payback was shorter, longer or the same as the intended period and were subsequently grouped according to achievement:

| Response | Sub-score |
|---|---|
| i) Written off capital expenditure[13] | 4 |
| ii) Payback achieved in less than expectedtime but not immediately | 3 |
| iii) Payback achieved within or just over expected time | 2 |
| iv) Payback achieved in more than expected time or experiencing difficulties in ever achieving payback | 1 |

Why should written-off capital expenditure be classed at the top? An assumption was made that because capital was available at the time of installation, cook chill operations in this group had *immediate* payback.

Finally, the association between the amount of total capital expenditure, payback periods and how these were reflected in the percentage employment change figures were combined to obtain a cost reduction factor score. Unfortunately, there was an incomplete data set for total capital expenditure and therefore, an alternative method for its assessment was found. A relationship between total capital expenditure and maximum capacity was expected, since it was reasonable to assume that the higher the number of meals produced, the greater the amount of equipment required and hence the

higher the capital expenditure. In fact, a non-parametric correlation showed a statistically significant relationship existed.[14] On the basis of the strength of this relationship ($p \leq 0.000$) maximum capacity figures were used in place of total capital expenditure figures for the purpose of obtaining a full score for this sub-factor. This sub-factor was called 'Techcap' and was calculated:

$$\text{Techcap} = \frac{\text{Percentage employment change}}{\text{Maximum capacity}} \times 100$$

The calculation of Techcap produced a list of scores which ranged from +10.3 to -45.5. The operations with the smallest value for Techcap were deemed most successful in this respect. Closer analysis of these results justified the substitution of maximum capacity for capital expenditure. For example, an operation with a maximum capacity of 1000 and a percentage employment change of -40 was more effective in its cost reduction than an operation with a maximum capacity of 1000 and a percentage employment change of -12.5.

Quartiles were used to allocate sub-scores:

| Quartile | Range | Sub-score |
|---|---|---|
| Lower | less than -4.3 | 4 |
| Third | -4.3 to -1.2 | 3 |
| Second | -1.2 to -0.3 | 2 |
| Upper | -0.3+ | 1 |

This third score concluded the assessment of achievement of aims for labour cost reduction. Thus each of the 52 operations in this sub-group had scores up to a maximum of 12. In order to obtain a final sector score out of 4, sub-scores obtained so far were split into quartiles:[15]

| Quartile | Range | Score |
|---|---|---|
| Upper | more than 9 | 4 |
| Second | 8 to 9 | 3 |
| Third | 5 to 7 | 2 |
| Lower | less than 5 | 1 |

## (ii) Improvement of Quality

Nine (11.25%) operations in the sample as a whole, said that the need to improve end product quality was their main reason for the introduction of cook chill. These operations had experienced difficulties with their catering system prior to cook chill as far as end-product quality was concerned. These problems often included feeding consumers who were situated some distance from the preparation kitchen, for example; in small rural schools in outlying areas; remote wards in a hospital complex without their own full catering facilities; and nightshift workers, who were temporally rather than physically remote from the main production area. Cook chill was seen as an answer to problems such as these.

Three different catering systems were in use before the introduction of cook chill in this sub-sample. Five (55%) operations used a conventional system (cooking - warmholding - service), two (22.2%) a cook freeze system and two (22.2%) a system of hot transportation. The quality of food produced in these systems was sub-standard for the consumers, be they school children, hospital patients or nightshift workers.

Calculation of a suitable factor score for end-product quality proved difficult because of its subjective nature. It was achieved, however, through the utilisation of two sets of information obtained from the catering managers interviewed. First, respondents were asked to rate their previous system against their cook chill system on a five point scale; much better, better, same, worse, or much worse. None of the operations in the sub-sample claimed that their previous system was 'much better' than cook chill. Therefore, given that the scoring system was based on the assessment of *relative* rather than *absolute* success comparisons of end-product quality standards were simply scored out of 4:

| Response | Sub-score |
|---|---|
| much worse | 4 |
| worse | 3 |
| same | 2 |
| better | 1 |

However, this score was in itself somewhat subjective, as it was based entirely on the views of the catering manager responsible for the installation of cook chill. Therefore, it was considered imperative to include a further indication of the quality of the end

product. An appropriate indicator which showed this was the incidence of consumer dissatisfaction since the introduction of cook chill.[16] This was based on the assumption that assessment of end product quality and its subsequent acceptability lay with the consumer. A qualitative measurement was developed which investigated levels of consumer acceptability since the introduction of cook chill. In addition, the situation at the time of interview was taken into account, that is, whether these problems had been overcome, remained the same or developed further. Once this information had been collated it was scored:

| | Response | Sub-score |
|---|---|---|
| i) | No consumer acceptance problems at all | 4 |
| ii) | Yes at first, but overcame them | 3 |
| iii) | Not at first, but now developing | 2 |
| iv) | Continual consumer acceptance problems | 1 |

There were a wide range of responses from the nine operations in this sub-group. For example, a rejection of food quality directly:

> "They complain about the chips because they are 'soggy', so we took them off the menu and then they complained that there were no chips at all, so we put them back on the menu and they still complain" (CC,39).

or complaints which included a combination of the 'system' and the food,

> "...at first everything was fine, but then they found out that the food is stored and regenerated later and now they don't like the idea of getting 'warmed-up' food which is three days old" (CC,79).

These responses were easily accommodated into the above classification. The examples cited clearly fell into groups iv and iii respectively.

For the purposes of scoring the two sub-scores of quality assessment were added together and divided into quartiles to give a final factor score out of 4:

| Quartile | Range | Score |
|---|---|---|
| Upper | 8 | 4 |
| Second | 7 | 3 |
| Third | 6 | 2 |
| Lower | 5 | 1 |

### (iii) Optimising Work Production

Nine (11.25%) of the cook chill operations visited fell into this category. Their reasons for cook chill start-up included; lack of space for production at the satellite units, lack of space overall and a sudden need to serve a number of units other than those already served by the kitchen. All of these operations had to increase their productivity within a limited physical area but none of the 9 operations in this sub-group expanded their premises to accommodate cook-chill.

Productivity is usually calculated with employment levels and annual turnover data, therefore a comparison between the productivity levels prior to cook chill and the subsequent levels after the introduction of cook chill was an ideal method to use for establishing success rates. Data were available which enabled calculation of productivity levels of the current cook chill operation,[17] but unfortunately comparative data of actual productivity levels were unavailable for the system prior to cook chill. Thus, any simple comparison of 'before' and 'after' productivity levels was not possible.

However, it was possible to compare surrogate productivity levels pre- and post-cook chill, using other available data which, although not as precise as actual productivity levels, did indicate whether productivity had increased, decreased or stayed the same since the introduction of cook chill. Percentage employment change was calculated[18] and compared with production capacity levels pre-cook chill to estimate whether productivity levels had increased - in which case they had succeeded in their aims - or stayed the same/decreased - in which case they had failed to achieve their original aims. Where the data indicated a reduction in labour or an increase in production capacity, it was assumed that the productivity levels had increased. Where there had been an increase in labour or a decrease in production capacity, it was assumed that productivity had been reduced. Two operations (22.2%) in this sub-group had no change in both employment and production capacity levels and were therefore classified as unsuccessful in their attempt to improve productivity levels (their stated main aim for the introduction of cook chill), as an improvement had not resulted it had merely remained the same.

However, given the range and complexity of the productivity issue under investigation, this simplistic approach to potential productivity levels was considered insufficient and thus, a qualitative assessment of each operation in the sub-group was incorporated. The measure of productivity described above is one of *potential* productivity rather than *actual* productivity because it draws on *maximum* production capacity levels and *total* employment change figures - irrespective of the extent to which these operations used cook chill in terms of the percentage of their total catering operation. Thus, a qualitative approach was used in order to assess the extent of the actual achievement of increased productivity. Three questions were posed which related to quality and were answered with individual information from each of the 9 operations in the sub-sample. The questions were as follows:

i) Was a suitable, safe, system installed which actually improved their specific productivity related problems?

ii) Was there an *actual* increase in productivity, taking into account employment problems, customer acceptance, and logistics (as opposed to potential increases)?

iii) Was there the opportunity for continued high productivity levels?

Data from each individual operation were used to answer either 'Yes' or 'No' to each question, after careful consideration of all the aspects involved. For each 'Yes' response, the operation in question scored '1' and for each 'No' response, the operation in question scored '0'. Thus, a score out of '3' resulted for the above qualitative analysis of this factor. This score was made up to a total out of '4' by the inclusion of the initial sub-score on potential productivity levels. Operations scored '1' if the potential productivity had *improved* since cook chill and '0' if the potential productivity levels had *decreased or remained the same* after installation of cook chill.

**(iv) Feeding 'Remote' Consumers**

A qualitative approach was again used for the allocation of scores for this sub-factor. Out of the 8 operations (10%) who stated their main reason for introduction of cook chill was to feed 'remote' consumers 2 operations (25%) needed to feed a nightshift, 1 operation (12.5%) needed to feed hospital patients situated in an outlying area of the hospital complex and 5 operations (62.5%) needed to feed their workforce as close as possible to their place of work.

Each operation therefore, was examined individually to ascertain the level of success achieved in its attempt to feed these 'remote' consumers. A number of issues were addressed which included:

i) *Who* they intended to feed
ii) Were meals actually being provided for the intended consumer?
iii) If intended consumers were 'remote' an investigation of the type of transport available for carrying food to the satellite kitchen.
iv) An investigation of the type of system in use and whether appropriate and acceptable, which included customer acceptance and take-up levels.

These issues were posed as questions which required a simple 'yes/no' answer based on responses obtained from the questionnaires.

i) Did they produce a system capable of feeding their stated potential customers?
ii) Were transport facilities/storage facilities suitable for the distance to be travelled?
iii) Was the system used at the satellite unit(s) safe (temperature controlled, for example)?
iv) Were consumers satisfied (according to managers)[19]?

For every 'yes' response, a score of '1' was allocated and for every 'no' response a zero score was allocated. Addition of these scores gave a final factor score out of 4. This method introduced the potential for a zero score. In actual fact this did not arise in analysis because each operation gained a 'yes' for at least one question. In the event of a zero score, a default score of '1'would have been introduced, since success was being judged on a relative rather than an absolute basis.

### (v) Other

Two (2.5%) of the interviewed catering managers stated that they had no influence on the decision to introduce cook chill. However, they did reveal that the decision to use cook chill had been based on the previous experience of the decision makers. Factor scores for an assessment of the achievement of aims were calculated as an average figure arrived at by subjecting both organisations to analysis of each sub-factor described above.

## Factor 4 Temperature Control

This factor was concerned with one aspect of technical success - temperature control, which is fundamental to all cook chill operations. The whole system of cook chill is based on cooking, chilling, storage at chill temperatures and regeneration to carefully controlled temperatures, in order to maintain microbiological and organoleptic qualities to a maximum. The DHSS guidelines (1980) for cooked chilled foods stress the importance of temperature control at all stages. Measurements for the temperature control factor were based on adherence to temperature principles (in both the blast chiller and chilled storage areas) recommended by the DHSS (1980). These principles state that food should be chilled to +3°C[20] and should be stored between 0°C and +3°C, for a maximum of five days (which included day of production and day of service). If storage temperature increases to +7°C, food should be consumed within 12 hours, since above +7°C pathogenic organisms resume multiplication and render food potentially unsafe, with +10°C regarded as the critical safety limit (DHSS,1980,5). Thus, the scores for this factor were allocated as follows:

| Storage temperature (°C) | Score |
|---|---|
| 0 to +2 | 4 |
| +3 | 3 |
| 4 to +6 | 2 |
| above +7 | 1 |

Why distinguish between 0°C to +2°C and +3°C? The reliability of chilled temperature maintenance was considered greater where organisations had striven for storage temperatures below, rather than at +3°C. Whilst +3°C represented good temperature control, it was obviously less strict than 0°C to +2°C. In short, the lower the temperature, the better the score.

## Factor 5 Waste

Allegedly, cook chill enables the opportunity for improved portion control and waste reduction. More accurate estimations of meal requirements for an operation may be possible because only the amount of food necessary at any given meal needs regeneration, a figure which may be estimated fairly accurately in advance. The amount of waste, therefore, was an important indicator of success. Waste levels were not only

associated with the efficiency of portion control, but also with the quality and acceptability of the final product.

The waste factor was a score of *change* rather than absolute performance. It did not give a score for actual quantities of waste in an operation. Rather, it measured the extent of waste from cook chill compared with the extent of waste experienced with the catering system used prior to cook chill. Each respondent was asked to give a response to the question; 'Are the levels of waste with cook chill: more, less, or the same, as the waste levels with the catering system prior to cook chill?' Scores were allocated to the responses in the following way:

| Response | Score |
|---|---|
| Less waste than previous system | 4 |
| Same waste as previous system | 3 |
| More waste than previous system | 2 |
| No comparison due to abandonment of cook chill[21] | 1 |

Obviously, a system which had less waste than the previous system scores highly for this factor and those with more waste than the previous system scored poorly.

### Factor 6 Problems

This factor was considered important in an assessment of successful technology transfer. A problem is defined here as any occurrence that caused a delay at any point in the implementation process.[22] If transfer was perfect, then no problems would exist, whereas if technology transfer was a failure, numerous problems would be apparent.

Data were collected from the catering managers with regard to the type and extent of problems experienced at different stages during the technology transfer process, i.e, at the initial stages of implementation and at the time of interview. The major problems cited by the respondents were classified as:

i) technical problems
ii) operational problems (including recipes and operative problems)
iii) customer interface problems

i) Technical problems related to the actual technology used. For example, a blast chillers' inability to chill food to 3°C within the required time specifications (DHSS,1983)[23] or regeneration equipments' failure to reheat food uniformly.

Where a solution had been discovered for any of the technical problems it had either been because of an adaptation of the operation or a repurchase of a different brand of the inadequate piece of technology. Adaptation often necessitated complication of the operational process and often, in an effort to overcome the experienced inadequacies of the equipment, resulted in a reduced use of in-built equipment controls, such as, temperature or time control. In the absence of either adaptation or further capital expenditure, the problem remained and was reluctantly accepted as a deficiency of the system.

Fifty-nine (73.8%) of the catering managers interviewed stated that they had initial 'technical' problems. Twelve (15%) of this sub-group had found a solution to the problem. A further 16 (20%) had developed technical problems since start-up. Such problems were caused by mechanical failure or an introduction of further technology since start-up which was difficult to use either through inexperience or lack of knowledge.

ii) Problems associated with operational aspects of the system were the most commonly cited ones amongst the surveyed cook chill operations. In 15 cases, industrial relations problems had seriously affected the introduction of cook chill and in some cases had actually resulted in the subsequent non-use of the system. In less severe cases, communication was the biggest problem followed by the fact that the introduction of cook chill inevitably resulted in a loss of overtime (evenings, weekends and bank holidays) and hence reduced remuneration. Labour-related problems occurred most frequently amongst the cook chill operations surveyed. All 80 of the cook chill operations visited emphasised that it had caused problems at some stage in the process of implementation. Seventy-two (90.0%) of these had an unresolved problem[24] at the time of interview, which had been apparent since start-up. Only 6 operations (7.5%) had successfully overcome industrial relations problems at the time of interview and a further 2 (2.5%) units had developed industrial relations problems after start-up.

Other operational problems included the inadequacy of some of the recipes or food items for use with cook chill and the change in working practice from a conventional catering operation with concentrated activity immediately prior and during meal times, to an even production system throughout the day with cook chill. In some cases this resulted in the

cook chill system following the same pattern of work as a conventional system, especially in those operations where cook chill constituted a *minor* percentage of their total output. Operatives' confusion and frustration were often apparent where two different catering systems were in operation side by side.

iii) Problems at the customer interface were the area of concern least mentioned by the 80 respondents. Nevertheless, 53 (66.25%) respondents stated that customer related problems were encountered from the outset. Subsequently, thirty-two (40%) of these managed to overcome their problems either by education programmes for customers with regard to the concept of cook chill or a passive change obtained by gradual acceptance of, and familiarity with, the 'new' system by the consumer.

However, a further seven (8.75%) respondents said problems at the customer interface had developed over time. One of the reasons stated for this was a decrease in the quality of food since start-up. However, the reason cited most frequently, was the realisation by the consumer that a conventional system was provided for other consumers situated elsewhere within the same organisation. In most cases this had resulted in a feeling of perhaps unfair discrimination, as cook chill food was perceived as being of inferior quality to that produced in a conventional catering situation.

For the purposes of scoring this factor, the initial extent to which a problem was cited, for each of the three categories discussed above, was noted for each operation in the sample. The position with regard to these problems at the time of interview was also observed and a comparison made. This comparison showed whether a problem remained, had been solved, had worsened, or whether the problem category in question had not arisen either at, or since, start-up.

An initial measurement was achieved for each organisation in the sample for each of the categories (technical, operational and consumer related) mentioned above:

| Category | Sub-score |
|---|---|
| problem not arisen | 4 |
| problem solved | 3 |
| problem remaining | 2 |
| problem worsened | 1 |

Each establishments' measurements for each of the three categories (technical; operational; and consumer problems) were added together to give an overall total between 3 and 12. The factor score was established by the use of quartiles:

| Quartile | Range | Score |
|---|---|---|
| Upper | more than 8 | 4 |
| Second | 7 to 8 | 3 |
| Third | 6 to 7 | 2 |
| Lower | less than 6 | 1 |

## Factor 7 Future Developments

This factor took into account the future developments of each cook chill operation. Each operation was asked: 'What future developments are planned for your cook chill operation?' The responses received from the managers interviewed were grouped into four categories which related to the extent and type of change planned for cook chill in their particular operation.

Basically the future role of cook chill in the catering operations visited fell into one of four main sub-groups:

i) Improvement or expansion of an operation by an introduction of more sophisticated techniques or increased expansion of the existing system.

ii) No change of current system.

iii) Small alteration due to an element of dissatisfaction with cook chill at the time of interview.

iv) Radical changes due to extensive dissatisfaction with the system at the time of interview, which culminated in some operations running the system down to subsequent non-use of cook chill.

Obviously, these were rather broad categories and within each sub-group there were a host of responses from the introduction of advanced techniques such as vacuum packing, sous-vide or cryogenics (category i) to termination of cook chill and thenceforth the blast

chiller used as efficient refrigerators (category iv). In general, the managers who were dissatisfied with their cook chill operation made one of two decisions:

(i) to run the current operation down and revert to a different type of catering (for example, a conventional, cook serve type of operation) and write off the capital expenditure, or
(ii) to invest more capital into the system to try and recoup some of their losses by the help of new equipment, fresh training or revised production systems.

Given that success was measured as at the time of interview, it was assumed that a need for radical changes (for example, the purchase of different equipment or radical retraining/restaffing programmes) was indicative of a problem system and hence received a low score. Similarly, those who intended a total withdrawal from cook chill, also received the lowest score. The only difference between operations in these two situations, at the time of interview, was that one was about to pull out and the other was to attempt to put it right.[25] The introduction of more advanced techniques and a further expansion of the current system were, in this instance, regarded as the outcomes most indicative of success. Thus scores were allocated as follows:

| Responses falling into: above category | Score |
|---|---|
| i | 4 |
| ii | 3 |
| iii | 2 |
| iv | 1 |

This concluded the scoring for the success factors with *complete* factor scores for each operation in the sample. The scores produced for each operation in the sample were presented in the form of a 'success table' (see Table 3.1). However, Table 3.1 did not take into account the effects of the three remaining incomplete factors.

Table 3.1 Success Table of Complete Factor Scores

| Serial Number | Usage | Utili-sation | Aims | Temp control | Waste | Prob-lems | Future | Total Score |
|---|---|---|---|---|---|---|---|---|
| 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 27 |
| 20 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 27 |
| 6 | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 26 |
| 48 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 26 |
| 2 | 4 | 4 | 4 | 3 | 4 | 4 | 2 | 25 |
| 1 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 25 |
| 22 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 25 |
| 52 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 25 |
| 28 | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 25 |
| 58 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 25 |
| 55 | 4 | 2 | 4 | 3 | 4 | 4 | 4 | 25 |
| 61 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 25 |
| 54 | 3 | 4 | 4 | 4 | 4 | 2 | 4 | 25 |
| 3 | 4 | 3 | 4 | 4 | 2 | 3 | 4 | 24 |
| 13 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 24 |
| 44 | 4 | 2 | 4 | 3 | 4 | 3 | 4 | 24 |
| 70 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 24 |
| 74 | 4 | 3 | 4 | 3 | 4 | 4 | 2 | 24 |
| 47 | 4 | 3 | 4 | 3 | 3 | 4 | 3 | 24 |
| 10 | 4 | 3 | 2 | 3 | 4 | 3 | 4 | 23 |
| 80 | 4 | 4 | 5 | 2 | 3 | 2 | 3 | 23 |
| 42 | 4 | 4 | 2 | 3 | 3 | 3 | 4 | 23 |
| 33 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 23 |
| 9 | 4 | 4 | 4 | 3 | 2 | 4 | 2 | 23 |
| 36 | 4 | 2 | 4 | 4 | 4 | 2 | 3 | 23 |
| 4 | 4 | 2 | 3 | 3 | 4 | 4 | 3 | 23 |
| 41 | 4 | 4 | 1 | 4 | 4 | 1 | 4 | 22 |
| 43 | 4 | 2 | 3 | 3 | 4 | 3 | 3 | 22 |
| 16 | 4 | 1 | 2 | 3 | 4 | 4 | 4 | 22 |
| 12 | 4 | 2 | 3 | 2 | 4 | 3 | 4 | 22 |
| 8 | 4 | 4 | 2 | 3 | 4 | 1 | 4 | 22 |
| 79 | 4 | 3 | 3 | 3 | 4 | 2 | 3 | 22 |
| 63 | 4 | 3 | 3 | 4 | 2 | 3 | 3 | 22 |
| 14 | 4 | 4 | 2 | 2 | 4 | 3 | 3 | 22 |
| 67 | 4 | 4 | 2 | 4 | 4 | 3 | 1 | 22 |
| 39 | 4 | 3 | 3 | 3 | 2 | 4 | 2 | 21 |
| 30 | 4 | 1 | 3 | 3 | 3 | 3 | 4 | 21 |
| 35 | 4 | 1 | 3 | 3 | 4 | 4 | 2 | 21 |
| 25 | 4 | 3 | 2 | 2 | 4 | 2 | 4 | 21 |
| 11 | 4 | 3 | 3 | 3 | 4 | 2 | 2 | 21 |
| 78 | 4 | 2 | 3 | 1 | 4 | 4 | 3 | 21 |
| 27 | 4 | 4 | 1 | 3 | 3 | 2 | 4 | 21 |
| 68 | 4 | 4 | 4 | 2 | 2 | 3 | 2 | 21 |
| 38 | 4 | 3 | 2 | 3 | 2 | 2 | 4 | 20 |
| 57 | 4 | 1 | 2 | 3 | 4 | 2 | 4 | 20 |
| 53 | 4 | 2 | 3 | 2 | 4 | 2 | 3 | 20 |
| 62 | 4 | 3 | 2 | 4 | 3 | 3 | 1 | 20 |
| 31 | 4 | 3 | 3 | 2 | 2 | 3 | 3 | 20 |
| 76 | 4 | 2 | 3 | 3 | 2 | 2 | 4 | 20 |
| 56 | 4 | 2 | 1 | 2 | 3 | 4 | 4 | 20 |
| 37 | 4 | 3 | 2 | 3 | 2 | 1 | 4 | 19 |
| 50 | 4 | 1 | 2 | 2 | 2 | 4 | 4 | 19 |
| 15 | 4 | 2 | 2 | 1 | 2 | 4 | 4 | 19 |
| 34 | 4 | 2 | 2 | 3 | 2 | 2 | 4 | 19 |
| 7 | 3 | 1 | 3 | 3 | 2 | 3 | 4 | 19 |

Table 3.1 (cont)

| Serial Number | Usage | Utili-sation | Aims | Temp control | Waste | Prob-lems | Future | Total Score |
|---|---|---|---|---|---|---|---|---|
| 21 | 3 | 4 | 3 | 3 | 1 | 1 | 4 | 19 |
| 66 | 4 | 1 | 3 | 2 | 4 | 2 | 3 | 19 |
| 65 | 4 | 3 | 1 | 2 | 2 | 3 | 4 | 19 |
| 59 | 4 | 2 | 2 | 2 | 4 | 4 | 1 | 19 |
| 23 | 4 | 1 | 3 | 2 | 4 | 2 | 3 | 19 |
| 32 | 4 | 4 | 3 | 1 | 2 | 2 | 3 | 19 |
| 49 | 4 | 3 | 1 | 4 | 3 | 3 | 1 | 19 |
| 24 | 4 | 3 | 3 | 3 | 2 | 1 | 2 | 18 |
| 26 | 4 | 2 | 2 | 3 | 2 | 1 | 4 | 18 |
| 72 | 4 | 1 | 3 | 3 | 2 | 2 | 3 | 18 |
| 73 | 2 | 2 | 2 | 4 | 3 | 4 | 1 | 18 |
| 51 | 4 | 2 | 1 | 3 | 3 | 2 | 2 | 17 |
| 75 | 2 | 4 | 3 | 4 | 1 | 2 | 1 | 17 |
| 19 | 4 | 1 | 3 | 3 | 1 | 2 | 3 | 17 |
| 40 | 2 | 1 | 3 | 3 | 4 | 3 | 1 | 17 |
| 17 | 4 | 2 | 1 | 3 | 1 | 3 | 3 | 17 |
| 64 | 4 | 1 | 2 | 3 | 3 | 2 | 1 | 16 |
| 29 | 2 | 1 | 2 | 2 | 4 | 4 | 1 | 16 |
| 18 | 4 | 2 | 1 | 2 | 2 | 2 | 3 | 16 |
| 60 | 4 | 1 | 2 | 3 | 1 | 1 | 4 | 16 |
| 69 | 2 | 1 | 3 | 4 | 2 | 1 | 1 | 14 |
| 71 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 11 |
| 45 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| 46 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| 77 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 |

## Incomplete Factors

Up until this point in the scoring process, each operation in the sample was allocated a score for each factor. Unfortunately, for the three remaining factors, (financial efficiency, employee satisfaction and consumer satisfaction) this was not possible. In these cases, information was not forthcoming from *all* of the managers interviewed. There were several reasons for this but, in the main, it reflected the respondents unwillingness to disclose information considered sensitive (for example, financial details) and their reluctance to allow approaches to operatives and consumers. Twenty-four operations (30%) refused to give any financial data at all, 20 operations (25%) refused permission to speak to operatives and a large percentage (55 operations 68.75%) refused permission to approach consumers.[26]

## Factor 8 Financial Performance

Financial aspects are often used alone in the assessment of company performance (see 3.2 and 3.3) and were a natural inclusion in this multi-factor assessment of overall

relative success. However, only 56 of the 80 cook chill operations visited were willing or able to disclose financial details such as: profit/loss figures; capital expenditure; or annual turnover data. Nevertheless, financial performance was viewed as an essential component in an overall success formula, for potential cost reductions associated with the introduction of cook chill were considered important by every respondent interviewed in sample. Where the reduction of costs was not the prime reason for the introduction of cook chill, it was named as an important secondary consideration. However, despite the fact that the introduction of cook chill was often perceived as a 'great money-saver', the results of this survey indicated that such savings were not always achieved (see Chapter 5).

The use of profit and loss figures[27] to score financial performance proved difficult as post-cook chill budget levels may have been changed to counteract reduced budget requirements caused by the introduction of cook chill. Furthermore, the majority of surveyed cook chill operations utilised it for a minority of their total catering output and thus, any fluctuations in profit and loss figures may have been attributable to the effect of factors other than the introduction of cook chill. This method, then, would have generated unreliable and in most cases meaningless scores.

Therefore, financial performance was assessed by the use of variables in the data set which took into account the methods for financial recovery which included: the extent of cost savings; the recovery within the estimated time period; the extent to which the catering managers' interviewed considered that similar savings could have been achieved by the introduction of a catering system other than cook-chill; their total capital expenditure and maximum capacity levels; and the purchase of the most essential technology for the use of cook chill. Two sub-factors were developed which accounted for the effects of these variables and contributed towards an overall assessment of financial performance. The first sub-factor used 'Yes/No' responses to four separate questions, each related to different aspects of controlled payback and cost saving procedures These questions were broadly based and answered qualitatively using data from responses in the main questionnaire.

i) Was there a planned system for the maximisation of cost benefits (for example, labour reduction programmes, plans to obtain increased revenue from increased sales)[28]?

ii) Were actual cost savings accrued using this method?[29]

iii) Was payback achieved within the designated time period (regardless of planned method)?

iv) Did the catering manager perceive a similar cost saving by investment of equivalent capital into an alternative catering system?

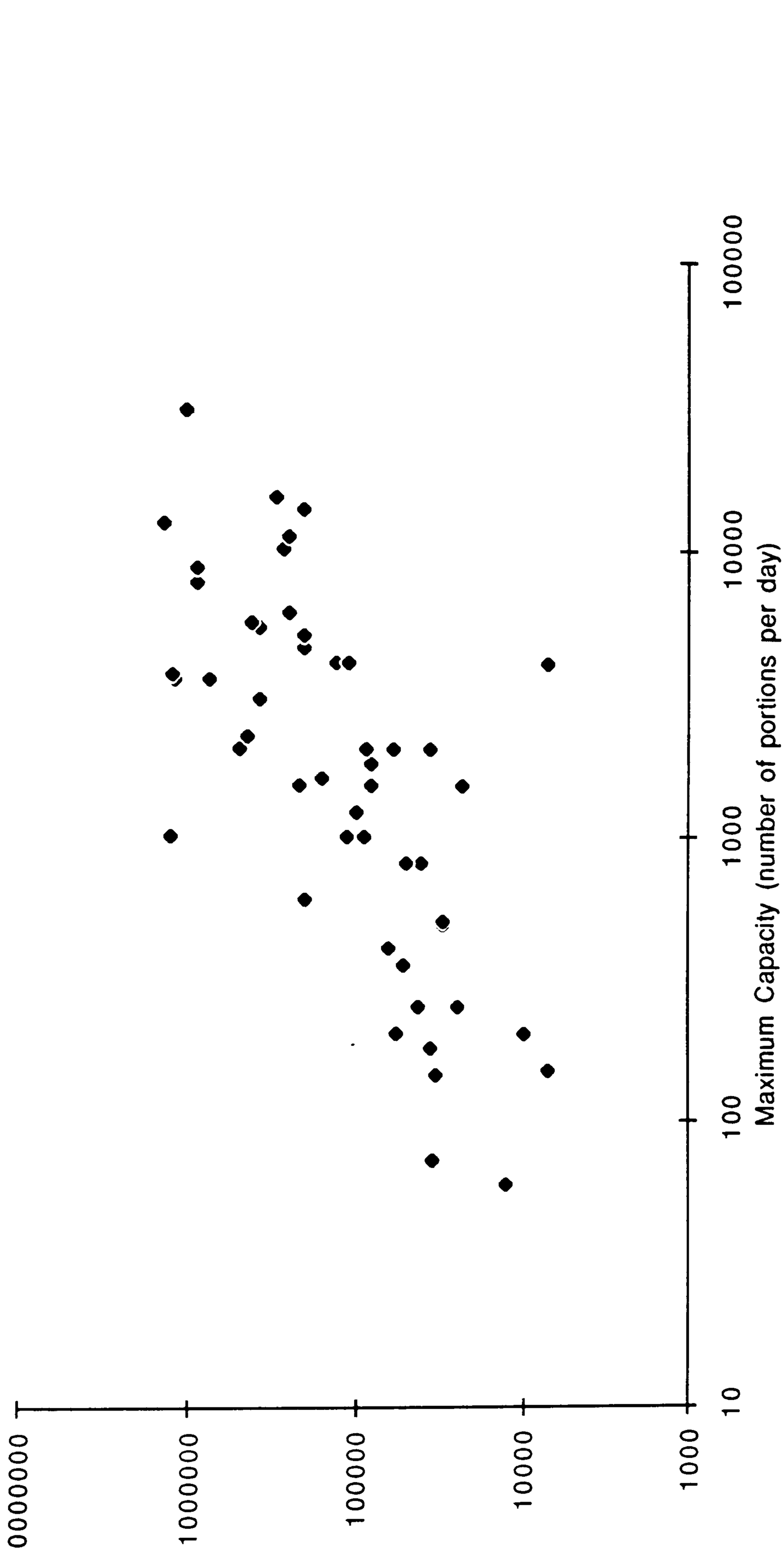
Data were available for 60 of the 80 cook chill operations in the sample for this sub-factor. A score of '1' allocated if the response amounted to 'Yes' and a score of '0' if the response amounted to a 'No'.

The second sub-factor consisted of two parts. First, a figure was calculated which showed the relationship between total capital expenditure and maximum capacity of the cook chill system. This was calculated on the assumption that the larger the maximum capacity of the cook chill operation, the higher the amount of capital expenditure required. Although the evidence from this survey shows that the relationship between maximum capacity and total capital expenditure was statistically significant, the relationship was not absolutely linear. Figure 3.4 shows that there were a few operations with a low capacity which had higher total capital expenditure than operations with a high maximum capacity and vice versa. Therefore, a measure which gave an indication of which operations spent their capital efficiently[30] was calculated using the equation:

$$\text{Capital efficiency} = \frac{\text{maximum capacity}}{\text{total capital expenditure}} \times 100$$

However, this calculation alone did not take into account whether capital was used for 'essential purchases' (of for example, technology and training) required for the safe management of a cook chill operation.[31] Further capital investment may have been necessary, on top of that already spent, if the training or retraining of the workforce on the use of cook chill, had not been carried out. Consequently, this may have exacerbated potential problems within the cook chill operation. Thus, an assessment of 'wise expenditure' for each operation, was made using relevant data from the questionnaires. This was completed by an investigation of whether 'essential'[32] items of technology had been purchased (for example, blast chillers, temperature controlled storage areas, temperature control monitors, and where necessary, temperature controlled transportation[33] ) and, in addition, the extent and type of training carried out.

Figure 3.4 Scatter Plot of Maximum Capacity and Total Capital Expenditure



The surveyed cook chill operations which failed to purchase 'essential' equipment were allocated a sub-score of '1'. Although in some of these cases, capital expenditure appeared 'efficient' in the initial calculation,[34] further examination showed that their failure to make 'essential purchases' resulted in a misallocation of capital resources.

The rest of the cook chill operations in this sub-group had purchased the necessary technology and were listed in accordance to their performance in the calculation between maximum capacity and total capital expenditure. For the purpose of scoring, these remaining operations were divided into tertiles and scored:

| Quartile | Range | Score |
|---|---|---|
| Upper | 2.2+ | 4 |
| Middle | 0.9-2.2 | 3 |
| Lower | less than 0.9 | 2 |

This resulted in a sub-score out of 8 for financial efficiency. A score out of 4 was obtained by taking quartiles of the sub-score and scoring each unit as previously. The cook chill operations with a score for Factor 8 were then extracted from the main success table and placed into a new table which included the results for Factor 8 (see Table 3.2). Obviously, because of the existence of an incomplete data set for this factor, not all operations were included in Table 3.2.

### Factor 9 Employee Satisfaction

This factor was a measure of 'employee satisfaction' towards the introduction and subsequent operation of the cook chill system. Qualitative information was collected from operatives in 60 (75%) of the cook chill operations in the sample. Twenty catering managers (25%) would not allow their workforce to be approached.[35]

Table 3.2 Success Table of Complete Factor Scores Plus Incomplete Factor 8 (finance)

| Serial Number | Usage | Utili-sation | Aims | Temp control | Waste | Prob-lems | Future | Finance | Total Score |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 31 |
| 20 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 31 |
| 48 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 30 |
| 6 | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 29 |
| 52 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 4 | 29 |
| 28 | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 29 |
| 58 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 29 |
| 2 | 4 | 4 | 4 | 3 | 4 | 4 | 2 | 3 | 28 |
| 1 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 3 | 28 |
| 22 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 3 | 28 |
| 54 | 4 | 1 | 3 | 4 | 4 | 4 | 4 | 4 | 28 |
| 3 | 4 | 3 | 4 | 4 | 2 | 3 | 4 | 4 | 28 |
| 13 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 28 |
| 55 | 4 | 2 | 4 | 3 | 4 | 4 | 4 | 2 | 27 |
| 44 | 4 | 2 | 4 | 3 | 4 | 3 | 4 | 3 | 27 |
| 74 | 4 | 3 | 4 | 3 | 4 | 4 | 2 | 3 | 27 |
| 10 | 4 | 3 | 2 | 3 | 4 | 3 | 4 | 4 | 27 |
| 36 | 4 | 2 | 4 | 4 | 4 | 2 | 3 | 4 | 27 |
| 80 | 4 | 4 | 5 | 2 | 3 | 2 | 3 | 4 | 27 |
| 42 | 4 | 4 | 2 | 3 | 3 | 3 | 4 | 4 | 27 |
| 61 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 1 | 26 |
| 47 | 4 | 3 | 4 | 3 | 3 | 4 | 3 | 2 | 26 |
| 33 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 26 |
| 41 | 4 | 4 | 1 | 4 | 4 | 1 | 4 | 4 | 26 |
| 16 | 4 | 1 | 2 | 3 | 4 | 4 | 4 | 4 | 26 |
| 12 | 4 | 2 | 3 | 2 | 4 | 3 | 4 | 4 | 26 |
| 14 | 4 | 4 | 2 | 2 | 4 | 3 | 3 | 4 | 26 |
| 70 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 1 | 25 |
| 8 | 4 | 4 | 2 | 3 | 4 | 1 | 4 | 3 | 25 |
| 79 | 4 | 3 | 3 | 3 | 4 | 2 | 3 | 3 | 25 |
| 39 | 4 | 3 | 3 | 3 | 2 | 4 | 2 | 4 | 25 |
| 30 | 4 | 1 | 3 | 3 | 3 | 3 | 4 | 4 | 25 |
| 35 | 4 | 1 | 3 | 3 | 4 | 4 | 2 | 4 | 25 |
| 25 | 4 | 3 | 2 | 2 | 4 | 2 | 4 | 4 | 25 |
| 9 | 4 | 4 | 4 | 3 | 2 | 4 | 2 | 1 | 24 |
| 4 | 4 | 2 | 3 | 3 | 4 | 4 | 3 | 1 | 24 |
| 43 | 4 | 2 | 3 | 3 | 4 | 3 | 3 | 2 | 24 |
| 78 | 4 | 2 | 3 | 1 | 4 | 4 | 3 | 3 | 24 |
| 38 | 4 | 3 | 2 | 3 | 2 | 2 | 4 | 4 | 24 |
| 57 | 4 | 1 | 2 | 3 | 4 | 2 | 4 | 4 | 24 |
| 62 | 4 | 3 | 2 | 4 | 3 | 3 | 1 | 4 | 24 |
| 63 | 4 | 3 | 3 | 4 | 2 | 3 | 3 | 1 | 23 |
| 67 | 4 | 4 | 2 | 4 | 4 | 3 | 1 | 1 | 23 |
| 11 | 4 | 3 | 3 | 3 | 4 | 2 | 2 | 2 | 23 |
| 68 | 4 | 4 | 4 | 2 | 2 | 3 | 2 | 2 | 23 |
| 53 | 4 | 2 | 3 | 2 | 4 | 2 | 3 | 3 | 23 |
| 56 | 4 | 2 | 1 | 2 | 3 | 4 | 4 | 3 | 23 |
| 37 | 4 | 3 | 2 | 3 | 2 | 1 | 4 | 4 | 23 |
| 50 | 4 | 1 | 2 | 2 | 2 | 4 | 4 | 4 | 23 |
| 27 | 4 | 4 | 1 | 3 | 3 | 2 | 4 | 1 | 22 |
| 76 | 4 | 2 | 3 | 3 | 2 | 2 | 4 | 2 | 22 |
| 7 | 3 | 1 | 3 | 3 | 2 | 3 | 4 | 3 | 22 |
| 24 | 4 | 3 | 3 | 3 | 2 | 1 | 2 | 4 | 22 |
| 26 | 4 | 2 | 2 | 3 | 2 | 1 | 4 | 4 | 22 |

Table 3.2 (cont)

| Serial Number | Usage | Utili-sation | Aims | Temp control | Waste | Prob-lems | Future | Finance | Total Score |
|---|---|---|---|---|---|---|---|---|---|
| 31 | 4 | 3 | 3 | 2 | 2 | 3 | 3 | 1 | 21 |
| 15 | 4 | 2 | 2 | 1 | 2 | 4 | 4 | 2 | 21 |
| 34 | 4 | 2 | 2 | 3 | 2 | 2 | 4 | 2 | 21 |
| 59 | 4 | 2 | 2 | 3 | 2 | 2 | 4 | 2 | 21 |
| 59 | 4 | 2 | 2 | 2 | 4 | 4 | 1 | 2 | 21 |
| 23 | 4 | 1 | 3 | 2 | 4 | 2 | 3 | 2 | 21 |
| 66 | 4 | 1 | 3 | 2 | 4 | 2 | 3 | 2 | 21 |
| 51 | 4 | 2 | 1 | 3 | 3 | 2 | 2 | 4 | 21 |
| 75 | 2 | 4 | 3 | 4 | 1 | 2 | 1 | 4 | 21 |
| 32 | 4 | 4 | 3 | 1 | 2 | 2 | 3 | 1 | 20 |
| 21 | 3 | 4 | 3 | 3 | 1 | 1 | 4 | 1 | 20 |
| 65 | 4 | 3 | 1 | 2 | 2 | 3 | 4 | 1 | 20 |
| 49 | 4 | 3 | 1 | 4 | 3 | 3 | 1 | 1 | 20 |
| 64 | 4 | 1 | 2 | 3 | 3 | 2 | 1 | 4 | 20 |
| 72 | 4 | 1 | 3 | 3 | 2 | 2 | 3 | 1 | 19 |
| 73 | 2 | 2 | 2 | 4 | 3 | 4 | 1 | 1 | 19 |
| 19 | 4 | 1 | 3 | 3 | 1 | 2 | 3 | 2 | 19 |
| 60 | 4 | 1 | 2 | 3 | 1 | 1 | 4 | 3 | 19 |
| 40 | 2 | 1 | 3 | 3 | 4 | 3 | 1 | 1 | 18 |
| 17 | 4 | 2 | 1 | 3 | 1 | 3 | 3 | 1 | 18 |
| 29 | 2 | 1 | 2 | 2 | 4 | 4 | 1 | 2 | 18 |
| 18 | 4 | 2 | 1 | 2 | 2 | 2 | 3 | 1 | 17 |
| 69 | 2 | 1 | 3 | 4 | 2 | 1 | 1 | 2 | 16 |
| 71 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 12 |
| 45 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| 46 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| 77 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |

Each employee interviewed was asked several questions which related to the diffusion and use of the cook chill system in their organisation. These questions included; reference to training, problems encountered with the day to day running of the system, and whether there were aspects of the system which required improvement. The responses thus collected from employees were collated together and graded as a favourable, neutral or adverse response. A rating of '1'[36] was assigned for each adverse response given by an interviewed employee. Responses from employees included information which reflected inadequate or non-existent training or retraining on the use of cook chill, problems concerned with the actual technology (in particular, chilling or regeneration equipment), problems with getting the items of food down to chill temperatures within the time limits recommended by the DHSS (1980), industrial relations problems, communication, inadequacies of the building or system design, and customer acceptability.[37]

The number of employees interviewed varied between cook chill operations in the sample. Therefore, for the purpose of comparison, the total response ratings made for each operation were added together and the mean calculated. An overall rating thus

indicated the level of employee satisfaction with regard to the introduction and running of the cook chill operation. As it was a mean total of *adverse* responses, those operations containing a relatively low total were assumed to exhibit a higher incidence of employee satisfaction than those operations with a relatively high total. The factor score for employee satisfaction was ascertained by the use of quartiles:

| Quartile | Range | Score |
|---|---|---|
| Lower | 0-1 | 4 |
| Third | 1-2 | 3 |
| Second | 2-3.25 | 2 |
| Upper | 3.25+ | 1 |

Cook chill operations with a score for Factor 9 were extracted from the main success table in a similar way to that carried out for Factor 8. A further success table was then developed which combined the scores for Factors 1 to 7 and Factor 9 for these operations (see Table 3.3).

Table 3.3 Success Table of Complete Factors Plus Incomplete Factor 9 (employees)

| Serial Number | Usage | Utili-sation | Aims | Temp control | Waste | Prob-lems | Future | Emp-loyees | Total Score |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 30 |
| 20 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 30 |
| 6 | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 29 |
| 52 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 4 | 29 |
| 28 | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 29 |
| 2 | 4 | 4 | 4 | 3 | 4 | 4 | 2 | 4 | 29 |
| 54 | 4 | 1 | 3 | 4 | 4 | 4 | 4 | 4 | 28 |
| 13 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 28 |
| 48 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 1 | 27 |
| 36 | 4 | 2 | 4 | 4 | 4 | 2 | 3 | 4 | 27 |
| 80 | 4 | 4 | 5 | 2 | 3 | 2 | 3 | 4 | 27 |
| 70 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 27 |
| 1 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 2 | 27 |
| 22 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 1 | 26 |
| 58 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 1 | 26 |
| 3 | 4 | 3 | 4 | 4 | 2 | 3 | 4 | 2 | 26 |
| 61 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 1 | 26 |
| 44 | 4 | 2 | 4 | 3 | 4 | 3 | 4 | 2 | 26 |
| 10 | 4 | 3 | 2 | 3 | 4 | 3 | 4 | 3 | 26 |
| 43 | 4 | 2 | 3 | 3 | 4 | 3 | 3 | 4 | 26 |
| 63 | 4 | 3 | 3 | 4 | 2 | 3 | 3 | 4 | 26 |
| 11 | 4 | 3 | 3 | 3 | 4 | 2 | 2 | 4 | 25 |
| 42 | 4 | 4 | 2 | 3 | 3 | 3 | 4 | 2 | 25 |
| 41 | 4 | 4 | 1 | 4 | 4 | 1 | 4 | 3 | 25 |

Table 3.3 (cont)

| Serial Number | Usage | Utili-sation | Aims | Temp control | Waste | Prob-lems | Future | Emp-loyees | Total Score |
|---|---|---|---|---|---|---|---|---|---|
| 8 | 4 | 4 | 2 | 3 | 4 | 1 | 4 | 3 | 25 |
| 79 | 4 | 3 | 3 | 3 | 4 | 2 | 3 | 3 | 25 |
| 30 | 4 | 1 | 3 | 3 | 3 | 3 | 4 | 4 | 25 |
| 16 | 4 | 1 | 2 | 3 | 4 | 4 | 4 | 2 | 24 |
| 12 | 4 | 2 | 3 | 2 | 4 | 3 | 4 | 2 | 24 |
| 39 | 4 | 3 | 3 | 3 | 2 | 4 | 2 | 3 | 24 |
| 53 | 4 | 2 | 3 | 2 | 4 | 2 | 3 | 4 | 24 |
| 31 | 4 | 3 | 3 | 2 | 2 | 3 | 3 | 4 | 24 |
| 37 | 4 | 3 | 2 | 3 | 2 | 1 | 4 | 4 | 23 |
| 14 | 4 | 4 | 2 | 2 | 4 | 3 | 3 | 1 | 23 |
| 35 | 4 | 1 | 3 | 3 | 4 | 4 | 2 | 2 | 23 |
| 25 | 4 | 3 | 2 | 2 | 4 | 2 | 4 | 2 | 23 |
| 78 | 4 | 2 | 3 | 1 | 4 | 4 | 3 | 2 | 23 |
| 23 | 4 | 1 | 3 | 2 | 4 | 2 | 3 | 4 | 23 |
| 32 | 4 | 4 | 3 | 1 | 2 | 2 | 3 | 4 | 23 |
| 27 | 4 | 4 | 1 | 3 | 3 | 2 | 4 | 1 | 22 |
| 34 | 4 | 2 | 2 | 3 | 2 | 2 | 4 | 3 | 22 |
| 59 | 4 | 2 | 2 | 2 | 4 | 4 | 1 | 3 | 22 |
| 72 | 4 | 1 | 3 | 3 | 2 | 2 | 3 | 4 | 22 |
| 38 | 4 | 3 | 2 | 3 | 2 | 2 | 4 | 1 | 21 |
| 57 | 4 | 1 | 2 | 3 | 4 | 2 | 4 | 1 | 21 |
| 62 | 4 | 3 | 2 | 4 | 3 | 3 | 1 | 1 | 21 |
| 24 | 4 | 3 | 3 | 3 | 2 | 1 | 2 | 3 | 21 |
| 15 | 4 | 2 | 2 | 1 | 2 | 4 | 4 | 2 | 21 |
| 65 | 4 | 3 | 1 | 2 | 2 | 3 | 4 | 2 | 21 |
| 49 | 4 | 3 | 1 | 4 | 3 | 3 | 1 | 1 | 20 |
| 75 | 2 | 4 | 3 | 4 | 1 | 2 | 1 | 2 | 19 |
| 29 | 2 | 1 | 2 | 2 | 4 | 4 | 1 | 3 | 19 |
| 64 | 4 | 1 | 2 | 3 | 3 | 2 | 1 | 3 | 19 |
| 51 | 4 | 2 | 1 | 3 | 3 | 2 | 2 | 1 | 18 |
| 19 | 4 | 1 | 3 | 3 | 1 | 2 | 3 | 1 | 18 |
| 40 | 2 | 1 | 3 | 3 | 4 | 3 | 1 | 1 | 18 |
| 17 | 4 | 2 | 1 | 3 | 1 | 3 | 3 | 1 | 18 |
| 18 | 4 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 18 |
| 69 | 2 | 1 | 3 | 4 | 2 | 1 | 1 | 2 | 16 |
| 45 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| 46 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| 77 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |

## Factor 10 Customer Satisfaction

The final success factor in this analysis was customer satisfaction. Only 26 (32.5%) of the operations in the sample gave permission for their customers to be approached.[38]

Those cook chill operations which allowed customer input into the survey distributed self-completion questionnaires to consumers. In answer to the question, 'How do you rate the food served in this establishment?' each consumer was asked to tick the relevant response as either excellent, good, satisfactory, fair, or poor. As with employees, the

number of responses obtained from consumers per cook chill operation varied between operations[39] and therefore, to gain a comparable figure for the purposes of scoring, aggregate figures were obtained which gave the mean rating for customer satisfaction. This was calculated in 3 stages. First, for each response a number code was allocated:

| | |
|---|---|
| Excellent | 5 |
| Good | 4 |
| Satisfactory | 3 |
| Fair | 2 |
| Poor | 1 |

Second, these were used to calculate the mean rating for customer satisfaction:

$$\text{Mean rating} = \frac{(n5+n4+n3+n2+n1)}{\sum n}$$

where n = number of customers giving a particular response
and $\sum n$ = total number of customers respondents in a given cook chill operation.

This produced figures which showed the average ratings for meals in each cook chill operation. The *actual* range of ratings was between 1.0 and 4.2, thus factor scores with regard to customer satisfaction were allocated by the use of quartiles:

| Quartile | Range | Score |
|---|---|---|
| Upper | 3.4-4.2 | 4 |
| Second | 2.9-3.4 | 3 |
| Third | 2.4-2.9 | 2 |
| Lower | 1.0-2.4 | 1 |

This final factor score concluded analysis of the assessment of relative success and was added to the main success table, the results of which are shown in Table 3.4.[40] The next process was to establish a final order of relative success in the sample, which took into account the effects of both complete (Factors 1 to 7) and incomplete (Factors 8 to 10) factor scores.

## 3.6 Establishing the Order of Cook Chill Operations in the Success Table

The existence of incomplete factor scores was potentially problematic for a meaningful comparison between successful and unsuccessful cook chill units. A set of complete factor scores for each operation in the sample would have provided an ideal basis for comparisons. However this was not possible and therefore an alternative method which took into account the effects of incomplete factors was sought. A solution was investigated for predicting missing scores for Factors 8, 9 and 10, from other factor scores.

Table 3.4 Success Table of Complete Factors Plus Incomplete Factor 10 (consumers)

| Serial Number | Usage | Utili-sation | Aims | Temp control | Waste | Prob-lems | Future | Emp-loyees | Total Score |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 31 |
| 6 | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 4 | 30 |
| 1 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 29 |
| 22 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 29 |
| 2 | 4 | 4 | 4 | 3 | 4 | 4 | 2 | 3 | 28 |
| 54 | 4 | 1 | 3 | 4 | 4 | 4 | 4 | 4 | 28 |
| 70 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 27 |
| 3 | 4 | 3 | 4 | 4 | 2 | 3 | 4 | 2 | 26 |
| 55 | 4 | 2 | 4 | 3 | 4 | 4 | 4 | 1 | 26 |
| 10 | 4 | 3 | 2 | 3 | 4 | 3 | 4 | 3 | 26 |
| 61 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 1 | 26 |
| 36 | 4 | 2 | 4 | 4 | 4 | 2 | 3 | 2 | 25 |
| 42 | 4 | 4 | 2 | 3 | 3 | 3 | 4 | 2 | 25 |
| 39 | 4 | 3 | 3 | 3 | 2 | 4 | 2 | 4 | 25 |
| 43 | 4 | 2 | 3 | 3 | 4 | 3 | 3 | 2 | 24 |
| 16 | 4 | 1 | 2 | 3 | 4 | 4 | 4 | 1 | 23 |
| 38 | 4 | 3 | 2 | 3 | 2 | 2 | 4 | 3 | 23 |
| 57 | 4 | 1 | 2 | 3 | 4 | 2 | 4 | 3 | 23 |
| 11 | 4 | 3 | 3 | 3 | 4 | 2 | 2 | 2 | 23 |
| 30 | 4 | 1 | 3 | 3 | 3 | 3 | 4 | 1 | 22 |
| 35 | 4 | 1 | 3 | 3 | 4 | 4 | 2 | 1 | 22 |
| 37 | 4 | 3 | 2 | 3 | 2 | 1 | 4 | 3 | 22 |
| 32 | 4 | 4 | 3 | 1 | 2 | 2 | 3 | 3 | 22 |
| 59 | 4 | 2 | 2 | 2 | 4 | 4 | 1 | 2 | 21 |
| 24 | 4 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 19 |
| 51 | 4 | 2 | 1 | 3 | 3 | 2 | 2 | 2 | 19 |
| 45 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| 46 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| 77 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |

Statistical relationships between individual factors were investigated through the use of a correlation matrix (see Figure 3.5). Correlation matrices are used as ideal methods for the presentation of correlations amongst sets of variables in a compact, understandable form. Matrices are calculated as arrays of all possible correlation coefficients between variables (CROFT,1976). A symmetrical rectangular matrix usually results, of which only the lower triangle is shown in Figure 3.5. Correlation coefficients range from -1 to +1. Thus the closer the coefficient to 1, the stronger the relationship, a zero coefficient constitutes no relationship and -1 an inverse relationship. The main diagonal in Figure 3.5 (from top left to bottom right) gives correlations of the factors with themselves and are, of course, 1.0. Statistically significant relationships between two factors are indicated after the relevant correlation coefficient in the matrix (**=$p \leq 0.001$, *=$p \leq 0.01$). Of the incomplete factors (Factors 8, 9 and 10), only Factor 8 (financial performance) had statistically significant relationships with other complete factors. For example, a statistically significant relationship ($p \leq 0.001$) existed between Factor 8 and Factor 1 (usage) and Factor 8 and Factors 4 (temperature control), 5 (waste) and 7 (problems) respectively ($p \leq 0.01$). However, despite the fact that the correlations between these pairs of factors was statistically significant, the individual correlation coefficients were relatively small. The best correlation coefficient for an incomplete factor with a complete factor was 0.37 (Factor 8 with Factor 1). Thus, although the test of statistical significance on the correlations between for example, Factor 8 and Factor 1, proved that a relationship existed, it was not a strong enough relationship to allow prediction of missing scores for the three incomplete factors. Indeed, the correlation coefficients for these pairs of factors were closer to zero (no relationship) than to 1 (perfect relationship).

There is a distinct possibility for two variables to appear unrelated to each other, with correlation coefficients close to zero but, when a third variable is controlled their causal relationship or connection becomes manifest (ERICKSON and NOSANCHUK,1979,347). As there were no sufficiently strong relationships between any individual incomplete factor and any individual complete factor, an investigation was carried out to ascertain whether a multiple regression equation of combined factors produced a sufficiently strong statistical relationship to be used as a prediction for missing scores.

Figure 3.5 Correlation Matrix of Factor Scores •

| | Usage | Util-isation | Aims | Temp | Waste control | Prob-lems | Future | Fin-ance | Emp-loyees | Cons-umers |
|---|---|---|---|---|---|---|---|---|---|---|
| Usage | 1.00 | | | | | | | | | |
| Utilisation | .33* | 1.00 | | | | | | | | |
| Aims | .25 | .22 | 1.00 | | | | | | | |
| Temp control | .22 | .23 | .24 | 1.00 | | | | | | |
| Waste | .35* | .14 | .27 | .21 | 1.00 | | | | | |
| Problems | .28 | .12 | .31* | .14 | .44** | 1.00 | | | | |
| Future | .56** | .19 | .16 | .11 | .17 | .12 | 1.00 | | | |
| Finance | .37** | .11 | .18 | .29* | .33* | .09 | .34* | 1.00 | | |
| Employees | .21 | .11 | .24 | .09 | .26 | -.07 | .09 | .24 | 1.00 | |
| Consumers | .11 | .17 | .09 | .14 | .16 | .14 | .16 | .23 | .31* | 1.0 |
| 0 | | | | | | | | | | |

* Significance <0.01

** Significance < 0.001

• calculated as Pearson correlation coefficients

Multiple regression is useful as a method for an investigation of combinations of factors which could be used as predictors. It shows how a number of (independent) variables fit together to explain another (dependent) variable. For example, a simple linear equation of two independent variables could be:

$$Y = b_1x_1 + b_2x_2 + a$$

Where Y = dependent variable

$X_1$ and $X_2$ = independent variables

$b_1$ and $b_2$ = regression weights

a = constant

Thus, the effect of variable $X_1$ is added to the effect of variable $X_2$. The $b_1$ and $b_2$ (beta) values are the regression weights by which the x variables are multiplied. Although regression weights explain the direction of each X's effect on Y, with the other X controlled, they do not show the strength of each independent variables separate effect

X controlled, they do not show the strength of each independent variables separate effect on Y.[41] However, partial correlation coefficients do show the strength of each independent variables separate effect on Y, but difficulties may arise when comparing their weights. If all the data is of a similar nature, then there is no problem, if the data is of a different nature, then a comparison of standardised beta coefficients is necessary.

In this analysis, stepwise multiple regression was used in order to discover whether regression equations of combined factors could be used to predict missing scores for Factors 8 (financial performance), 9 (employee satisfaction) and 10 (consumer satisfaction) respectively. In stepwise regression, independent variables are taken one at a time and entered into a regression equation. The first step took an independent variable (a complete success factor) with the biggest simple correlation coefficient to the dependent variable (an incomplete success factor). The second step introduced the next independent variable (complete factor) which had the strongest partial correlation with the first independent variable controlled, and added it into the equation. The third step examined the remaining variables and added one that strengthened the multiple regression equation the most. This process continued until the point where the addition of further variables failed to raise the strength of the equation significantly. This strength or goodness of fit was shown by the value of $R^2$. When $R^2=1.0$, then the regression equation constitutes a perfect fit (that is, the equation is 100% explanation of the dependent variable), when $R^2=0.5$, the regression equation explains 50% of the dependent variable (ERICKSON and NOSANCHUK,1979). With regard to the current research, a stepwise regression model was attempted first with the dependent variable as Factor 8, then subsequent models with dependent variables as Factors 9 and 10 respectively.

Table 3.5 shows the results of the stepwise regression model for each dependent variable. Thus, for Factor 8, the multiple regression equation was:

Factor 8 = (0.49 Factor 1) + (0.27 Factor 5) +0.05 (constant)

Table 3.5 Results of Multiple Regression Analysis on Incomplete Factor Scores

| Dependent variable | Independent variable in equation | Adjusted $R^2$ | Beta value | SE Beta | T significance |
|---|---|---|---|---|---|
| Factor 8 (finance) | Factor 1 | | 0.49 | 0.18 | 0.009 |
| | Factor 5 | 0.16 | 0.27 | 0.12 | 0.04 |
| | constant | | 0.05 | 0.67 | 0.95 |
| Factor 9 (employees) | Factor 5 | 0.06 | 0.36 | 0.15 | 0.02 |
| | constant | | 0.87 | 0.48 | 0.07 |
| Factor 10 (consumers) | multiple regression equation not possible | | | | |

The adjusted $R^2$ figure (0.19) showed how much of Factor 8 was explained by the regression equation above. From the results in Table 3.5, the multiple regression failed to explain Factors 8 or 10 significantly or Factor 10 at all. In fact, the best degree of fit was only 16% (for Factor 8). Furthermore, a comparison of the beta values and the standard error of the beta values for each equation showed a relatively high standard error for each beta value compared with the beta values themselves (see Table 3.5). In short, neither the correlation matrix nor the multiple regression model produced a reliable method for the prediction of missing scores for Factors 8, 9 or 10.

However, this analysis did indicate that although a full data set were unavailable for the three incomplete factors used, the non-relationship between factors justified their inclusion in the overall assessment of success. Had there been a strong relationship between any two factors then it would have been difficult to justify each individual factor as an independent contributor towards successful transfer of cook chill technology.

In summary, the stepwise regression yielded no basis for a prediction of success but it did indicate a support for the inclusion of each of the factors which have been shown to be independent of one another and can be objectively used to assess overall relative success from a multiple of angles.

The problem remained of how to arrive at a final success table which included the effects of each success factor, for each cook chill operation surveyed. Given that success was

measured throughout as *relative* success, the effect of incomplete factors was ascertained by comparing changes in the positional order of the cook chill operations imposed by an incomplete factor on the positional order of the cook chill operations in the main success table (Table 3.1). This comparison of positional orders was achieved by plots of the positional order of cook chill operations in, for example, Table 3.2, against the positional order (of those cook chill operations which appeared in Table 3.2), in Table 3.1. Figures 3.6 to 3.8 show the results of this exercise for Tables 3.2, 3.3 and 3.4 respectively.[42] The vertical lines indicate any change in position relative to the main success table caused by the inclusion of incomplete factor scores.

The fluctuations which occurred in Figures 3.6 to 3.8 were relatively small. Non-parametric correlations gave a statistically significant relationship between each pair of lines on the graph.[43] In addition, the strength of this relationship was reinforced by the results of a correlation matrix of positional order in each success table (see Appendix 3d, Figure 1). The correlation coefficients were all both highly significant ($p \leq 0.01$) *and* close to 1, thus indicative of an almost perfect correlation. In short, addition of Factors 8, 9 and 10 had little effect on the order of cook chill operations in the main success table (Table 3.1).

Given the strength of this result and given that the final assessment was one of *relative* success, in subsequent comparisons of the activities of successful and unsuccessful cook chill units throughout the technology transfer process (Chapters 4, 5 and 6), the most appropriate success table, for the particular stage being analysed, was utilised. For example, the majority of comparisons related to the main success table (Table 3.1), whereas financial comparisons related to Table 3.2 employee-related comparisons related to Table 3.3 and consumer-related comparisons to Table 3.3.

Finally, a question arose from the above analysis, 'If the incomplete factors had such a minor effect on the order of cook chill operations in the main success table, then why include them?' It could be argued that Factors 8, 9 and 10 should be omitted from the analysis of success, given their insignificant effect on the positional order of cook chill operations in the main success table, particularly as this measure of success is relative. However, there were some fluctuations (albeit minor) and there appeared to be no pattern to where these fluctuations were manifested; sometimes these fluctuations are worthy of note and comment and must not be ignored. Moreover, the lack of relevent data with regard to incomplete success factors may be the main reason influencing their ineffectuality rather than the strength of the relationship. Thus the use of different tables in relevant parts of the comparative analysis (Chapters 4, 5 and 6) was valid.

Figure 3.6 Positional Change Effects of Factor 8 (finance) on Table 3.1.

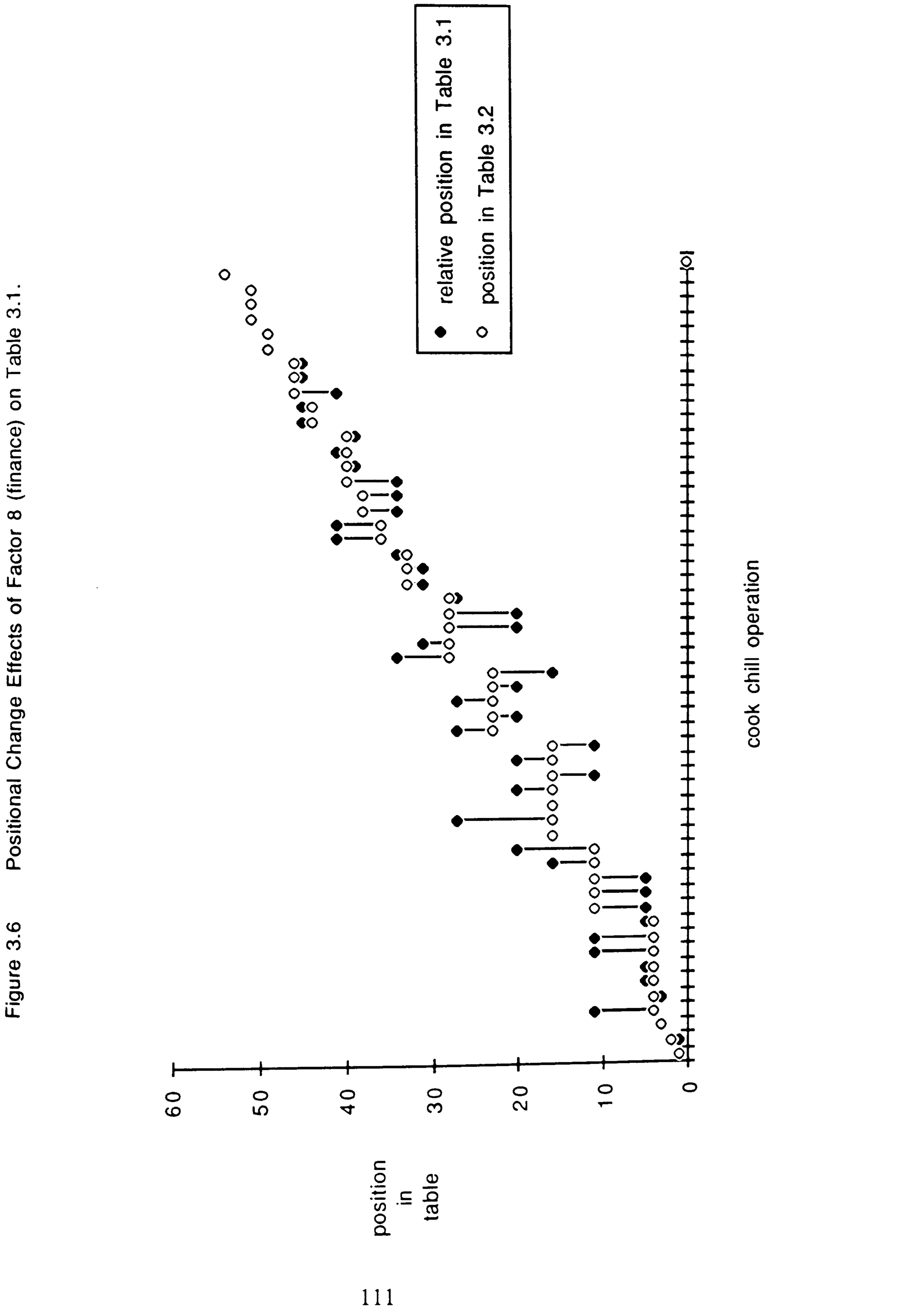


Figure 3.7 Positional Change Effects of Factor 9 (employees) on Table 3.1

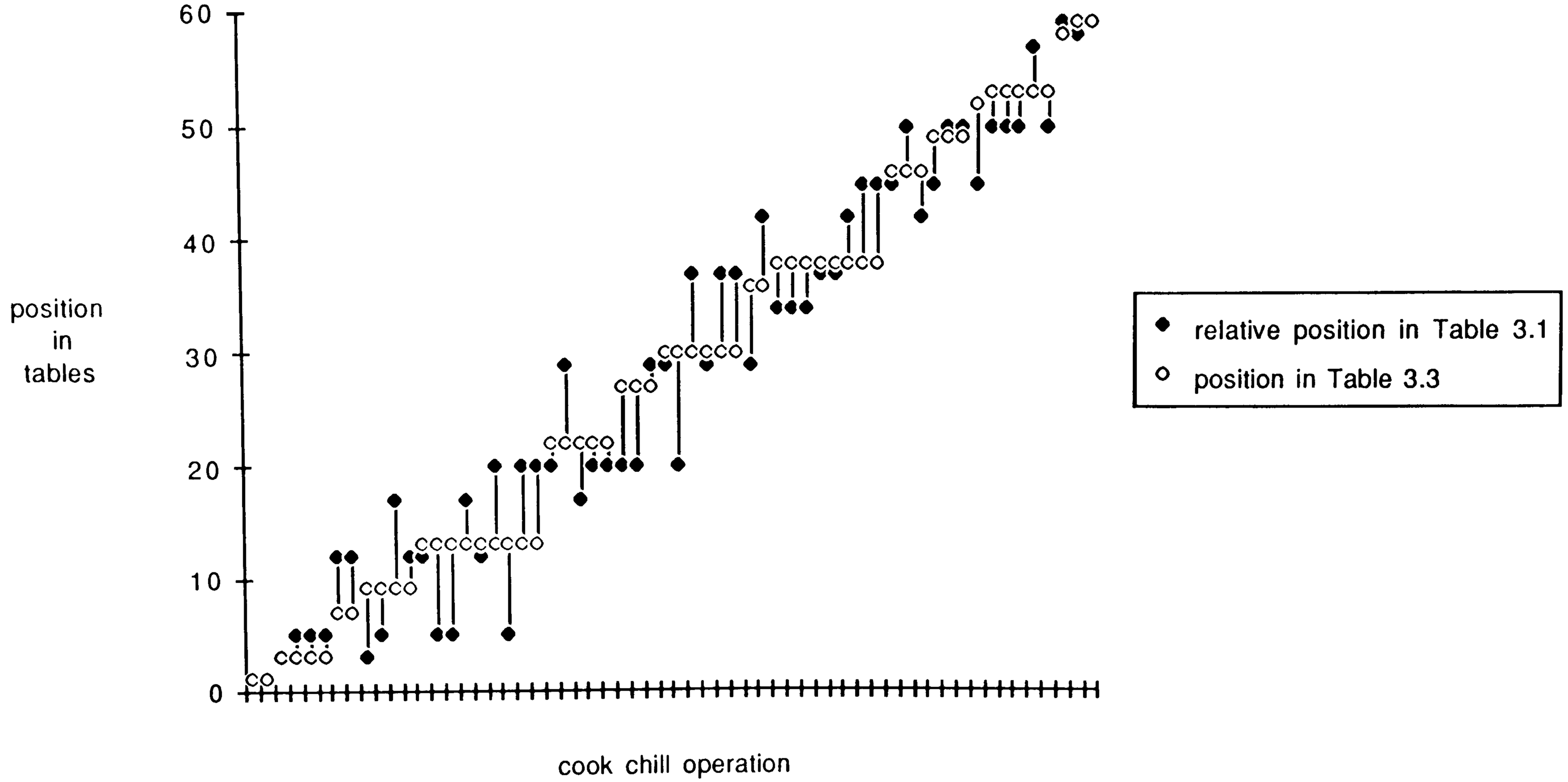
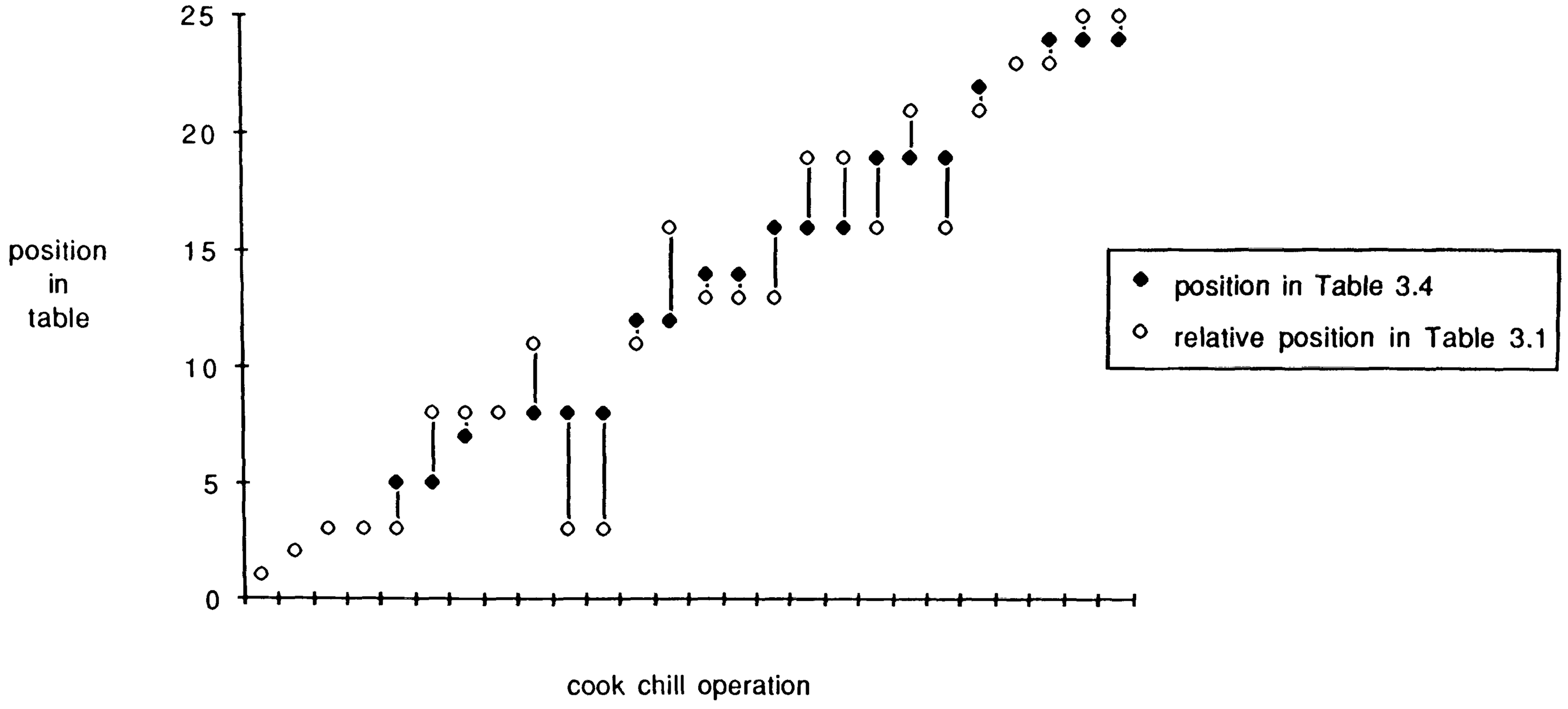


Figure 3.8 Positional Change Effects of Factor 10 (consumers) on Table 3.1



## 3.7 Conclusions

This Chapter has succeeded in developing a robust measure of success which, treats the introduction of 'new' technology - in this case, cook chill - as a multi-faceted phenomenon.

Previous studies showed an absence of clearly defined success criteria. In particular, the use of reputational methods as a reliable measure of technological success was highly questionable. Studies which used uni-factor definitions failed to agree not only on which criteria to use, but also how to measure each single criteria. Variations of financial success were frequently cited as the criteria of success used, *but,* these measures failed to take into account a number of pertinent questions such as: 'What is a suitable measure for financial success? (market share?, profit levels?), 'When are the full financial implications of the introduction of technology reached?' and 'What are the effects on profit and loss of other influences within the organisation?' Studies reliant solely on financial criteria showed little agreement on answering these questions and very often did not even address them. Financial success also loses some of its credibility as a single measure when the organisation is considered as a dynamic institution which changes and develops over time and as such the individual effects of the introduction of new technology become difficult to isolate. Despite the fact that, theoretically at least, success is eventually measured on financial efficiency, this judgement of success is dependent on there being sufficient time resources available to follow financial success to its conclusion. This time factor is deficient in snap-shot type surveys (such as this one)[44] and, arguably, is also deficient in longitudinal studies, because of difficulty in isolating the financial effects of technology transfer from other activities within the organisation. Therefore, the development of a multi-faceted technique for establishing and measuring success criteria was crucial.

In previous studies only ETTLIE (1973) and ROTHWELL et al (1974) attempted anything remotely parallel to a multi-factor definition of success. Thus, the 10 success factors which related to the functional, technical and social aspects of a cook chill catering organisation provided a much needed break-through with regard to reliable criteria of success. This Chapter's detailed analysis and scoring procedure has resulted in a sound and reliable foundation for a subsequent diagnosis (in Chapters 4 to 6) of *why* particular cook chill organisations have been, respectively, successful and unsuccessful.

Methods for a prediction of 'missing scores' from factors with a complete data set were analysed using correlation and multiple regression techniques. Despite the failure of

these methods as predictors of missing data in this study, their use in further studies should be considered. Potentially, their use may be relevant in further research with, perhaps, the original data of the success factors being entered into the analysis rather than the actual factor scores. In the current analysis, the nature of the data dictated the use of factor scores because the original data would have caused an excessive complication of the analysis. It is suggested that multi-variate techniques be explored further as a method for overcoming future problems of this sort. The results of this analysis showed, without doubt, that each factor was an independent measure of success (because of the weak correlations between them) and served to further strengthen a hypothesis that the success factors selected were a valid and resistant measurement for success.

The following Chapters (4 to 6) compare and examine the activities at three key phases of the total technology transfer process namely, initiation, implementation and assessment of outcomes. They will compare those organisations which have successfully introduced cook chill technology with those that have been unsuccessful.

## Footnotes to Chapter 3

1 The sample was taken from "I.R. 100" Award. One hundred technological innovations are selected each year from one thousand screened candidates developed or introduced during the year in the United States. The selected innovations are recognised as superior innovations of the year by a panel or eminent scientists and engineers (BRAGAW,1970,53-54).

2 The Queens Award Scheme recognises both outstanding achievement by industry either in increasing exports or in technological innovation. The emphasis is on use of new technology rather than discovery or invention. Sixty six awards were given for technical innovation in 1966/67 (LANGRISH ET AL,1972,62).

3 SAPPHO stands for Scientific Activity Predictor from Patterns with Heuristic Origins. The project studied the innovation process in two sectors of industry to identify and evaluate factors which distinguish innovations which have achieved commercial success from those which have not (ROTHWELL,1972,3-4).

4 For example, financial efficiency or employee problems.

5 Also, he gave no indication of how the phenomenon of cleaning affected his measurements!

6 A total catering system refers to the majority of food output in a particular catering outlet.

7 Financial success is ultimately the measure of success but the time scale required by some organisations to assess the eventual impact of introducing a cook chill systems was beyond the scope of this study.

8 Technological utilization defined as the degree to which an innovation is successfully implemented into an organisation.

9 Catering managers in the non-user category were asked to answer questions in the questionnaire as if their cook chill operation were still in use, in order for comparisons to be made ,with regard to their activities during the technology transfer process, with successful organisations.

10 This is not a measure of productivity because of a lack of the necessary data, but of optimising production within certain limits which will be discussed, using qualitative methods of assessment..

11 Remote consumers refer to those consumers who are situated at a distance from the main production/kitchen areas.

12 Using full-time equivalent numbers only.

13 This could have been from company profits or a special capital budget not intended for inclusion in normal accountability of the operation.

14 Kendall correlation coefficient 0.000, Pearson correlation coefficient 0.000.

15 This method was justified bearing in mind that it was a judgement of *relative* success.

16 Based on responses from the caterin gmanager rather than the consumers themselves. Consumer satisfaction was analysed in Factor 10.

17 This was calculated from employment levels since the introduction of cook chill and production capacity in use, to give a measure of potential productivity::

$$\frac{\text{employment levels since cook chill}}{\text{maximum capacity level}} \times 100$$

18 Using the equation:

$$\text{percentage employment change} = \frac{\text{employment levels since cook chill - employment levels prior cook chill}}{\text{employment levels prior to cook chill}} \times 100$$

19 This was assessed by looking at managers' opinion data and the numbers using the system.

20 As most pathogenic or spoilage organisms will not grow below +3oC.

21 This category is introduced where no waste is attributable to cook chill due to the non-use of the system.

22 Refer to Figure 1.2 for a detailed diagram of the process of innovation.

23 This was true even when the exact specification set out in the DHSS guidelines were adhered to.

24 Although these problems varied by degrees.

25 Should a simlar measurement of success be taken at some later stage, organisations attempting to improve their cook chill systems may fair better in the 'success stakes'.

26 This was because of a variety of reasons, not all because of the respondents unwillingness to them being approached. Although some operations refused outright giving no reason, others cited the inability of the consumers to answer questionnaires, for example, very young school children, patients in psychiatric hospitals and guests at a high class banquet!

27 Most of the catering operations visited operated within a budget reviewed annually, therefore any data relating to profit and loss figures may not accurately reflect any financial benefits gained by the introduction of more technological systems.

28 Say, from diversification or increased advertising.

29 Each operation was looked at individually and an assessment made as to whether they achieved any savings and if so whether the intended method for cost benefits was utilised.

30 Efficiency here refers to a relative measure of concise spending of capital on necessary pieces of equipment.

31 For example, temperature control equipment critical in all cook chill operations, see Chapter 2.

32 Based on the equipment requirements to enable fulfilment of the DHSS guidelines (1980).

33 Obviously, these requirements varied between different types of system in use. For example, a bought-in chilled vending system would require different equipment to a full cook chill operation with its own central production unit.

34 This calculation being:

$$\frac{\text{maximum capacity}}{\text{total capital expenditure}} \times 100$$

35 This was for a number of reasons including; logistics and time, but the majority had no apparent reason.

36 This rating is not to be confused with the overall scoring system, but as a means of identification of employee satisfaction.

37 These issues will be dealt with in more detail in later chapters.

38 As explained earlier, a number of reasons were given for this: some operations refused to give a reason and others said customers were unable to answer questions because they were either too young, too old, infirm or psychiatric patients, or they were guests in a high class restaurant or banquet.

39 However, this difference did not always reflect size of operation.

40 For Tables of other combinations of the main success table (table 3.1) and incomplete factors see Appendix 3b, Tables 1 to 4.

41 However, this had already been shown in the correlation matrix (Figure 3.5)

42 Or figures showing the effects of combined incomplete success factor scores on the order of cook chill operations in the main success table see Appendix 3.c, Figures 1 to 4.

43 Pearsons correlation and Kendalls correlation both gave a statistical significance of 0.000.

44 Unless of course in the unlikely situation that all cases in the sample had reached ultimate financial 'success' or f'ailure'.

# Chapter 4

# Factors Affecting Success During the Initiation Phase

## 4.1 Introduction

The varying ability of different firms to successfully introduce new technological systems into their organisation remains an unresolved, though critical, area for attention. Only a few industry specific studies have addressed this important issue (ROTHWELL,1973; ROTHWELL et al,1974; ETTLIE,1983; SZAKASITS,1974). The lack of any universal agreement on the factors which affect success illustrates the fact that any interchange of results between industries or innovations is limited. RHODES and WIELD (1985) point out that each specific industry or innovation has its own peculiarities, thus it may be unrealistic to transfer lessons learned from one industry or innovation to another.[1]

In particular, no empirical studies have concentrated on the catering industry (Chapters 1 and 2). This is a serious omission given the speed of technological change currently being experienced by the service industries in general (RUYSSEN,1987; QUINN et al,1987). The following Chapters seek to redress this imbalance by comparing the activities of successful and unsuccessful cook chill units during the three phases of the technology transfer process.[2] The initiation phase will be dealt with in this Chapter and the implementation and outcomes phases dealt with in Chapters 5 and 6 respectively.

It has been established (Chapters 1 to 3) that the technology transfer process is a complex network of inter-related activities which can be categorised into three main operational levels: functional; technical; and social (see Figure 2.2). An analysis of factors affecting success during the initiation phase was carried out using a systematic, multi-faceted approach at the three operations levels outlined above. At each operational level the differences between the successful and unsuccessful groups with regard to specific areas will be shown.

## 4.2 Methods

Briefly, the method of selecting successful and unsuccessful operations will now be explained. Information was collected from each catering manager with respect to the process followed at each phase of the transfer of cook chill technology. In addition, information regarding particular aspects of the technology transfer process was gleaned from operatives and consumers respectively. The appropriate variables for each stage of the analysis were selected and the responses compared between those operations falling into the upper quartile (the successful group) of this study's table of success, (Table 3.1), and those operations falling into the lower quartile of the same table of success (the unsuccessful group).[3] The two groups (successful and unsuccessful) were based on

quartiles because their overall 'scores' were significantly far apart to illustrate their differences. A quartile analysis allows the achievement of statistically significant results which illustrated similarities and differences between the two groups. Moreover, comparisons of successful and unsuccessful groups (23 and 22 cook chill operations respectively in each group) enabled the use of a much wider range of qualitative information in subsequent analysis. This range of information would have been deficient if the comparisons had been made with smaller groups, for example, the extremely successful few and the extremely unsuccessful few. It was considered of more value to impart a wider range of qualitative information by use of quartiles rather then resting content with revealing a few acute differences which would have been apparent in analyses between very extreme successes and failures. In short, analysis was not limited to a statistical base, rather, it utilised a mass of valuable qualitative information. Thus, a comparison of the upper and lower quartiles of this study's success table (Table 3.1), was the most appropriate method to use.

## 4.3 General Characteristics of the Successful and Unsuccessful Groups

An overview of the general characteristics of the catering operations falling into the successful and unsuccessful groups provides an insight into the type of organisations in the two sub-samples. In the initial sampling procedure, a number of identified cook chill users in each sector of the industry[4] were selected for interview proportional to the total number of identified cook chill users in each sector in the UK as a whole (see Chapter 2). This was based on the hypothesis that inter-sector differences would be apparent. Overall there were no statistically significant differences in the sector composition of the successful and unsuccessful groups, but, there were some slight differences. In particular, there was a higher proportion of industrial units in the unsuccessful group (13 operations, 32.5% of all industrial units, 59.1% of all unsuccessful units) than in the successful group (8 operations, 20% of all industrial units, 34.8% of the group) and more hospitals in the successful group (8 operations, 50% of all hospitals; 34.8% of the group) than the unsuccessful group (3 operations, 18.75%; 13.6%). Furthermore, more operations from the public sector, particularly the National Health Service, fell into the successful group (13 units, 38.2% of all public sector units in whole sample; 56.5% of the group) than fell into the unsuccessful group (7 units, 20.6% of all public sector units; 31.8% of the group). In addition, the number of public limited companies (PLC's) or private limited companies, was greater in the unsuccessful group (6 PLC's 9 private limited companies, 68.2% of all unsuccessful units) than the successful group (4 PLC's and 5 private Ltd, 39.1% of all successful units). There was also a substantial difference between the number of successful units run by contract caterers; the

unsuccessful group showing a higher percentage of contract caterers (7 units, 33.3% of contract catering units in the sample as a whole; 31.8% of the group) than the successful group (2 units 9.5% contract caterers; 8.7% of all successes).

The size of the catering operation seemed to have a profound influence on whether the organisation fell into the successful or unsuccessful group. The successful organisations were larger (mean employment 75.3 people, median employment 34 people) than the unsuccessful ones (mean 32, median 19) and served a higher mean total customers per day: 2545.5 (median 1700) compared with the unsuccessful organisations at 699.5 per day (median 155). Both of these differences were statistically significant.[5] This result gives weight to the view that cook chill is more applicable in larger rather than smaller operations (in terms of the numbers of meals produced by cook chill) for maximum benefit to be gained from its introduction (SHEPPARD,1987; HADLINGTON,1987).

To sum up, the cook chill systems in the successful group were on the whole, larger (enabling more economies of scale), more public sector orientated and more likely to be run in-house than the unsuccessful group.

## 4.4 Initiation Phase

This Chapter compares the process followed by both the successful and unsuccessful groups from idea conception through to the point of implementation, on three levels: functional, technical and social. These will be dealt with in the following pages in turn.

## 4.5 Functional Level

With regard to user uptake, it has been suggested elsewhere that a prerequisite of the implementation process is either: an awareness of the technology or technological system in question, followed by a decision on whether there is a substantive reason to introduce the system for the particular organisation or; the need to change an existing system comes first and the subsequent search for a suitable replacement system or method follows. In addition, both an awareness and a need can contribute to a technological change (UTTERBACK,1971; GOLDHAR,1973). It is reasonable to assume, therefore, that at some stage there exists a dissatisfaction with the system already in use be it because of inefficiencies or the influence of some other external factor.[6]

The first stage of the analysis in this study, therefore, looked at the reasons for introducing cook chill which included as a background to the introduction; the reasons for investigating cook chill; the type of catering operated prior to cook chill; any problems associated with the previous system; the extent of consideration of alternative catering systems and any other external influences which affected the decision making process.

## Reasons for Introducing Cook Chill

The main reason for introducing cook chill for each organisation was identified in Chapter 3 and appropriate data used to assess whether an organisation introducing cook chill had successfully achieved its aims. This section examines the reasons for introducing cook chill, scrutinizing in detail, those factors which affected the success or failure of transferring cook chill technology.

It was established in Chapter 3 that every organisation in the sample was concerned with cutting costs to varying degrees. Further analysis revealed differences between the successful group and the unsuccessful group which are best dealt with by sector. First, many establishments in the *hospital sector* (NHS) face a likelihood of privatisation, that is, placing services ancillary to essential health care with privately owned organisations (HOSPITALITY,1984; OBSERVER,1987; HOSPITAL CATERER,1988). Thus, all catering units within the NHS were and are seeking cost effective methods to keep the service 'in-house'. With the units from the hospital sector interviewed in this study's survey, cook chill was chosen as a potential solution to the cost problem. It is important to note at this stage the process of decision making in the NHS relevant to the catering department. Decision making in the health sector ultimately takes place at regional level.[7] Thus individual hospitals, with their own unique problem areas, may not have much influence in the decision-making process. The exclusion of all levels of staff in the decision-making process was found to be strongly associated with cook chill units in the unsuccessful group (see section 4.7).

Of those hospitals in the successful group 7 (85%) mentioned the possibility of privatisation and the subsequent need to reduce their catering costs as a serious consideration. In 3 (37.5%) of the 8 cases falling into the successful group, the reduction of costs was the main issue, but all three stressed other factors which were priority aims of introducing cook chill. These included, for example, the need to improve hygiene by using a more systemised process, to improve the temperature and quality of the food served to the patient. In the remaining 5 cases (62.5%) of the successful group, the main stated reason for the introduction of cook chill was to

improve the quality of food (thermally as well as organoleptically) received by the patient, or to overcome those problems created by physically transporting hot food to wards in a remote part of the hospital campus.

In the words of the respondents themselves it was clear that some degree of thought had gone into non-cost factors, which indicates that they were assessing the 'overall' need for a cook chill system rather than regarding it purely as a cost-cutting exercise:

> "We were under pressure from the government to privatise, but we saw other advantages such as improving hygiene in the kitchen and at ward level, increasing variety and an ability to feed patients in demand at ward level (CC,70)....We wanted primarily to reduce costs but only if we could retain high quality ....and that was a big if (CC,5)....Our prime concern was to improve the quality of food to the patient, competitive tendering gave us the ability to push the capital expenditure through the system as revenue cost savings with cook chill could be demonstrated (CC,58)....We had a problem keeping food hot...but couldn't finance cook chill except through competitive tendering(CC,61)....We wanted to save on labour, most of the equipment required was already there, there were operational benefits from cook today, see tomorrow and the workforce were under less stress(CC,54)....The furthest feeding place was miles and we had heat loss and spillages frequently with the old system, ward regeneration, although costly initially, enabled the patient to receive hot food (CC,44)....With the removal of crown immunity pending we wanted to introduce a safe, cost-effective method to transport meals(CC,48)"

It was divulged that in a number of cases the introduction of cook chill enabled the disposal of staff considered unreliable or troublemakers. The threat of privatisation was seen by some managers as advantageous. It was regarded as a useful lever to introduce radical changes into catering operations which for a variety of reasons would normally have been difficult to achieve.[8]

In contrast to those in the successful group, the three units from the hospital sector in the unsuccessful group saw the introduction of cook chill purely as a cost cutting exercise. The decision-makers in those units which fell into the unsuccessful group gave no consideration to other possible consequences of introducing the system which, in turn, led to inadequate consideration of the total effects of a cook chill system. Furthermore, the consequences of over-emphasis on cost cutting produced its own industrial relations

problems. Although the reduction of labour costs was a prime concern for the majority of cook chill units in the sample as a whole, it was apparent from the respondents in the successful group that little thought was given to implementing, managing and presenting the consequences to the employees:

> "We wanted to reduce the quality (skill level requirement) of staff at the end units (CC,49)....We needed to reduce staff, they'll be closing the psychiatric hospitals soon, so why keep a full staff? (CC,64)....We calculated an annual saving of half a million pounds in wages by introducing the system, as we could close 6 of our kitchens (CC,77)"

Undoubtedly, insufficient consideration had been given to the consequences of reducing staff, for in all three cases, industrial action followed the proposal, which in one case severely delayed its start-up date.

Second, in the *education and welfare sector,* a similar pattern emerged. The successful cook chill operations in this sector indicated a wider variety of reasons for introducing cook chill than the unsuccessful ones who were seeing it purely as a cost cutting exercise. In two (66%) of the cases in the unsuccessful group, the cook chill system was for use in a meals-on-wheels service which, in practice, quickly proved an unsuitable system to operate. There were various problems such as those associated with temperature control during transport, storage (both in the central units and at the end points, which were usually peoples homes), and training of the regeneration 'staff' who were either voluntary workers or the consumers themselves in their own homes. The system was risk-filled and uncontrolled, producing a poor quality product which was a result of both inadequately reheated food and neglect throughout the whole system.

Third, in the *hotel and leisure sector,* 8 operations (57.1% of all leisure and hotels sector) were found in the successful group (34.8% of the successful group) and 3 operations (21.4% of hotel and leisure) in the unsuccessful group (13.6% of the group). In the majority of these cases, cook chill was introduced to cope with a banqueting service, involving a concentration of a large number of meals at once. It was also introduced in a few cases to feed hotel staff and to be used in the a la carte and table d'hote restaurants. The major differences apparent between the successful groups and the unsuccessful groups was one of attitude, best illustrated with quotes from the respondents themselves. Managers of the successful cook chill operations reported the following:

"There is increasing competition within the town for banqueting business, space restrictions meant that we couldn't cope with increased business with the old system. We didn't know much about the system at first, but we borrowed some experienced experts from within the industry for a while. We also had to consider retraining the chefs for cook chill (CC,80)....Cook chill offered more advantages with better flavour and quality retention at a lesser running cost (due to reduced staff overtime)(CC,74)....Cook chill reduced costs but also gave the staff easier and more relaxed working hours (CC,6)"

The evidence from these quotes indicates that respondents in the successful group were not just motivated by the attraction of saving money - they were at the same time giving consideration to the workforce, albeit encouraged by economics. The unsuccessful group on the other hand showed less concern for employees or customers:

> "We introduced it to improve productivity and quality, although the customers think it was to lower costs (CC,75)....We wanted to reduce labour and a cook chill vending system was cost effective (CC,18)"

Although the first respondent mentions productivity and quality as their reasons for introducing the system, the paramount question is: 'Why then does the customer think it was to cut cost?' One conclusion which can be drawn from this is that the consumer has experienced a deterioration in quality of either the food or the service since the introduction of cook chill. This does not mean, necessarily, that this is a fault of cook chill, rather, the preparation of the organisation was probably inadequate or inappropriate especially when it is considered that the successful group had a high proportion of the hotel and leisure group operating similar systems amongst its ranks.

Finally, in the *industrial sector,* the overwhelming feature portrayed by those operations falling into the unsuccessful group was a ready acceptance of 'sales literature hype'. Typically, cook chill was seen as 'cost saving', ideal for canteens and enabled much sought after staff reductions. Little thought was given to the applicability to individual organisational needs. Very few operations in the unsuccessful group mentioned anything other than reducing costs. A common response appearing in one form or another, in the majority of units in the industrial sector falling in the unsuccessful group, being:

> "We wanted to cut down on staff, in numbers and overtime (CC,19)....the only aim was to reduce labour (CC,8)"

Whereas the successful group tended to expose additional reasons for introducing cook chill:

> "We had cook freeze before and we suffered increased complaints from the workers, we therefore had to be very wary when we introduced cook chill, a lot of preparation had to be completed to avoid repeating our previous mistakes (CC,52)....It's a listed building, with no kitchen facilities for a conventional system, we discovered that buying in chilled food, from a supplier of excellent quality, and regenerating on site was the best solution (CC,47)....We wanted to feed remote workers on site (CC,2)"

In general, the successful group showed in all sectors, a greater awareness of the possibilities and limitations of cook chill which was reflected in the greater variety of reasons stated for introducing cook chill compared with those from the unsuccessful group. The obsession with cost reductions without consideration of other possible consequences of the introduction of cook chill may have even contributed to the failure of these operations.

## Information Sources

An analysis of the sources of information used by the respondents during their investigation into the introduction of cook chill reinforces the argument that the activities of the successful organisations were more thorough and systematic than the unsuccessful group, during the technology transfer process.

Data were collected on the awareness levels and sources of information used at the initiation phase. Table 4.1 shows a breakdown of sources by successful and unsuccessful groups. The most striking differences to appear between the two groups were in the use of equipment manufacturers information, other cook chill users, the electricity council, the DHSS guidelines and 'own knowledge'. These will be discussed in turn.

The successful group tended to collect information and advice from more than one equipment manufacturer, even though both groups overwhelmingly were aware that information could be gleaned from a number of equipment manufacturers. Fourteen

(60.9%) respondents in the successful group said they used more than one equipment manufacturer compared with 3 (13.6%) in the unsuccessful group. Furthermore, the type of equipment manufacturer used gave some enlightening results. A selection of manufacturers were seen as specialists in particular types of equipment, for example, in chilling equipment, production equipment or regeneration equipment. Thus, the use of only one of the equipment manufacturers indicated a degree of short-sightedness in that they could only give expert information and advice regarding their own particular equipment specialisation. Some equipment manufacturers had developed close business relations with each other, especially where their products were complementary. Thus if a potential cook chill user approached such a manufacturer they may recommend equipment from the manufacturer with whom they had a collaborative understanding. In one particular case this practice enabled some manufacturers to dominate the market in certain cook chill equipment. This is worrying as buyers may fail to consider manufacturers with less market power. This concern is given substance by the fact that a few of the successful group (14 units, 17.4%) and the majority of the unsuccessful group (19 units, 86.4%) relied on the advice of one equipment manufacturer alone.

A similar pattern appears between the successful and unsuccessful groups with regard to the use of other cook chill users as information sources within the catering industry. In total, 17 (73.9%) of the successful group visited other cook chill users, with 14 of these (82.4%) visiting a number of other users. In contrast, 12 (54.5%) of the unsuccessful group visited other users and of these only 7 (32%) visited more than one. Not only did the actual number of other users visited differ between the two groups but also the activities experienced from such visits differed. The successful groups tended to emphasise that the value of such visits was dependent on their *choice* of other sites. For example, emphasis was placed on visiting a comparable cook chill unit in terms of size and sector, rather than relying on visiting a well-known unit popularised by the press. They also made use of the opportunity to send employees to other units to gain working experience of cook chill and an insight into a working cook chill operation. The successful operations also demonstrated a willingness to listen to someone with practical experience and greater knowledge of the cook chill system in practice. This is further indication of the more assiduous preparation of the successful group compared with the preparation of the unsuccessful group. Furthermore, from the results of the ranking list for sources of information, the experience of other cook chill users was placed consistently higher when more than one user was visited. In contrast the unsuccessful group, in general, placed less emphasis on the knowledge contribution of experienced users and tended to rank such advice lowly. Perhaps one of the reasons for this is that in the unsuccessful group, the units visited were so dissimilar from their own that the

experiences of the visited organisation were not directly applicable to the catering operation run by the visiting personnel.

Table 4.1 Use of Information Sources between Successful and Unsuccessful Cook Chill Units.

| Information Source | Successful Group | | | | Unsuccessful Group | | | |
|---|---|---|---|---|---|---|---|---|
| | Used | | Aware | | Used | | Aware | |
| | No of Units | (%) | No.of Units | (%) | No.of Units | (%) | No.of Units | (%) |
| Equipment Manufacturer * (1 only) | 4 | (17.4) | n/a | | 19 | (86.4) | n/a | |
| Equipment Manufacturer ** (more than one) | 14 | (60.9) | 21 | (91.3) | 3 | (13.6) | 21 | (95.5) |
| Trade magazines | 7 | (30.4) | 19 | (82.6) | 6 | (27.3) | 20 | (90.0) |
| Consultants | 12 | (52.2) | 21 | (91.3) | 9 | (40.9) | 17 | (77.3) |
| Other cook chill users (1 only) | 3 | (13.0) | n/a | | 5 | (22.7) | n/a | |
| Other cook chill users (more than 1)• | 14 | (60.9) | 21 | (91.3) | 7 | (31.8) | 18 | (81.8) |
| Seminars/conferences | 12 | (52.2) | 23 | (100.0) | 14 | (63.6) | 17 | (77.3) |
| Electricity Council | 13 | (56.5) | 21 | (91.3) | 7 | (31.8) | 17 | (77.3) |
| DHSS Guidelines •• | 21 | (91.3) | 23 | (100.0) | 5 | (22.7) | 16 | (72.7) |
| Own knowledge§ | 10 | (43.5) | n/a | | 3 | (13.6) | n/a | |

* difference statistically significant chi-squared 21.5 of 1 sig 0.000
** difference statistically significant chi-squared 8.75 of 1 sig 0.003
• difference statistically significant chi-squared 2.74 of 1 sig 0.09
•• difference statistically significant chi-squared 23.7 of 1 sig 0.000
§ difference statistically significant chi-squared 3.53 of 1 sig 0.06

The importance of temperature control throughout the cook chill operation has been stressed earlier in this thesis (Chapters 2 and 3). The advice on temperature control (DHSS,1980) is extremely important. The DHSS guidelines (1980) outline the safety limits both in terms of temperature and time for operating a cook chill system. Although they are only guidelines and as such there is no legal requirement to enforce them, the adherence to their safety recommendations (for temperature and microbiological control) are imperative for any cook chill user. The contrast between the successful and unsuccessful groups regarding the use of the DHSS guidelines for cook chill (1980) was striking. In the successful group, 21 (91.3%) out of the 23 cook chill operations in this class used the DHSS guidelines as a prime information source. The remaining two operations not using the DHSS guidelines as an initial information source had had their cook chill systems installed before 1980, that is, prior to the compilation of the

guidelines.[9] In sum, all the respondents in the successful group were aware of the existence of the DHSS guidelines compared with only 16 (72.7%) out of the 22 units in the unsuccessful group. A disturbing revelation from this analysis was that only 5 (22.7%) operations in the unsuccessful group had actively enforced the recommendations in the guidelines.

The electricity council has been involved heavily with the installation of cook chill systems since the 1970's. The use of cook chill often shifts the emphasis on energy usage from gas (in a conventional system) to electricity, because of the increased need for electrical pieces of equipment (blast chillers, chilled stores, infra-red regeneration ovens, microwave ovens). Energy savings are claimed because, it is argued, the cook chill process forces more efficient utilisation rates of equipment compared with the conventional system (see Chapter 2). The type of service offered by the electricity council includes consultancy, feasibility studies and special booklets.

Twenty-one (91.3%) units in the successful group were aware of the service provided by the electricity council with 13 (56.5%) of the respondents from these units utilising it.[10] However, only in five (38.5%) of the cases using the facility was it ranked in the top 3 information sources by the respondents. In the unsuccessful group only 7 (31.8%) used the electricity council but it was ranked as one of the top 3 most useful information sources in 6 (85.7%) of these cases. A further ten (47.6%) respondents were aware of its existence. These findings suggest that the respondents of the unsuccessful group using the electricity council recommendations relied heavily on the contribution of these recommendations. The successful group on the other hand, although accepting that some of the electricity council information had been helpful, did not regard it as an important information source. Rather, they relied on experience gained from other users, the DHSS guidelines (1980), a variety of equipment manufacturers and their own experience. It can be concluded from this that the electricity council, although providing useful advice, cannot alone be a substitute for the personal involvement of the catering management team and employees within the catering operation in gaining knowledge and experience for themselves.

The original extent of knowledge possessed by the respondents themselves also differed between the successful and unsuccessful groups. Ten (43.5%) of the successful group said that they had prior knowledge of cook chill, gained from previous experience, college courses and reading literature such as trade magazines. Of the unsuccessful group, however, only 3 (13.6%) of the respondents had previous knowledge of the system. Obviously, existence of previous knowledge is not an essential feature affecting

the success of cook chill - indeed the majority of successful cook chill users had no previous experience whatsoever. Nevertheless, from these results it does appear that having some previous knowledge was helpful in increasing awareness of the intricacies involved with introducing technologically based catering systems such as cook chill and may have been instrumental in increasing awareness and use of other information sources.

Another aspect illustrating the level of investigation undertaken prior to decision making was a consideration of alternative catering systems to cook chill. Overall, throughout the sample of 80 operations, there was a tendency to assume that introducing a cook chill system was *the* most appropriate method for improving their catering system and all the investigatory channels were aimed at supporting this argument. This trend was reinforced by comparing the responses of the catering managers from both the successful and unsuccessful groups when asked whether they considered an alternative system to cook chill for their catering operation. There was some agreement between the two groups with regard to in-depth considerations of alternative catering systems to cook chill. The majority of the operations in both groups disclaimed consideration of altering or modifying their existing system in any way. This was a surprising omission given the fact that the percentage of total food output attributable to cook chill, for the sample as a whole, was small (median percentage cook chill 29% of total catering output for the sample as a whole). Nonetheless, the successful group tended to explore alternative systems more than the unsuccessful group. Fourteen (60.9%) of the successful group investigated cook freeze, compared with 7 (31.8%) of the unsuccessful group, a finding which was statistically significant.[11] Furthermore, the successful group were more thorough in the depth of research into cook freeze quoting reasons for its rejection as: higher capital costs; inflexibility; increased requirement for storage space; more recipe modifications required; need for additives such as stabilisers; and higher energy consumption. The unsuccessful group admitted to only a fleeting consideration of cook freeze with higher capital costs being most frequently cited as the only reason for rejecting cook freeze.

Although the majority of operations falling into both the successful and unsuccessful groups had undertaken a separate feasibility study of one form or another prior to the final decision to introduce cook chill, there was considerable differences with regard to who carried out the study and what was included in the study. In the successful group, 83.3% of the group had carried out a feasibility study and in all cases the study was completed within their own organisation (in-house). Although in the unsuccessful group a similar percentage (86.4%) had carried out a feasibility study, 8 units (42%) had

employed a consultant to complete their study. Furthermore, in only two cases were these units able to indicate the content of their particular study, and in both cases their responses gave cause for concern:

> "The study was carried out by consultants. The first study looked at cook chill as a total system, but this was rejected, so we got them to do another study which was accepted using the system for vegetable dishes only, not entrees (CC,26)...done by consultants, looked at building and capital only, but not staffing requirements (CC,77)"

The first response begs the questions 'Why was this operation so desperate to install cook chill when it was obviously inappropriate as a total catering system?' and 'What were the advantages of limiting cook chill to vegetable dishes alone? Whilst the second asks 'Why ignore one of the most important factors in the employees?'

Of those operations in the successful and unsuccessful groups who carried out a feasibility study, a wider range of topics were considered important by the successful group than the unsuccessful group. Financial considerations were almost wholly the preoccupation of the unsuccessful group who ignored other aspects such as staffing and equipment requirements. This omission was worrying given the lack of in-depth general background research carried out by the unsuccessful group.

## Decision Time

Further differences were found between the successful and unsuccessful groups regarding the time between an initial idea for cook chill and the implementation of a cook chill system, hereafter termed the 'decision time'. Although the differences between the average length of decision time was small (17 months for the successful group and 15 months for the unsuccessful group), the standard deviations for the two groups differed considerably (9.3 for successful, 17.9 for the unsuccessful)[12], pointing to a wider range of decision times in the unsuccessful group compared with the successful group. This finding suggests that there is an optimum decision time since there was a concentration of successful units with a decision time between 7 and 24 months. However, optimum decision time is also dependent on that time being spent effectively.

Table 4.2 shows the major differences between the two groups was found in the 7-24 month 'decision time' period. Fifteen (65.2%) of the successful group stated that their decision time fell into this time period. Obviously, the time period of the decision

process alone does not guarantee success. Indeed, Table 4.2 shows that 5 (22.7%) of the unsuccessful group considered cook chill for between 7 and 24 months but had not, at the time of interview, achieved a successful cook chill operation. However, the way in which decision time is *utilized* is intrinsically linked to the length of decision time period. An illustration of this was that the 5 respondents in the successful group whose decision time period was less than 6 months had all had previous knowledge and/or experience with cook chill, either through previous occupation, college courses or other colleagues.[13]

Table 4.2 Decision Time of Successful and Unsuccessful Cook Chill Units

| Decision Time (months) | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) | Total* Units | (%) |
|---|---|---|---|---|---|---|
| Up to 6 | 5 | (21.7) | 8 | (47.1) | 18 | (45.0) |
| 7 - 24 | 15 | (65.2) | 5 | (29.4) | 20 | (50.0) |
| 25 + | 3 | (13.0) | 4 | (23.5) | 7 | (17.5) |
| Total | 23 | (100.0) | 17 | (100.0) | 40 | (100.0) |

* Only 17 firms were able to disclose this information out of a total of 22 in the unsuccessful group.

Undoubtedly, these findings indicate that the decision time needed to be a carefully balanced period, allowing sufficient time for enough knowledge and planning to induce success, whilst at the same time not allowing the process to carry on too long. Bearing in mind the wider sources of information used in the successful group, there was an indication that the decision time had been utilised more efficiently and hence, cost effectively, in comparison to the unsuccessful group. Indeed, the longest decision making period by any of the successful group was 36 months (1 case, 4.4%) whereas in the unsuccessful group, 3 units (3.6%) took longer than 36 months, one of these units taking as long as 5 years to reach the point of implementation.

In summary, the successful group considered a number of options, collected information in more depth and from a wider variety of sources than the unsuccessful group. This resulted in a more objective approach to evaluating the suitability of cook chill for their particular organisation, within a limited time period. Overall, with respect to the differences discussed so far no single factor alone should be considered as the determinant for success. Rather, the factors influencing success were found to be intrinsically linked together.

## 4.6 Technical Level

This section investigates some of the technical considerations made by the successful group compared with the unsuccessful group at the initiation phase. In particular, differences between the successful and unsuccessful group with regard to equipment selection, alteration to premises, and product development will be discussed.

### Equipment Selection

Each respondent was asked how they decided on the particular pieces of equipment purchased for cook chill and asked to rank the advice they received from different sources in order of merit.[14] Further, they were prompted on the extent to which pre-existing equipment was utilised within the cook chill system.

Overall, there were similarities between the two groups on two points. First, no respondent in either the successful group or the unsuccessful group reported that their equipment choice had been influenced by advertisements in the trade press. Second, none of the respondents in either group said that the attraction of 'high-tech' or novel equipment infiltrating the market had been an influencing factor. But there the similarities end. The responses from the successful group once again demonstrated a higher degree of forethought than the unsuccessful group (see Table 4.3).

Table 4.3 Influences in the Decision Making Process for Equipment Selection Amongst the Successful and Unsuccessful Groups.

| Influence | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) |
|---|---|---|---|---|
| Experience * | 10 | (45.5) | 3 | (15.0) |
| Other Cook Chill Users | 7 | (31.8) | 4 | (20.0) |
| Manufacturers Recommendation | 9 | (40.9) | 11 | (55.0) |
| Advertisements | 0 | (0.0) | 0 | (0.0) |
| Seminars/Conferences | 2 | (9.1) | 0 | (0.0) |
| Costs ** | 3 | (13.6) | 0 | (0.0) |
| Owned already | 10 | (45.5) | 5 | (25.0) |
| Novelty | 0 | (0.0) | 0 | (0.0) |
| Other | 9 | (40.9) | 9 | (45.0) |
| Total No of Units | 22 | (100.0) | 20 | (100.0) |

* Statistically significant different between two groups sig at 0.02 level
** Statistically significant different between two groups sig at 0.05 level

In general terms, the successful group showed a tendency to rely on specific spheres of influence which led to their decision regarding which type of equipment to purchase (see Table 4.3). For example, the successful group tended to rely upon their own experience rather than the experience of other users and adapted and utilised appropriate existing equipment more than the unsuccessful group, a finding which was statistically significant.[15] The successful group relied far less on the recommendations of the equipment manufacturers than the unsuccessful group. The cost of equipment was considered to be more important by the successful group than the unsuccessful group, although few respondents overall would admit to costs being an influential factor in equipment selection.

## Alteration to Premises

Whether or not respondents had taken into consideration the impact of a cook chill system on the structure of their premises was investigated. Indeed, there appeared to be an equal number from the successful group (11 units, 52.4%) and the unsuccessful group (10 units, 45.5%) reporting any structural alterations. However, the differences between the two groups arose not in *whether* they had any alterations, but *what* the alterations were. In particular, whether the alterations were *in anticipation of* or *as a consequence of* the installation of cook chill. For example, according to those managers in cook chill units which fell into the successful group, the alterations were completed to accommodate cook chill:

> "We extended the kitchen to include the corridor, converted the layout to aid flow and built a chilled food store at the end (CC,55)....We removed the walls to make the kitchen open plan, leveled out the floor and bought equipment with wheels and (where possible) put wheels on existing equipment (CC,20)....Upgraded the existing buildings and altered the electricity supply to cope with the extra demands (CC,13)....A new kitchen was built within an existing building utilising redundant space (CC,22)....Converted rooms to different preparation areas and developed a transport loading bay. Then a cook chill store was built and extra deep freeze installed(CC,42)....In 1981 there was a major kitchen upgrading which took account of the possibility of cook chill, therefore when it actually materialised we were prepared (CC,61)"

A further 5 operations in the successful group had a new central production unit built on a 'greenfield' site designed specifically for cook chill. Conversely, those cook chill

units falling into the unsuccessful group tended to react because of the effects the cook chill system had after installation:

> "There was no major conversion....we stuck it in a spare corner....there was no need for dedicated cooking equipment for cook chill (CC,59)....We had a few alterations but we're going to see if they work before we chance any more (CC,75)....a shell of a kitchen existed, installed chillers and regeneration ovens but when we got it going it caused overloading on the power supply. Now we need major structural alterations to accommodate it (CC,49).... None really, just the CPU partitioned from the day to day general kitchen area (CC,24)....We got the system up and running, then found we had a problem with the power supply (CC,26)"

A further 2 (9.1%) operations in the unsuccessful group found after start-up that they should have increased their electricity power capabilities before installation as the existing power supply could not cope with the extra demands enforced by the increased electrical equipment needed for cook chill.

These findings indicate a tendency for the successful group to be *proactive* towards accommodating the necessary structural modifications requirements necessary for the introduction of cook chill whereas the unsuccessful group tended to be *reactive*.

## Product Development

Much of the sales literature concerning cook chill (ELECTRICITY COUNCIL,1980; REGETHERMIC,1980; FOSTERS,1984) claim that the introduction of cook chill requires no recipe alteration or method modification. In practice the converse is true. Repeatedly, amongst the operations interviewed, the claims that there need be no recipe alteration were often refuted. The extent and type of product development carried out may therefore have a bearing on success.

The majority of organisations interviewed reported that at least some (if not all) of the recipes used in their particular catering operation required modification in some way. The most common modifications concerned the proportions, methods or, in a few cases, even the actual ingredients used. Table 4.4 distinguishes between different modifications often cited by the respondents as requiring particular attention with regard to the product formulation. For all types of modification, more research and

development had been carried out by the operations in the successful group than in the unsuccessful group.

Table 4.4 Product Development in the Successful and Unsuccessful Cook Chill Units

| Products Developed | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) | Total* Units | (%) |
|---|---|---|---|---|---|---|
| All Recipes | 8 | (34.8) | 3 | (13.6) | 11 | (24.4) |
| Sauces | 17 | (73.9) | 10 | (45.5) | 27 | (60.0) |
| Batters | 11 | (47.8) | 5 | (22.7) | 16 | (35.6) |
| Fried Foods | 11 | (47.8) | 7 | (31.8) | 18 | (40.0) |
| Egg Dishes | 11 | (47.8) | 9 | (40.9) | 20 | (44.4) |
| Methods | 14 | (60.9) | 11 | (50.0) | 25 | (55.6) |
| No Development | 2 | (8.7) | 5 | (22.7) | 7 | (15.6) |
| Total | 23 | (100.0) | 22 | (100.0) | 45 | (100.0) |

However, a need to modify products does not affect the success of a cook chill operation. The number of operations reporting the need to alter at least one type of product, does not vary greatly between the two groups, 21 (91.3%) of the successful cook chill units compared with 17 (77.3%) of the unsuccessful cook chill units. However, what did appear to affect success was the *type* and *extent* of research and development and *when* it was carried out. Not only was there a tendency by the successful group to investigate a wider range of products for development (Table 4.4) but the experimental methods used in the development stage differed (see Table 4.5).

A substantially higher proportion of the successful group (15 units, 65%) carried out their product development using a series of formal experiments conducted in-house, *prior* to the installation of cook chill. This use of formal experiments had helped to irradicate the majority of problems prior to the implementation and use of the system.

The value of these experiments was reflected in the responses from the catering managers in the successful group:

> "All our recipes were made for cook chill, we constructed new menus to fit into the system (CC, 1) .... the experiments were conducted by the chefs, nutritional analysis was completed and microbiological counts taken. This process is repeated for every new diet that we introduce (CC, 2) ....We

experimented with methods mainly, comparing chilling and regenerating with the lid on and the lid off. Many products required help, especially with regard to liquid content (CC, 3).... there were bound to be problems with liquid content due to the extra time in the oven (during regeneration) so experimentation was initially concerned with that. However it's an ongoing development... (CC, 48).... it was methods and regeneration times that we experimented with mainly, rather than recipes. As other products come into use, they are tested thoroughly, (CC, 58)"

Table 4.5 Methods Used in Product Development by the Successful and Unsuccessful Cook Chill Units

| Method Used | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) | Total Units | (%) |
|---|---|---|---|---|---|---|
| Formal experiments | 15 | (65.2) | 7 | (31.8) | 22 | (48.9) |
| Trial and error | 12 | (57.2) | 14 | (63.6) | 26 | (57.8) |
| Other users results | 4 | (21.8) | 5 | (22.7) | 9 | (20.0) |
| No development | 2 | (8.7) | 5 | (22.7) | 7 | (15.6) |
| Total Units | 23 | (100.0) | 22 | (100.0) | 45 | (100.0) |

In comparison, few of the unsuccessful group (7 units, 31.8%) had conducted formal experiments to develop acceptable end products. Of those seven, only two elaborated on the extent of their experiments and the results obtained and the two that did indicated that the process had been difficult.

> "Trying to get the chefs to experiment with a change of recipes was difficult, but it has turned out to be unimportant because now we're phasing it out (CC, 71).... we're still looking to perfect even the simple recipes (CC. 49)"

A number of the successful group had utilized trial and error as a basis for modifying recipes, but this was often completed alongside *formal* experimentation or the use of external help. In contrast, the unsuccessful group tended to use *trial and error* as the main method of changing recipes or even the only method. Often the approach used by the unsuccessful group was unsystematic and haphazard. They frequently discovered *after* implementation that a problem with recipes existed. A number of the unsuccessful group claimed that they were currently (at the time of interview) in the process of

reassessing their recipes because of the poor results achieved thus far with cook chill. For example :

> "We will compile standardised recipes in time, including standardised recipes and standard timings for chilling and regeneration (CC, 17).... we're now testing all recipes and placing results on a computer (CC, 77).... we're looking at other dishes now (CC, 18)"

In other cases amongst the unsuccessful group what at best could be termed passivity was the only reaction apparent:

> "the product is basically O.K. but the men are still complaining .... we're not doing any development now (CC, 69).... we only have a limited menu so development isn't really necessary (CC, 19)"

This rather negative attitude seems unlikely to generate a successful cook chill system in the future, whereas the other operations in the unsuccessful group may eventually make a success of their cook chill system if they continue their efforts to improve the system as highlighted in their comments on recipe development.[16]

In summary, at the technical level, the successful group manifested a more complex process of equipment selection than the unsuccessful group. An outstanding phenomenon revealed in this analysis is the tendency for the successful group to be *proactive* and the unsuccessful group to be *reactive* with regard to technical development.

## 4.7 Social Level

The employees and consumers are arguably the most influential factors which affect the success of any technological innovation. A number of research studies into the transfer of technology have found that successful organisations place more emphasis on communication and understanding fully user needs (ETTLIE,1973; ROTHWELL et al,1974; see Chapter 1). With regard to the present study, these effects may indeed be exacerbated by the fact that both employee and consumer satisfaction with cook chill had the potential to affect success. The social level plays an extremely important part in affecting successful technology transfers in any industry and as such deserves detailed treatment at each stage of this comparison of successful and unsuccessful cook chill units.

The issues addressed in this section include: the consultation levels and extent of communication with employees prior to cook chill; the involvement and attitudes of trade unions; the extent of pre-installation training of operatives; the impressions of activities pre-cook chill from the employees; and the extent and methods used for informing customers.

## Employee Consultation and Communication Prior to Cook Chill

According to the catering managers interviewed, many industrial relations problems discovered in the survey were a result of a misunderstanding by the workforce. In the main, this was attributed to a lack of communication between management and employees. A common theme which was apparent amongst the firms visited and highlighted by recent publicity (CATERER and HOTELKEEPER,1987) was concern over job losses and loss of overtime pay. This threat of pending job and financial insecurity, as a result of cook chill, was often cited by the managers interviewed as a major cause of discontent amongst the employees. This factor must be seen as an important contributor to the success or failure of an operation.

Although it was not necessary for the employees to be informed of every single detail of the process of introducing cook chill, it was clear amongst the cook chill units visited, that the successful rather than the unsuccessful group made more attempt to keep their employees well informed of the changes likely to take place as a result of cook chill. In fact there were striking differences between the successful and unsuccessful groups, not only in the number of cook chill operations that consulted their operatives, but also on whether the employees were continually kept in touch with the progress being made or whether they received a one-off communique.

Table 4.6 illustrates this phenomenon quite clearly. Of those cook chill units falling into the successful group , 19 (90.5%) kept their chefs continually informed of progress with regard to cook chill. A similar pattern emerged for other levels of staff amongst the successful group, with 17 (80.9%) of the successful group keeping their staff informed continually. Some of the comments from the catering managers of the successful group typify their rather thoughtful approach:

> "the employees were involved from the beginning, not only with the methods to be used, but also the problems as they saw them. We felt it important to show the staff successful operations at work. It's a proper method and the system needs to be shown right through all levels to the pot

wash man and the drivers. We had short talks on all aspects and its potential...We wanted to overcome the fear of unknown problems (CC, 20)....the staff from the chefs to the kitchen porters were informed as soon as the feasibility study had proved O.K. We then sold the package (to the workforce) continually (CC, 3)....they already knew a lot about cook freeze in the kitchen, and therefore had the beginning of ideas on what cook chill was all about. They were all consulted from the start and kept informed continually (CC, 54)"

In contrast the unsuccessful group placed less importance on informing their staff. Table 4.6 shows that only half of respondents continually informed staff. Nine operations (37.5%) did not involve the chefs at all prior to start-up and 10 (41.7%) operations did not inform the rest of the employees (cooks, kitchen assistants and porters). At all staff levels in the unsuccessful group, 4 companies (18.2%) involved their staff at some stage, but on a non-continuous basis. A difference in attitude detected between the successful and unsuccessful groups can be illustrated with typical responses from the unsuccessful group regarding employee consultation:

> "told them two and a half months prior to start-up due to notice periods for redundancies (CC, 69)....they were told just before the machines arrived (CC, 75)....not consulted (CC, 26)....never consulted (CC, 59)"

The responses from the catering managers of both the successful and the unsuccessful groups, were reinforced by responses from the employees themselves. A general theme that tended to appear for those respondents who had been informed over a year before actual implementation was that "it had been talked about for years". This vagueness often led employees to approach cook chill with boredom, complacency or even to ignore it. Thus, it is suggested, that the most productive time to involve the majority of staff is closer to implementation, when the project has been well thought out, so that employees get a clear picture of what the system involves and their questions, if not answered, can at least be pursued.

The results shown in Table 4.7 lend support for this suggestion. The majority of operations in the successful group involved all levels of employees up to 6 months before installation. In the unsuccessful group, of those organisations which informed staff, a slight majority did so up to 6 months before start-up, an almost equal number of units in the group however, were not informed at all. Further, a substantial percentage of the successful group involved their workforce as much as a year before installation with few

Table 4.6 Continuity of Involvement of Different Levels of Employees during the Decision Making Process

| | Successful Group * | | | | | | Unsuccessful Group ** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Continuous | | Non-Continuous | | No involvement | | Continuous | | Non-Continuous | | No involvement | |
| | No units | (%) | No units | (%) | No units | (%) | No units | (%) | No units | (%) | No units | (%) |
| Chefs | 19 | (90.5) | 1 | (4.8) | 1 | (4.8) | 11 | (45.8) | 4 | (16.7) | 9 | (37.5) |
| Cooks | 17 | (80.9) | 1 | (4.8) | 3 | (14.3) | 10 | (41.67) | 4 | (16.7) | 19 | (41.7) |
| Kitchen Assistants | 17 | (80.9) | 1 | (4.8) | 3 | (14.3) | 10 | (41.7) | 4 | (16.7) | 10 | (41.7) |
| Kitchen Porters | 17 | (80.9) | 1 | (4.8) | 3 | (14.3) | 10 | (41.7) | 4 | (16.7) | 10 | (41.7) |

* 21 cook chill operations in successful group
** 24 cook chill operations in unsuccessful group

respondents involving them for longer periods. In contrast, the employees of 4 units (16.7%) in the unsuccessful group were involved for long periods, in one case as much as 5 years before start-up, these four units constituting 27% of all units who bothered to involve staff at all.

What is probably more meaningful is the length of employee involvement as a percentage of the total decision time taken by the catering managers of each operation.[17] The successful group involved their employees for a greater proportion of their total decision time, than did the unsuccessful group. This finding is intrinsically linked to earlier ones, for example, decision time, feasibility studies and accumulating knowledge through information sources. Thus, if the transfer of technology is planned properly, then employees are more likely to be involved in the decision making process. In contrast, if the earlier processes are carried out inadequately, the involvement of employees is likely to be conducted in an equally ad-hoc disorganised fashion.

### Trade Union Involvement

Only since the early 1980's has attention been paid to the dearth of employees in the catering industry with trade union membership (DRONFIELD and SOTO,1980). However, this situation has been changing gradually and, in the public sector in particular, union membership has grown rapidly. Some trade unions have appointed sections specifically to respond to the needs of catering workers (LOW PAY UNIT,1976, PINE,1987).

The results of the cook chill survey show that there was little difference in the extent of union membership between the employees in the successful group and those in the unsuccessful group (mean membership 56.2% and 53.8% respectively). On the surface it would seem that trade union membership had little effect on successful introduction of cook chill. However, this view was quickly refuted when the trade union question was investigated further. There were fewer cook chill units in the successful group having no union membership at all (4 units; 17.4% of all successful units) than the unsuccessful group (7 units; 31.8% of all unsuccessful units). Furthermore, in each group, two of the cook chill units with no union membership were run by contract caterers, although this is not evidence in itself that contract caterer-run units have less union membership. Of the seven (31.8%) contract caterer run units in the unsuccessful group, 5 (22.7%) had union membership of 86% or more of their employees. What this evidence does suggest however, was that the union presence in in-house catering organisations had more

Table 4.7 Number of Months Before Implementation when Different Levels of Employees Were Informed of Cook Chill Decision

| | Successful Group * | | | | | Unsuccessful Group ** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No of Months | 0 | 1-6 | 7-12 | 13-24 | 25 + | 0 | 1-6 | 7-12 | 13-24 | 25 + |
| Chefs *** | 3 (14.3) | 10 (47.6) | 6 (28.6) | 2 (9.5) | 0 (0.0) | 9 (37.5) | 10 (41.7) | 1 (4.2) | 1 (4.2) | 3 (12.5) |
| Cooks | 3 (14.3) | 10 (47.6) | 6 (28.6) | 2 (9.5) | 0 (0.0) | 10 (41.7) | 11 (45.8) | 1 (4.2) | 1 (4.2) | 1 (4.2) |
| Kitchen Assis | 3 (14.3) | 11 (52.4) | 5 (23.8) | 2 (9.5) | 0 (0.0) | 10 (41.8) | 11 (45.8) | 1 (4.2) | 1 (4.2) | 1 (4.2) |
| Kitchen Porter | 3 (14.3) | 10 (47.6) | 6 (28.6) | 2 (9.5) | 0 (0.0) | 10 (41.7) | 11 (45.8) | 1 (4.2) | 1 (4.2) | 1 (4.2) |

* 21 cook chill operations in successful group
** 24 cook chill operations in successful group

*** Mann Whitney U test of success group and consultation of chef statistically significant at 0.04 level.

influence than that in contract caterer run organisations in effecting successful transfer of cook chill technology.

Each catering manager interviewed was asked to comment on the attitudes of the trade unions towards the introduction of cook chill and the responses obtained indicated a difference between the successful and unsuccessful groups in their approach and attitude and hence, the response of the trade unions. The main differences appeared not only in the extent of involvement of the trade unions, with a higher percentage of the successful group consulting the unions, but also in the type of information given and the methods used to solve any problems arising from the transfer of technology in a particular organisation. In a few isolated cases, in the successful group, the involvement of the trade unions proved to be non-problematic. These were in cases where the unions had been made party to the decision process right from the outset. In these cases trade union reaction varied from passive acceptance to active co-operation. However, this was the exception rather than the rule. The majority of units, where trade union membership existed, saw the involvement of the trade unions as a problem.

Again, the major differences between the successful and unsuccessful groups can be best demonstrated by the statements of the catering managers themselves. First, the successful group:

> "We took the shop stewards and gave them a meal, some conventional, some cook chill and did a blind tasting session. Most problems come from the conventional products (CC, 20).... the union were split, bitter with regard to the employees (jobs), but supportive for the consumers who were getting an improved service....they were well briefed on the alternative....(no service) (CC, 10)....100% of the employees are in a union, but not all the same union, some were anti, some were pro cook chill, but the threat of privatisation helped (CC, 58)....They realised the future was cook chill but didn't like it - still don't. *But* they realise there's no other way of beating privatisation - which is worse. We don't have any problems now (CC, 70)...there was cautious acceptance (by the trade unions), they accept that we have achieved improved quality now, but they still don't like the labour losses (CC, 44)....We had hostile unions at first but they were involved all the time and after a while the discussions became more receptive. They were reluctant to change - revolving around the loss of their mid-morning break, when bacon butties were available - which was easily resolved (CC, 52)....Unions wanted assurances

regarding redundancies. The national representatives were happy with what we were doing and we showed it would be better for the staff in the long run. If we hadn't had cook chill the powers would've been telling them to close units and the staff would then have had compulsory redundancies (CC, 42)"

These responses indicate that the methods used by managers of the successful group to placate the trade unions were sometimes elliptic in an effort to circumvent any possible reaction against the installation of a cook chill system. The two methods most frequently made use of were:

a) 'sweet-talking' the shop stewards or trade union representatives with free meals laid on to demonstrate cook chill highlighting its advantages only, avoiding reference to any problems or
b) stressing how much better for 'the staff' cook chill would be in the long run, suggesting that it was the lesser of two evils (the other choices being privatisation, or no jobs at all) without reference to loss of jobs, loss of overtime and, in some cases loss of skills.

Whatever the ethics, in the case of the successful group, the problems encountered in the early stages of the technology transfer process were largely overcome by the implementation stage. In contrast this was not always the case in the unsuccessful group. Moreover, in a large percentage of cases in the unsuccessful group, the trade unions were not even consulted. A selection of typical responses were:

"Unions concerned with safety aspects, cooking, storage and regeneration of second hand food. We made guarantees to the unions (CC,23)....Not happy - see it as night workers being treated differently, other shifts getting a conventional catering service, also there was the job loss thing....they're still unhappy (CC,29)....At the time - marvellous, but when it was introduced they opposed it - it was because we introduced a lot of microwave ovens and they were wary about the radiation and the effects the microwave reheating had on the food after regeneration (CC,32)....totally against it, saw it as a means to take peoples jobs, they still don't accept it, they're still trying to change back (CC,40)....Unions doubtful as system unknown. Now still looking for line service and we're fighting to avoid a canteen committee (CC,51)....not consulted (CC,60)....not informed (CC,75)"

A further eight catering managers from the unsuccessful group responded that the trade unions had not been formally consulted at all. Untypically, a few of the unsuccessful group had minimal problems with the trade unions:

> "Canteen committees held every three months, employees and trade unions were informed at this meeting, but it evoked very little reaction (CC,72)....Indifference (from the trade unions); it didn't matter that much - only 2 natural wastages and they weren't even union members (CC,64)....not against system per se, but concerned about loss of jobs and overtime as it would decrease take home pay. They're happy now though, we got over the overtime bit, they were earning a 95% production bonus, a work study showed it to be near 100% with cook chill, so increased bonus rate got over the overtime loss (CC,77)"

The extent to which trade unions were involved in the cook chill decision varied from non-involvement to complete consultation at all stages of the implementation process. The major stumbling blocks were the extent of job loss, working conditions and the quality of food to the consumer, (the latter particularly in the case of industrial caterers, where the highest union membership was the factory workers rather than the catering staff). These problems were approached in a number of ways, through what might be seen as a form of 'bribery' of the trade union representatives; the threat of privatisation; the threat of a loss of all catering if a cook chill system was not implemented or; the eventual withdrawal of cook chill as inappropriate. It is arguable which of these methods is the most acceptable. Bearing in mind that the majority of catering managers interviewed introduced cook chill for economic reasons (i.e. to reduce labour costs), trade unions representing catering workers have an important role to play in ensuring that catering employees have some protection As far as successful transfer of cook chill technology is concerned, the methods used by the successful group with regard to trade unions produced the most effective results. However, it remains open to question whether these methods were justified or proper. It is perhaps a matter of regret and a reflection of attitudes in this industry that few operations involved trade unions in the technology transfer process on a proper, fully professional basis.

## Operative Training

Many of the problems experienced in the initial stages were operative-related, which were caused, for example, by inexperience, lack of knowledge or industrial relations problems. Whilst adequate pre-installation training may have had little effect on the

latter, it would certainly have had some positive effect on the first two. Information on the extent of pre- and post-installation training was collected from both the managers and, where possible, the employees of the cook chill operations in the successful and unsuccessful groups.

The information collected from the catering managers interviewed, revealed little difference in the training policies between the successful and unsuccessful groups. Both groups claimed to have involved their employees in a training programme.

However, the responses from the employees interviewed paint a quite different picture. The employees were divided into three grades: chefs; cooks; and kitchen assistants. Typical members of the chef group include head chefs, production managers, head cooks and production managers. Whilst the cooks group consisted of cooks, sous chefs, second and third chefs, kitchen supervisors and production supervisors. Finally, the kitchen assistants group included general assistants, production assistants, porters and apprentices.

There was, a marked difference in the type and extent of training provided both pre- and post-cook chill between the successful and unsuccessful groups. In total, for both the successful and unsuccessful groups, 35 (51.5%) employees out of a total of 68 interviewed (from 36, i.e. 80%, of the cook chill operations appearing in the two groups) received pre-installation training of some sort. In comparison, 64 (94.1%) employees from the successful and unsuccessful groups had experienced post-installation training. Table 4.8 shows the extent and type of employee training both before and after cook chill implementation, as reported by the employees themselves.

Even more striking than the differences in extent of training pre- and post-cook chill were the differences between different grades of staff in the successful and unsuccessful groups. The vast majority of chefs interviewed in the successful group had received pre-cook chill training (15 chefs,93.8%) compared with a minority in the unsuccessful group (6 chefs, 46.1%).

Of those chefs in either group receiving pre-cook chill training there were similarities in the type of training received. An equal proportion received some form of manufacturers training (66.6%) and in both groups this constituted the most common form of training received prior to the installation of cook chill. There was also little difference between the two groups with regard to past experience and college training although, bearing in mind the small numbers involved, it is doubtful whether either of these sub-groups are

Table 4.8 Employees Responses Regarding the Type of Training Received Pre and Post Cook Chill

| | Successful Group | | | | | | Unsuccessful Group | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pre Cook Chill | Chefs | | Cooks | | Kit Asst | | Chefs | | Cooks | | Kit Ast | |
| Visits elsewhere | 9 | (56.3) | 0 | (0.0) | 1 | (10.0) | 2 | (15.4) | 0 | (0.0) | 0 | (0.0) |
| Manufacturers trg | 10 | (62.5) | 3 | (15.8) | 0 | (0.0) | 4 | (30.8) | 1 | (11.1) | 1 | (11.1) |
| Induction/formal | 3 | (18.8) | 3 | (15.8) | 2 | (20.0) | 0 | (0.0) | 0 | (0.0) | 0 | (0.0) |
| Literature etc | 9 | (56.3) | 0 | (0.0) | 0 | (0.0) | 1 | (7.7) | 1 | (11.1) | 0 | (0.0) |
| Films etc | 5 | (31.3) | 0 | (0.0) | 0 | (0.0) | 1 | (7.7) | 1 | (11.1) | 0 | (0.0) |
| Past experience | 3 | (18.8) | 1 | (5.3) | 0 | (0.0) | 2 | (15.4) | 3 | (33.3) | 0 | (0.0) |
| College course | 2 | (12.5) | 1 | (5.3) | 3 | (30.0) | 1 | (7.7) | 2 | (22.2) | 0 | (0.0) |
| Pre cook chill total | 15 | (93.8) | 7 | (36.8) | 3 | (30.0) | 6 | (46.1) | 3 | (33.3) | 1 | (11.1) |
| Post Cook Chill | | | | | | | | | | | | |
| On-the-job | 11 | (68.8) | 10 | (52.6) | 3 | (30.0) | 2 | (15.4) | 3 | (33.3) | 0 | |
| Observation only | 5 | (31.3) | 10 | (52.6) | 3 | (30.0) | 3 | (23.1) | 4 | (44.1) | 1 | |
| No training | 0 | (0.0) | 1 | (5.26) | 0 | (0.0) | 2 | (15.4) | 1 | (11.1) | 0 | |
| Total employees | 10 | (100.0) | 19 | (100.0) | 10 | (100.0) | 13 | (100.0) | 9 | (100.0) | 1 | (100.0) |

significant. In addition, the majority of chefs having experience of use of cook chill and college courses, had acquired it prior to employment by the present employer; thus this type of pre-cook chill training was coincidental, and not a policy of the cook chill operation in question.

There were, however, clear differences between the successful and unsuccessful groups with regard to pre-cook chill training. Although the extent of manufacturers training was similar between the two groups, the successful group showed a tendency to extend training to include other sources. For example, a substantial proportion (9 chefs,60%) of those chefs receiving pre-cook chill training also gained experience from visits to other cook chill units either to work with or observe, another cook chill system in operation. In contrast, of those chefs receiving pre-cook chill training in the unsuccessful group, only 2 chefs (33.3%) had the opportunity to train and gain experience in other cook chill units.

In addition, 60% of chefs in the successful group who received pre-cook chill training were given or sought literature (including the DHSS guidelines (1980) and handouts produced by the cook chill unit in question) to gain further knowledge regarding cook chill. In contrast, only 16.6% of the chefs in the unsuccessful group who had any pre-cook chill training received this type of training. This constitutes one of the most noticeable differences between the two groups in terms of training.

The overall picture was even more striking. Only 30.8% of all the chefs interviewed in the unsuccessful group receiving manufacturers training (compared with 62.5% in the successful group), and only 33.3% and 16.6% respectively received training through contact with other cook chill units and the relevant literature. This differs from the successful group where 56.3% of all chefs interviewed received training in other cook chill units and 56.3% were made aware of a relevant literature.

In contrast to the chefs, the cooks and kitchen assistants received a minimal amount of training prior to cook chill being installed. However, the successful group again gave a higher percentage of their cooks and kitchen assistants pre-cook chill training (36.8% of cooks and 30% of kitchen assistants interviewed) compared with the unsuccessful group (33.3% and 11.1% for the cooks and kitchen assistants respectively). From the responses of employees interviewed the majority of training took place after cook chill had been installed (see Table 4.8). This was apparent particularly with regard to the cooks and kitchen assistants in the successful group, and the cooks in the unsuccessful

group (the kitchen assistant in this group cannot be assessed effectively with only one employee having been interviewed).

The majority of post-cook chill training was classed as either 'on-the-job' or learning through 'looking-on'. The major difference between these two classifications was that the former involved a high degree of employee participation, whereas the latter involved employees merely observing. In the successful group there was a greater tendency to utilise on-the-job training than looking-on. Furthermore, a higher percentage of employees in each occupational class of the successful group (chefs 68.8%; cooks 52.6%; and kitchen assistants 80%) received on-the-job training than those in the unsuccessful group (chefs 15.4%; cooks 33.3%).

However, the unsuccessful group relied more on observation as a means of post-cook chill training for each level of staff (chefs 23.1%; cooks 44.1%; and kitchen assistants 100%). Even though the unsuccessful group depended on this type of training, its use was lower than the successful groups' where 31.3% of chefs and 52.6% of cooks learnt by observation. Only one employee (2.2%) in the whole of the successful group claimed to have received no formal training in cook chill compared with 3 (13.0%) in the unsuccessful group. These employees though, were the exception and these responses were overshadowed by the majority of employees who reported at least some level of training.

In summary, these findings suggest that the majority of pre-cook chill training in successful operations concentrated on chefs. The main methods used were manufacturers training, visits to other units and literature. Among the unsuccessful units there was little evidence of pre-cook chill training and what there was concentrated solely on manufacturers training schemes. With regard to post-cook chill training a greater emphasis was placed on on-the-job training rather than observation for all levels of staff in the successful group, with little difference in emphasis for the unsuccessful group.

## Consumer Involvement

Opinion was divided amongst the 80 cook chill units visited, regarding the merits of making consumers aware of the introduction of cook chill. Two distinct views existed. First, that the customer has a right to know "what's happening to the food being served". Second, "what the customer doesn't know, doesn't worry him (or her)". However, amongst both the successful and unsuccessful groups there was a consistent effort to

Table 4.9 Extent of Customer Awareness in Successful and Unsuccessful Groups by Sector

| Sector | Successful Group | | | | Sub total | | Unsuccessful Group | | | | Sub total | | Total no of units |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No of units Aware | (%) | No of units Unaware | (%) | | (%) | No of units Aware | (%) | No of units Unaware | (%) | | (%) | |
| Industrial | 7 | (87.5) | 1 | (12.5) | 8 | (100.0) | 13 | (101.0) | 0 | (0.0) | 13 | (100.0) | 21 |
| Hotels & Leisure | 1 | (33.3) | 2 | (66.6) | 3 | (100.0) | 1 | (33.3) | 2 | (66.6) | 3 | (100.0) | 6 |
| Education | 4 | (100.0) | 0 | (0.0) | 4 | (100.0) | 2 | (66.0) | 1 | (33.3) | 3 | (100.0) | 7 |
| Hospitals | 6 | (75.0) | 2 | (15.0) | 8 | (100.) | 3 | (100.0) | 0 | (0.0) | 3 | (100.0) | 11 |
| Total | 18 | (78.3) | 5 | (27.7) | 23 | (100.0) | 19 | (86.4) | 3 | (13.6) | 22 | (100.0) | 45 |

alert the customer to the use of cook chill; 18 (78.3%) and 19 (90.5%) respectively of each group informing their consumers.

It was apparent from the results obtained that sector had an influence on the decision to alert customers to the introduction of cook chill. This tendency differed little between the successful and unsuccessful groups and were undoubtedly related to the relationship between the caterer and the customer. Table 4.9 illustrates the differences between sector and success group in notifying customers about the introduction of cook chill. Unsurprisingly, the industrial sector accounted for the majority of units where the customer had been informed officially of the change in catering practice, since their customers were generally captive and static (i.e. regular users of the restaurant/canteen facilities). Moreover, they had greater contact with the catering employees (often belonging to the same trade unions) and were more likely to notice changes than consumers served by other sectors of the industry. In fact, in only one instance, did an industrial sector unit refrain from informing the customers and it was made clear that in this instance a formal decision had been made not to inform the customers officially, although, full-time union officials were made aware from the outset.

The education and welfare and hospital sectors informed consumers to a fairly high extent (see Table 4.9). Overall, the education sector informed 85.7% of those units appearing in either the successful or unsuccessful group and the hospital sector 81.8%. Reasons for informing the customers in both these sectors were similar to those cited by the industrial sector; for example, regular consumers, more receptive of change and captive audiences. However, some fairly pertinent arguments existed for those units not attempting to inform customers. These reasons were often related to the temporary nature of the consumers (in hospitals particularly) in that some patients have only a short stay in hospital, (although having stated this, a large proportion of the hospitals in the two groups were using cook chill for long stay wards or in psychiatric hospitals); and the inability of the consumer to understand the implications of a change in system, for example, young school children or psychiatric patients.

It was rare in the hotels and leisure sector for customers to have been informed of the use of cook chill. Obviously, in the majority of cases this was because a large proportion of consumers visited the establishment for a 'one-off' occasion and hence there were potential difficulties in informing the consumer. The units in the hotel and leisure sector, where it was a policy to inform customers, were, in general, using cook chill for banqueting only and informed the client in the preparatory stages of the banqueting contract. In short, the main sectoral differences were between the hotel and leisure

Table 4.10 Methods Used to Alert Customers to the Use of Cook Chill in the Successful and Unsuccessful Groups

| Method | Successful Group No of units | Sub total (%) | Total (%) | Unsuccessful Group No of units | Sub total (%) | Total (%) |
|---|---|---|---|---|---|---|
| Formal | 14 | (100.0) | 77.8 | 6 | (100.0) | 31.6 |
| Seminars/conferences | 9 | (64.3) | 50.0 | 2 | (33.3) | 10.5 |
| Literature | 5 | (35.7) | 27.8 | 3 | (50.0) | 15.8 |
| Special meal | 3 | (21.4) | 16.7 | 1 | (16.7) | 5.3 |
| Informal | 14 | (100.0) | 77.8 | 13 | (100.0) | 68.4 |
| Discussion | 12 | (85.7) | 66.7 | 13 | (100.0) | 68.4 |
| Other | 8 | (57.1) | 44.4 | 5 | (38.5) | 26.3 |
| Total Units Informing Customers | 18 | --- | 100.0 | 19 | --- | 100.0 |

sector and the rest (hospitals, educational and industrial), with the hotel and leisure sector having a tendency to inform customers to a lesser extent than any of the other three sectors.

The main difference between the successful and unsuccessful groups with regard to customer involvement in the early stages, lay not in the actual number of units informing customers, but in the *methods* used to impart information. The most notable difference appeared between the extent of formal and informal methods of enlightening customers. The successful group made greater use of more formal methods, such as seminars and information leaflets than the unsuccessful group - a finding which was statistically significant[18] (see Table 4.10).

Thirteen (72.2%) out of the 18 catering operations in the successful group who alerted consumers to the use of cook chill had utilized a formal method, whereas in the unsuccessful group the majority of respondents who had informed customers had done so on an informal basis - often relying on casual conversation. These findings were reinforced further by the responses from the catering managers interviewed when asked about the methods of alerting customers to the introduction of cook chill. First, those in the successful group who had informed customers:

> "We ran articles in the local press and held special parents evenings (CC,33)....The governors were informed by council that cook chill was to be installed. Then we held meetings with the heads, teachers and parents (CC,13)....We instructed customers on the changes through a video and a photo display (CC,1)....The ward staff know about cook chill - they had the system explained to them fully and they explain to the patients (CC,55)....Cook chill was introduced and explained at a works canteen sub-committee lunch (CC,2)....We had a product display and demonstration day (CC,10)....We held a film show, visits and coffee meetings (CC,22)....Evenings with parents.teachers and governors.head teachers. We organised visits to the unit for everyone. The children have special lessons and do projects on cook chill with the schools which generates a lot of interest (CC,28)"

Clearly, these extracts demonstrate a general level of organised information - giving exercises aimed specifically at the customer. In all cases, these sessions were organised in-house with the specific requirements of the consumer in mind. The responses from the unsuccessful group however, have a different emphasis:

"We used a general brief (CC,51)....they're aware but it's from the grapevine (CC,17)....manufacturers came and gave a talk (CC,23)....We told the unions and the unions told their members, who are our customers (CC,29)....They don't really understand it. It wasn't done very well because we tried to keep it quiet (CC,49)....Everyone got to know because of the catering workers dispute, it got in the papers, on the local TV and even went on the radio (CC,77)....the client is aware as they need to have regeneration ovens, it's up to them to tell the rest (CC,75)....There was a manufacturers presentation to all personnel and that told them all they needed to know (CC,19)....There was a film shown to the (voluntary) staff (CC,46)."

These quotes indicate that although customers had been informed, it was often done with a degree of reluctance, if at all.

In short, the decision of whether or not to inform customers of the introduction of cook chill did not have a significant influence on success. However, there were significant differences between the successful and unsuccessful groups regarding the methods used to inform customers.

## 4.8 Conclusions

A number of clear differences have been shown to exist between successful and unsuccessful cook chill units in their activities during the initiation phase of the technology transfer process.

At all levels (functional, technical and social) the successful group were more thorough and carried out more research on the introduction of a cook chill system than the unsuccessful group. First, they collected information from a wider range of sources, placed more importance on other users advice and were more aware of and made greater use of the information sources available. Second, the successful group spent more resources researching into the type and amount of equipment necessary for the smooth running of a cook chill system and investigated the need to make any structural alterations to the premises in more detail. Third, they made a greater effort to produce foods specifically tailored to the requirements of their operation. Finally, the successful group had more effectively communicated with and involved employees of all grades with the decision to introduce cook chill, displayed a greater use of pre-cook chill as well as post-

cook chill training and had more organised methods of communication with consumers. In short, the approach of the successful group was *proactive* whilst that of the unsuccessful group was either *reactive* or *passive*.

Given sufficient time and resources, the differences shown between the successful and unsuccessful groups during the initiation phase might be easily redressed since every organisation is transient. In other words, these factors on the whole do not necessarily lead to infinite success or failure. None of the catering managers interviewed felt that they had needed to quit cook chill at this stage.[19] This suggested that the factors affecting success during this phase were not absolutely decisive, but rather they were limiting factors which pointed in the direction of success or otherwise rather than an irreversible outcome.

The two following Chapters therefore investigate the implementation and the outcomes phases respectively of the technology transfer process.

# Footnotes to Chapter 4

1 "The identification of a general framework for conceptualising the implementation process raises the important and fundamental issue of whether it is ultimately possible to try and understand the issues and the nature of problems at such a level. It may be felt that the factors involved in specific areas of manufacturing and within specific work places are at a level of uniqueness that makes this impossible to achieve meaningfully" (RHODES and WIELD,1985,7).

2 See Figure 2.2

3 The success groups were based on the quartiles of the tables of success developed in Chapter 3.

4 The sectors were identified as: industrial; hotels and leisure; hospitals; education and welfare.

5 Mann Whitney U test of success group and number employed was statistically significant U=158.5 W=411.5 Z=-2.5 2 tailed P significant 0.04. Mann Whitney U test of success group and total customers was statistically significant U=106 W=359 Z=-3.3 2 tailed P =0.0008

6 Such as the threat of privatisation in the health and education sectors.

7 Although the power hierarchy does vary between different regional health authorities.

8 For example, political resistance from employees with regard to job losses, changes in working conditions and reductions in remuneration and from management as far as capital expenditure was concerned. Further, it was felt that the introduction of cook chill would solve long standing problems inherent in the old system including overstaffing and inefficient practices.

9 and in fact, claimed to have contributed information towards the production of these guidelines.

10 Awareness in this instance refers to a knowledge of its existence, whereas utilisation refers to it actually being put into practice.

11 Crosstabulation gives: chi-squared 2.83; DF 1; sig 0.09.

12 It was inappropriate to use median values here as they failed to highlight the difference that were apparent.

13 In one case the person being interviewed referred to his immediate superior as having been experienced in cook chill.

14 For a discussion of the actual equipment purchased see Chapter 5.

15 Crosstabulation gives Chi-squared 3.2; DF1; sig 0.07.

16 However, as stressed earlier, success is not just reliant on a single factor and it is the gelling together of a number of inter-related activities which leads to success.

17 This gives a good indication of the total picture bearing in mind that there was little difference in the extent of communication for all levels of staff (as shown in Tables 4.7 and 4.8

18 Cross tabulation of success group and use of formal methods to inform customers was statistically significant Chi-square = 4.0 DF =1 significance =0.05 EF = none.

19 Although, some catering managers do. A telephone survey of 30 non-users of cook chill, revealed that 9 (30%) of the 30 had completed the initiation phase and had rejected the use of cook chill for their catering organisations.

# Chapter 5

# Factors Affecting Success During the Implementation Phase.

## 5.1 Introduction

This Chapter examines the differences in the activities between the successful and unsuccessful cook chill units during the implementation phase of the technology transfer process . The implementation phase involves putting the policy decisions made in the initiation phase into action. For the purpose of this study the implementation phase will follow the definitions used by SCHEIRER (1983) and BRAUN (1985) which sees the implementation phase occurring after initiation and the decision to adopt the technology and before the assessment of outcomes.[1] SCHEIRER (1983) reports that studies of implementation using this definition are scarce,

> "..an examination of potential implementation studies alerted us to a major gap in many sources of information about technology transfer: the initial absence of any consideration of the implementation of the technology. The transfer process is usually characterised as one of development, diffusion and adoption, sometimes followed by impact assessment. Implementation, if mentioned at all, may be presented as a minor management problem, rather than an integral part of the technology transfer process." (SCHEIRER,1983,77).

The few studies that have investigated the implementation phase regard it as an extremely important period where many interconnected activities are occurring simultaneously. BRAUN (1985) for example, states:

> "[the implementation phase] may be a complex matter, full of far reaching change. Among the many difficulties that may be encountered in the implementation stage of an innovation are: shortage of relevant skills, resistance to change by management and/or workers, shortage of capital, lack of space, need for extensive reorganisation, need for change in working practices, renegotiation of manning and/or pay agreements, technical malfunctions in the manufacturing system caused by the introduction of the innovation, changes in power structures and/or hierarchies". (BRAUN,1985,90).

A survey of the relevant literature revealed an absence of empirical studies of the implementation phase. Many studies of the transfer processes in technological change have concentrated on activities up to but not including implementation. SCHEIRER (1983) reported a lack of consideration to the implementation of technology in her review

of the study of implementation. Indeed, much of the literature concentrated on the development and adoption of technology but largely omitted the implementation phase merely as a minor management problem. This is a severe oversight given that during the initial stages of implementation, a whole host of new, inter-related activities are thrust upon the organisation and operators therein. The ability to cope with the changes in organisational activities caused by the introduction of new technology[2], could seriously affect its successful transfer.

The activities during the implementation phase can be highly complex and can involve high levels of uncertainty, especially where major re-equipment programmes are involved (WILLIAMS, 1985). RHODES and WIELD (1985) suggest that

> "There are a considerable range of things that can go wrong with new technology projects - although the precise extent to which they occur is uncertain" (RHODES and WIELD,1985,5).

Perhaps because the implementation phase is so complex, few attempts have been made to study it in depth. This study, by concentrating on the implementation phase as an important part of the whole technology transfer process, goes some way to alleviating this neglect.

The aim of this Chapter is to focus on the activities which took place at the implementation phase This included: at the functional level, an investigation of the catering system (size, type and location of system), total capital expenditure, and changes in purchasing; at the technical level, equipment, temperature control, and microbiological analysis; and at the social level, employment change, training, operative problems and customer acceptance. The successful and unsuccessful groups will be compared at each of these three organisational levels.

## 5.2 Functional Level

Analysis at the functional level of the implementation phase employed data which assessed the degree of variability between the successful group and the unsuccessful group in terms of financial characteristics (total capital expenditure, contracts and changes in the purchasing procedure); and operational characteristics (the size of the operation, the type of cook chill system operated, the number and location of the satellite units with respect to the Central Production Unit (CPU) and the transportation methods used).

## a) Financial Aspects

As has been explained earlier in this Chapter the implementation phase includes those activities which take place after the decision making phase, which includes capital expenditure and related issues. The differences between the successful and unsuccessful groups with regard to capital expenditure, the use of outside contracts and changes in purchasing procedures wil be investigated.

### Capital Expenditure

This section concentrates on the total capital expenditure with particular reference to its allocation to different resources, for example, equipment, redundancy payments, consultancy fees and training.[3] Total capital expenditure was found to be significantly higher in the successful group than the unsuccessful group.[4] This result was not surprising given that the cook chill operations[5] in the successful group were significantly larger than those in the unsuccessful group.[6] Furthermore, there was a strong correlation between total capital expenditure and maximum capacity.[7] Therefore, in order to gain a more meaningful comparison of the successful and unsuccessful groups which took into account the effects of size on capital expenditure, there was a need to develop an index of total capital expenditure using the equation:

$$\text{Index of total Capital expenditure} = \frac{\text{maximum capacity}}{\text{total capital expenditure}} \times 100$$

Using this index it was shown that the successful group spent more capital per unit of capacity than the unsuccessful group. Table 5.1 shows the differences between the two groups with regard to the index of total capital expenditure and also index values for capital expenditure on equipment and other items purchased specifically for cook chill. [8] For each expenditure category the successful group had a higher index of expenditure compared with the unsuccessful group. The differences between the successful and unsuccessful groups with regard to the index of total capital expenditure and the index of capital expenditure on equipment were both found to be statistically significant. [9]

In short, the successful group showed a higher capital expenditure per unit than the unsuccessful group.

## Outside Contracts

In order to improve their commercial viability, catering organisations (even in the public sector) are looking to increase their revenue by the use of outside catering contracts. The use of a centralised production system such as cook chill may allow increased productivity by systematically concentrating production skills in one area. In addition, the increased use of technology may lead to a more factory-like production system.

Table 5.1 Indices of Total Capital Expenditure by Success Group.

| | Successful Group | | | | Unsuccessful Group | | | |
|---|---|---|---|---|---|---|---|---|
| | No of Units | Mean | Median | Mean Rank* | No of Units | Mean | Median | Mean Rank* |
| Index of Total ** | | | | | | | | |
| Capital expenditure | 14 | 6.0 | 1.3 | 16.7 | 11 | 0.9 | 0.6 | 12.2 |
| Index of equipment | | | | | | | | |
| expenditure § | 10 | 11.1 | 2.8 | 14.5 | 10 | 1.2 | 0.9 | 7.8 |
| Index of remainder | | | | | | | | |
| expenditure | 5 | 111.4 | 80.4 | 7.4 | 5 | 7.7 | 2.1 | 4.8 |

* Mean rank is calculated in the Mann Whitney U test. The figures in both groups are ranked in order and each case receives a rank score. The rank score is then calculated for each group by a calculation of the mean value of the rank score foreach case in that group.

** Mann Whitney U test statisically significant U = 43.0, W = 121.0 2 tailed P signficiant at 0.035 level.

§ Mann Whitney U test statistically significant U = 20.0 W = 145.0 2 tailed P significant at 0.014 level.

In the sample as a whole, the incidence of catering operations engaged in producing cook chill products for outside contracts was low (19 operations, 23.75%) and thus, the percentage contribution to their total catering output at the time of interview was also low (mean 22.8%, median 10.0%). However, there was some evidence to suggest that, in future, the use of outside contracts would be more significant. Twelve units (52.2%) in the successful group stated that they intended to become involved in outside contracts compared with 6 units (30%) in the unsuccessful group, a difference which was statistically significant.[10] In the successful group, 6 units (26.1%) were involved in outside contracts (mean output 5.8%, median 5.0%). In comparison, there were 4 units

(20%) in the unsuccessful group engaged in outside contracts, but although their overall percentage involvement with outside contracts was higher (mean output 30.6%, median 10%), the monetary value of the contracts in the unsuccessful group was substantially lower, (mean value £1,783; median £1,510) than the successful group (mean £31,733, median £13,200).

Overall however, the successful group were less reliant on outside contracts to absorb cook chill capacity than the unsuccessful group. This was because of the difference in operational size of cook chill units in the successful and unsuccessful groups. For example, the majority of cook chill units in the unsuccessful group were smaller (mean percentage cook chill 22.1%) than the successful group (mean percentage cook chill 56.1.1%). Therefore, a large percentage output for the unsuccessful group would probably be worth less in monetary terms than a small percentage output from the successful group. In other words, if the successful group lost their outside contracts it would have less effect on their cook chill operation them if the same happened to the unsuccessful group.

In summary, because of the small number of units involved, there was little evidence to suggest that, at the time of interview, involvement with outside contracts had much effect on success. Of those units which were involved in outside contracts, the successful group tended to be less reliant on their contribution than the unsuccessful group, even though they were worth more in monetary terms than the unsuccessful group. However, the successful group were more likely to become further involved with outside contracts as they expanded their current cook chill operations. In contrast, the unsuccessful group were less likely to expand (see Chapter 6).

## Food Purchasing

Overall, there was little change amongst the successful and unsuccessful groups with regard to their purchasing procedure pre- and post- cook chill implementation. However, there was more of a trend in the successful group towards centralised purchasing procedures (8 units, 34.8%) than the unsuccessful group (2 units, 9.1%). This was probably a result of the differences in size of operation; centralised purchasing being more applicable in large cook chill operations than small. This difference in the use of centralised purchasing was found to be statistically significant.[11] These results show that the introduction of cook chill is more likely to be successful when greater control is exercised over purchasing procedures. This difference can perhaps be explained in the words of one catering manager from the successful group:

> "When you're talking about such big numbers [8500 portions per day] you have a lot of influence on the quality and specifications of food from the suppliers" (CC, 28)

In short, the successful group were associated with a more systematic procedure for food purchasing and a greater degree of centralised purchasing than the unsuccessful group.

## b) Operational Characteristics

This section investigates any differences between the successful and unsuccessful groups with regard to size of operation, types of cook chill in use, the number of central production units (CPU's), the number of satellite kitchens, the location of satellite kitchens, the delivery time and the transportation methods.

### Size of Operation

The differences in percentage use of each cook chill operation at the time of interview, was detailed in Chapter 3. This section looks at the relationship between the projected proportion of the total daily operation estimated in the initiation phase; the actual proportion and the plans for future changes in proportion, in the successful and unsuccessful groups. It has already been established in Chapter 4 that the maximum capacity of cook chill units in the successful group was higher than in the unsuccessful group. However, absolute capacity did not have a major affect on success. Rather, the key influence was the difference between the *projected* proportion size of a catering system designated to cook chill and the *actual* proportion designated to cook chill at the time of interview. The successful group as a whole had a mean projected proportion of 67.6% of the total catering operation designated to cook chill (median 71.6%) and a mean percentage actual proportion of 58.7% (median 65%). In comparison, the unsuccessful group had a mean projected proportion of 64% (median 80%) of the total catering operation size designated to cook chill and a mean actual proportion of 20.5% (median 10%). Obviously, the successful group came much closer to reaching their projected proportion targets than the unsuccessful group.

From these results, it would appear that the absolute proportion of the cook chill operation does not in itself affect success. There was very little difference between the successful and the unsuccessful groups in their projected proportions for cook chill. However, the difference between the two groups with regard to actual proportions of cook chill was statistically significant.[12] This prompts the question 'What happened

between planning and implementation that led to the failure by the unsuccessful group to reach their projected cook chill proportions?' In short, this factor does not in itself affect success, rather, the differences appear to be a product of other activities during the iniation and implementaton phases.

## Types of Cook Chill

An investigation into the types of different variations of cook chill within the sample as a whole was carried out. It was found that there were four main types of cook chill in use:

Type 1 — Electro-mechanical chilling (using electro-mechanical blast chillers) coupled with some form of mass regeneration (for example: infra-red ovens, combi-ovens or forced air convection ovens).

Type 2 — Cryogenic chilling using liquid nitrogen as the chilling medium coupled with (usually) mass regeneration as in Type 1.

Type 3 — Electro-mechanical or cryogenic chilling with chilled vending machine storage and individual regeneration using microwave ovens.

Type 4 — Bought-in chilled food with either mass or individual regeneration facilities only on side.

There was little difference between the successful and unsuccessful groups with regard to the use of cook chill types 2 and 4 (see Table 5.2). However, significant differences were apparent with regard to cook chill types 1 and 3. In the successful group the most popular main cook chill method was type 1; 87.0% (20 units) reported the use of this type of cook chill. In the unsuccessful group, only 59.1% (13 units) utilized type 1 cook chill. This difference was found to be statistically significant.[13] Although, in the sample as a whole electro-mechanical cook chill was the most common cook chill type utilized (58 units, 72.5%) it was not evenly distributed throughout the success tables and therefore, it must be concluded to have some influence on success.

The most decisive finding in this section was with regard to the use of type 3 cook chill. None of the units in the successful group utilized type 3 cook chill as their *main* cook chill technique whereas 7 (31.8%) of the unsuccessful group were utilizing type 3 cook chill as their main, indeed in all 7 cases, their only, cook chill method. In addition, 53.9% of all type 3 cook chill systems, in the sample as a whole, fell into the

unsuccessful group with 38.5% of the rest falling in the lower half of the main success table (Table 3.1). In the successful group, 3 units (13.0%) made use of type 3 cook chill as a supplement to their main cook chill type. In these cases it was used to provide catering facilities for remote and/or nightshift workers and was used for a minority of the total output attributable to cook chill in each organisation.

Table 5.2 Extent of Use of Different Types of Cook Chill Amongst the Successful and Unsuccessful Groups.

| Type of cook chill | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) |
|---|---|---|---|---|
| Type 1 | 20 | (87.0) | 13 | (59.1) |
| Type 2 | 2 | (8.7) | 1 | (4.5) |
| Type 3 | 0 | (0.0) | 7 | (31.8) |
| Type 4 | 1 | (4.3) | 1 | (4.5) |
| Total | 23 | (100.0) | 22 | (100.0) |

Why did the use of type 3 as the main cook chill system have a detrimental effect on success? Two possible factors emerged as explanations to this question. First, from a technical viewpoint, there was evidence that the average temperature level of the food stored in vending machines was higher than the recommended safe level advised by the DHSS (1980) guidelines. The mean storage temperature of those operations in the unsuccessful group using type 3 cook chill was 5.7°C (median storage temperature 6.0°C). Purely from a safety viewpoint, this constitutes unacceptable levels for any cook chill system. However, probably the most forceful reason behind the relative failure of cook chill vending type operations was the social factor. The respondents themselves had strong (retrospective) views on the reasons why their cook chill vending systems had not produced the intended results. From their responses it seems that, in all cases, consumer resistance was the most important factor:

> "The visual impact in the vending machines is poor, the presentation on the plate causes a problem, different foods reheat at different times, making the process of obtaining a hot meal a difficult experience for the consumer. Regeneration in a microwave can be poor especially for fried foods. The staff are cut-off from the customers and the consumers see it as having no

personal involvement (CC, 32)...Presentation is difficult, the food in the vending machine never looks quite right (CC, 18)...We have problems with acceptability by the employees (consumer). Smaller plates were required (to fit in the vending machine) it seemed like they were getting a smaller meal. This was significant - they saw it as a reduction in welfare benefits. We're slowly drifting back to a conventional operation (CC, 69)...When it got to the first Christmas (after cook chill vending was introduced) the night workers and the unions wanted a special meal. So the conventional system, with a serving lady (at a counter), was re-introduced for one night. From then on cook chill suffered as the night shift wanted the old system back. They like the personal contact ... the main problems has been customer acceptance - they just wont accept the vending machines, they feel they're missing out (CC, 29)...The main problem is convincing the consumer that the food is good. We had a bad experience with a similar system back in 1968 and the memory of it lives on, therefore making it difficult to gain customer acceptability (CC, 19)...Food out of the vending machine is just not acceptable to people. We're not using the system now for cook chill meals, only sandwiches, it's all the customers will accept (CC, 40)...The customers viewpoint is that the system provides poor quality food - from our viewpoint we achieved our expectation (Cost reduction) (CC, 51)".

Although the use of type 3 cook chill in any of the organisations in question was an outcome of the activities followed in the decision making phase, difficulties associated with this cook chill type (which may induce failure) only became apparent during the implementation phase.

## Number of Central Production Units and Satellite Kitchens

One of the much publicised advantages of a cook chill system is that a number of 'satellite' units can be served from one central production unit (CPU). These satellite units receive cooked, chilled food from the CPU, and then store the food at chilled temperatures until needed for regeneration. Ideally, no preparation or food production takes place at the satellite units. This section examines the differences between the successful and unsuccessful groups with regard to the number of CPU's and satellites and the location of the satellites with respect to the CPU.

There was little difference between the two groups regarding the number of CPU's. The successful group did however include 3 operations (13.0%) with several central production units, but these were very large operations (mean production per day 6200) covering a large distribution area. The biggest differences detected were in the number and location of the satellite units. Not surprisingly, given the vast difference in maximum capacity between the two groups (median capacity, 2602 and 475 for the successful and unsuccessful groups respectively) and the existence of operations with more than one CPU, there was a statistically significant difference between the successful and unsuccessful groups with regard to the number of satellites served.[14] Table 5.3 shows that more units in the successful group served multiple satellite units than single or few satellite units, whereas the unsuccessful group served single or few satellite units more than multiple units.

Table 5.3 Number of Satellite Kitchens Served By The Successful and Unsuccessful Groups*

| Number of Satellite Kitchens | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) | Total No of Units | (%) |
|---|---|---|---|---|---|---|
| 1 - 5 | 6 | (26.1) | 14 | (63.6) | 20 | (44.4) |
| 6 - 10 | 9 | (39.1) | 7 | (31.8) | 16 | (35.5) |
| more than 10 | 8 | (34.8) | 1 | (4.5) | 9 | (20.0) |
| Total | 23 | (100.0) | 22 | (100.0) | 45 | (100.0) |

* Differences between the two groups statistically significiant - Mann Whitney U test significant at 0.003 level.

## Location of Satellite Kitchens

From the survey results, there was a definite association between success and the location of satellite kitchens *away* from the CPU.[15] These findings indicate that the successful group utilised cook chill to its maximum potential by serving a number of satellite kitchens from the CPU, whereas the unsuccessful group tended to serve just one satellite kitchen which was often situated adjacent to the CPU. In such cases a conventional cook-serve type of operation would perhaps have been more appropriate.

The location of satellite units with respect to the CPU was an enlightening area of investigation. Table 5.4 shows the difference in location of satellite units with respect to

the CPU between the successful and unsuccessful groups. The unsuccessful group tended to have more *adjacent only* satellite units (11 units,50%) than the successful group whereas the incidence of adjacent only satellite units in the successful group was low (3 units, 13.0%). The majority of units in the successful group had satellite kitchens which were situated both adjacent to and at a distance from the CPU (12 units, 52.2%). In total, 20 units (87.0%) in the successful group had satellite kitchens situated away from the CPU compared to only 11 units (50%) in the unsuccessful group. The unsuccessful group tended to have satellite kitchens situated *either* adjacent *or* remote to the CPU. It was rare, in the unsuccessful group for cook chill units to have satellite kitchens which were situated *both* adjacent and remote to the CPU (4 units, 18.2% ). These differences were found to be statistically significant.[16]

Table 5.4 Location of the Satellite Kitchens with Respect to the Central Production Unit for the Successful and Unsuccessful Groups

| Location of Satellite Kitchen | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) |
|---|---|---|---|---|
| Adjacent only | 3 | (13.04) | 11 | (50.0) |
| Remote only | 8 | (34.8) | 7 | (31.8) |
| Adjacent and remote | 12 | (52.2) | 4 | (18.2) |
| Total | 23 | (100.0) | 22 | (100.0) |

Cross tabulation of success group and location of satelitte kitchens was statisticallt significant. Chi-squared 8.5 DF 2 sig at 0.01 level.

Several reasons were apparent which contributed towards the poor performance of those operations which had their lone satellite kitchen situated adjacent to the CPU. The two most prominent were the lack of suitable transportation equipment and delays in delivery time caused by inadequate planning. These and others will be discussed further in the following sections, but, it should be noted that these activities had detrimental effects on the food - resulting in frustrated operatives and dissatisfied customers.

## Delivery Time

The location of the satellite kitchens with respect to the CPU also had ramifications on the delivery time[17] of the food from the CPU to the satellite kitchens.

Figure 5.1 Delivery Time from CPU to Satellite Units

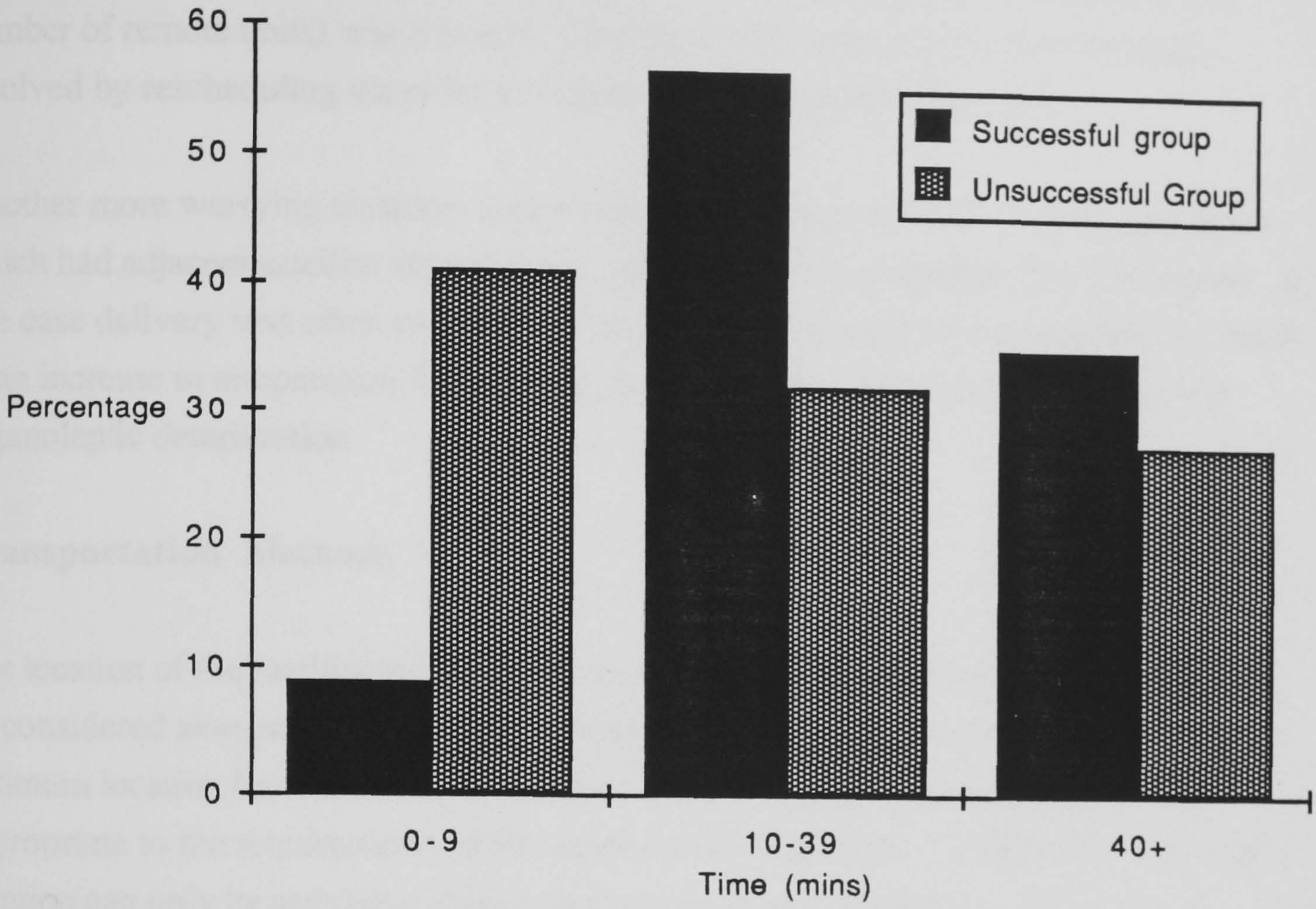



Figure 5.1 shows that the majority of the successful group (13 units, 56.5%) had a delivery time between 10 and 40 minutes. Very few (2 units, 8.7%) successful cook chill units had a delivery time of less than 10 minutes whilst the remainder of the successful group (8 units, 34.8%) had a delivery time of over 40 minutes. In contrast, the majority of the unsuccessful group (9, 40.9%) had a delivery time of less than 10 minutes, whilst 7 units (31.8%) took between 10 and 39 minutes to make deliveries and a further 6 units (27.3%) took over 40 minutes. The differences in delivery time between the two groups were found to be statistically significant.[18] From these results, there appeared to be some evidence of an optimum delivery time which was intrinsically linked to the location of the satellites with respect to the CPU.[19] This assumption was reinforced by the discrepancy in the unsuccessful group between delivery time and number of units with adjacent satellite kitchens. Indeed, this leads to the suggestion that it is not so much absolute time taken as time relative to distance (that is, speed of delivery) which is important. For example, six units (27.3%) in the unsuccessful group were taking longer than 10 minutes to deliver food to satellite units which were situated *adjacent* to the CPU. In four (66.7%) of these cases there were remote satellite units in addition to the one adjacent to the CPU. The adjacent satellite units were receiving

chilled food at the end of the delivery schedule. Thus, in 3 cases adjacent satellite units were receiving food at the end of a delivery which had taken between 20 and 60 minutes. In the one remaining case the delivery time to the adjacent satellite (after delivery to a number of remote units) was 8 hours! Obviously this malpractice could be simply resolved by rescheduling the order in which satellite received their food.

Another more worrying situation was revealed with regard to the 2 (33.3%) operations which had adjacent satellite kitchens only and a delivery time greater than 10 minutes. In one case delivery was often as long as 50 minutes. This would, in all probability, result in an increase in temperature,[20] rendering the food at risk from microbiological and organoleptic deterioration.

## Transportation Methods

The location of the satellite kitchens with respect to the CPU and the delivery time must be considered alongside the methods of transportation in use. It is pointless having an optimum location for satellite units without having adequate transportation facilities appropriate to the requirements of the organisation in question. Indeed, an 'optimum' location can only be arrived at given transportational considerations. Obviously a refrigerated vehicle is unnecessary if the only satellite kitchen is adjacent to the CPU. However, suitable methods of transportation need to be utilized to keep temperature increases in the food to a minimum (by the use of insulated containers for example). Table 5.5 shows the use of different methods of transportation by the successful and unsuccessful groups. There were over twice as many cook chill operations in the successful group (13 units, 56.5%) which used a refrigerated vehicle than in the unsuccessful group (6 units, 27.3%), a result which was statistically significant.[21] The successful group also used insulated containers to a greater extent (11 units, 47.8%) than the unsuccessful group (5 units, 22.7%).

In both the successful group and unsuccessful group, the main transportation methods used for all these cases was either a refrigerated van (with baskets, trolleys or insulated containers within) or insulated containers within an ordinary van. There was however, a slight difference between the two groups with regard to the percentage of units with remote satellites who also used refrigerated transport, 65% of the units in the successful group compared with 54.5% in the unsuccessful group.

Table 5.5 Transportation Method Used by the Successful and Unsuccessful Groups.

| Transportation Method | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) |
|---|---|---|---|---|
| Refrigerated van * | 13 | (56.5) | 6 | (27.3) |
| Insulated container | 11 | (47.8) | 5 | (22.7) |
| Ordinary van | 7 | (30.4) | 5 | (22.7) |
| Trolley | 4 | (17.4) | 7 | (31.8) |
| Other | 11 | (47.8) | 11 | (50.0) |
| Total | 23 | (100.0) | 22 | (100.0) |

* Cross tabulation statistically significant between two groups statistically significant. Chi-square 2.84 DF 1 sig 0.09

Note: Some units had more than one transportation method.

In summary at the functional level, the successful group tended to be larger and had achieved their projected size to a greater extent than the unsuccessful group. The successful group had also avoided the use of cook chill vending as their main cook chill type whereas for the unsuccessful group the converse was true. The successful group also tended to serve a number of satellite kitchens which were situated at a distance from the CPU whereas the unsuccessful group were more likely to serve few satellite kitchens adjacent to the CPU.

## 5.3 Technical Level

Analysis at the technical level examines some of the technologically related issues which were seen to affect cook chill at the implementation phase. It encompasses the implementation and use of the actual technology being transferred. ROGERS (1983) pointed out that it is almost inevitable that organisations experience problems at the implementation phase:

> "It is often one thing for the individual (or organisation) to decide to adopt a new idea and quite a different thing to put the innovation into use. Problems in exactly how to use the innovation may crop up at the implementation stage" (ROGERS,1983,174).

Most of the cook chill units in both the successful and unsuccessful groups experienced degrees of change-related problems at the implementation phase. However, as is shown in Chapter 6 the successful group were better equipped (in knowledge of the system, as well as hardware) to cope with these problems. The human problems are dealt with in the social level section of this Chapter. The main issues under examination in this section include the differences between the successful and unsuccessful groups in terms of the equipment used, the control of temperature, the frequency and methods of microbiological analysis and the incidence of problems as viewed by the operatives.

**Equipment**

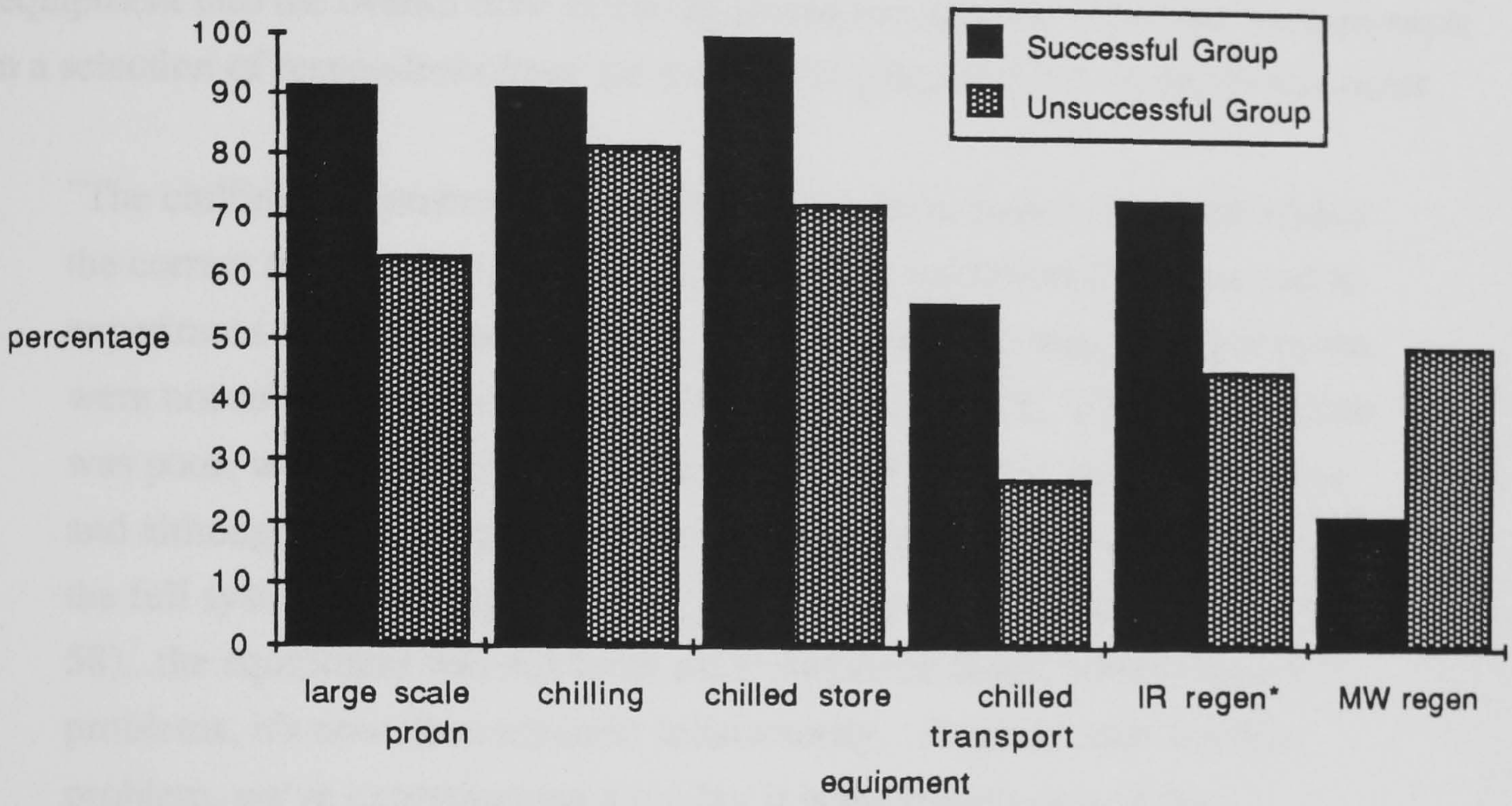
A comparison between the successful and unsuccessful groups with regard to the type and amount of equipment possessed, its harmonization into the total cook chill system and problems directly associated with the equipment at the implementation phase is described here.

There appeared little difference between the successful and unsuccessful groups with regard to the possession of chilling equipment. It was expected that those cook chill units in either group using type 4 cook chill (bought-in chilled) would have no requirement for a blast chiller so the possession of equipment was also based on needs. Of the cook chill units which required a blast chiller, there were 2 units (9.1%) in the unsuccessful group who had failed to purchase a blast chiller and thus did not fill the basic requirements of the system. This extraordinary oversight, despite being symptomatic of the unsuccessful group, was the exception rather than the rule.

There were differences between the two groups with regard to the possession of refrigerated transportation facilities.[22] The need for refrigerated transport appeared to have largely been overlooked as a serious consideration by the unsuccessful group. The most statistically significant difference between the two groups occurred in the possession of regeneration equipment. The unsuccessful group showed a tendency to rely heavily on non-specific regeneration equipment, (for example in the use of FAC ovens) and individual regeneration equipment such as microwave ovens. The successful group however, appeared to be more flexible in their choice of regeneration equipment, making use of a number of different types of regeneration equipment. The greater use of infra-red regeneration ovens and combination ovens (with a steam injection facility to try and combat food dehydration) by the successful group compared with the unsuccessful group was found to be a statistically significant difference.[23] Figure 5.2 shows the

major technological requirements of the cook chill system and the differences in equipment used by the two groups.

Figure 5.2 Principle Items of Technology in the Successful and Unsuccessful Group




* In some cases non-specialist equipment used for regeneration

In essence, the actual possession of individual pieces of equipment was intrinsically linked with the decision process. Success was found to be associated not only with the equipment possessed but also in the amount and type of background research undertaken, the suitability of the equipment for the organisation involved, the training given to the workforce in how to utilize such equipment (see Chapter 4) and location of equipment within the flow pattern of the production kitchen. This suggests that the pieces of equipment required for use within a cook chill system cannot be regarded as individual entities. Rather, they are components of the whole technological system and as such should complement each other. The mere possession of individual items of technology did not guarantee success.

No two organisations have exactly the same requirements. Therefore, it could be that members of the unsuccessful group possessed chilling equipment unsuitable for their requirements or more probably, were unaware of the equipments' capabilities, limitations

and the need for the learning process by the operatives. This problem of inadequate background research and the relative lack of awareness in the unsuccessful group was supported by the evidence from the respondents themselves regarding the incidence of technologically related problems encountered at the implementation and use phase. The successful group reported problems which were mainly concerned with the technology itself whereas the unsuccessful group not only experienced these problems but also encountered many difficulties with operating the equipment in practice and incorporating the equipment into the overall flow of the technological system. The following excerpts from a selection of respondents from the successful group serve to illustrate this point:

> "The chilling equipment couldn't reduce the temperature of the food within the correct time length [according to the DHSS guidelines]. So we had to experiment with different volumes. The regeneration was poor, the ovens were not robust enough it was out biggest concern (CC, 10)...regeneration was poor, we had to fluctuate temperatures and voltages at different units, and although we'd done a lot of experimental work, it was the volume [of the full system] that highlighted the inadequacy of the system (CC, 58)...the equipment was run from a computerised board which caused problems, it's now been repaired satisfactorily. Regeneration is still a problem, we've experimented a lot, but it is the inadequacy of the equipment. With a rigid regeneration temperature we still get cold spots. They [the equipment manufacturers] are still in the very early stages of the development of regeneration trolleys, but within the next 18 months - 2 years I think there will be [an equipment] revolution (CC, 70)...At first, we got a temperature rise during distribution even though we had refrigerated vans. The vans had not got any plastic screens, so whenever the door was opened on the delivery run there were fluctuations in temperature. We've now had screens fitted. Regeneration also caused problems. We got dehydration and scorching on the outside. The equipment didn't work properly with the increased volume [of the full system as opposed to the small experimental volumes]. Regeneration in general was poor. It needed to be a combination of convection, steaming and microwave ovens to achieve flexibility in regeneration (CC, 54)".

These quotes were typical of the technologically related problems which were experienced at the implementation phase by the successful group. Their experiences indicated that the majority of problems were associated with the technology itself and not so much in the operation of cook chill. Comments from the unsuccessful group

however revealed that other problems, besides those inherent to the technology itself, could be encountered:

> "We had bought new equipment from Germany, but the instructions were in German so we couldn't understand it. We had no information on the practical implications of cook chill. Regeneration was poor, mainly through the lack of training of the staff (CC, 46)...Inexperience was a problem. We found it difficult to get the right equipment and transport was a real problem (CC, 60)...There were grave production problems because of the use of it [cook chill] as a partial system. There was confusion. There was lack of training regarding temperature control, transportation and regeneration (CC, 64)...There was ineffective use of the chiller - queues of food waiting for the chiller. It was much more labour intensive than we thought. The cooks don't use recipes, it's difficult for the staff to comprehend the need for it [cook chill] and temperature control is not always enforced. Regeneration is poor, the equipment is not conducive to temperature control, but most of the problems were due to our inexperience (CC, 75)...The first day of regeneration caused a complete power failure, the extra power required for the regeneration ovens caused a complete overloading. Regeneration caused a problem anyway, the customer had an aversion to the use of microwave ovens and the different density of different foods that reheated differently (CC. 23)".

Other responses from the unsuccessful group were in a similar vein. The extracts above show that at the implementation stage both the successful and unsuccessful groups experienced problems. In both groups there were examples of inexperience of use causing initial problems and inadequacies of the technology itself. However, the activities of the successful group in the decision making phase had alerted them to potential difficulties and they seemed to be more aware of and prepared to deal with these problems.

### Temperature Control

The importance of temperature control within a cook chill operation has already been stressed in earlier Chapters (see Chapters 2 and 3). Accurate temperature control can only be achieved with appropriate equipment (see previous sub-section) and adequate measurement and control devices. This section investigates the differences between the successful and the unsuccessful groups with regard to the possession of apparatus to

control temperature and the frequency of temperature control during chilling and chilled storage.

The DHSS guidelines (1980) emphasise the necessity for temperature control throughout the cook chill process by the citation of safe time limits at specific temperatures for food in a cook chill situation (see Chapters 2 to 4). In order to fulfill the criteria set by the DHSS guidelines (1980), there needed to be specific controls within the system. There were a number of methods used amongst the successful and unsuccessful groups to ensure temperature control:

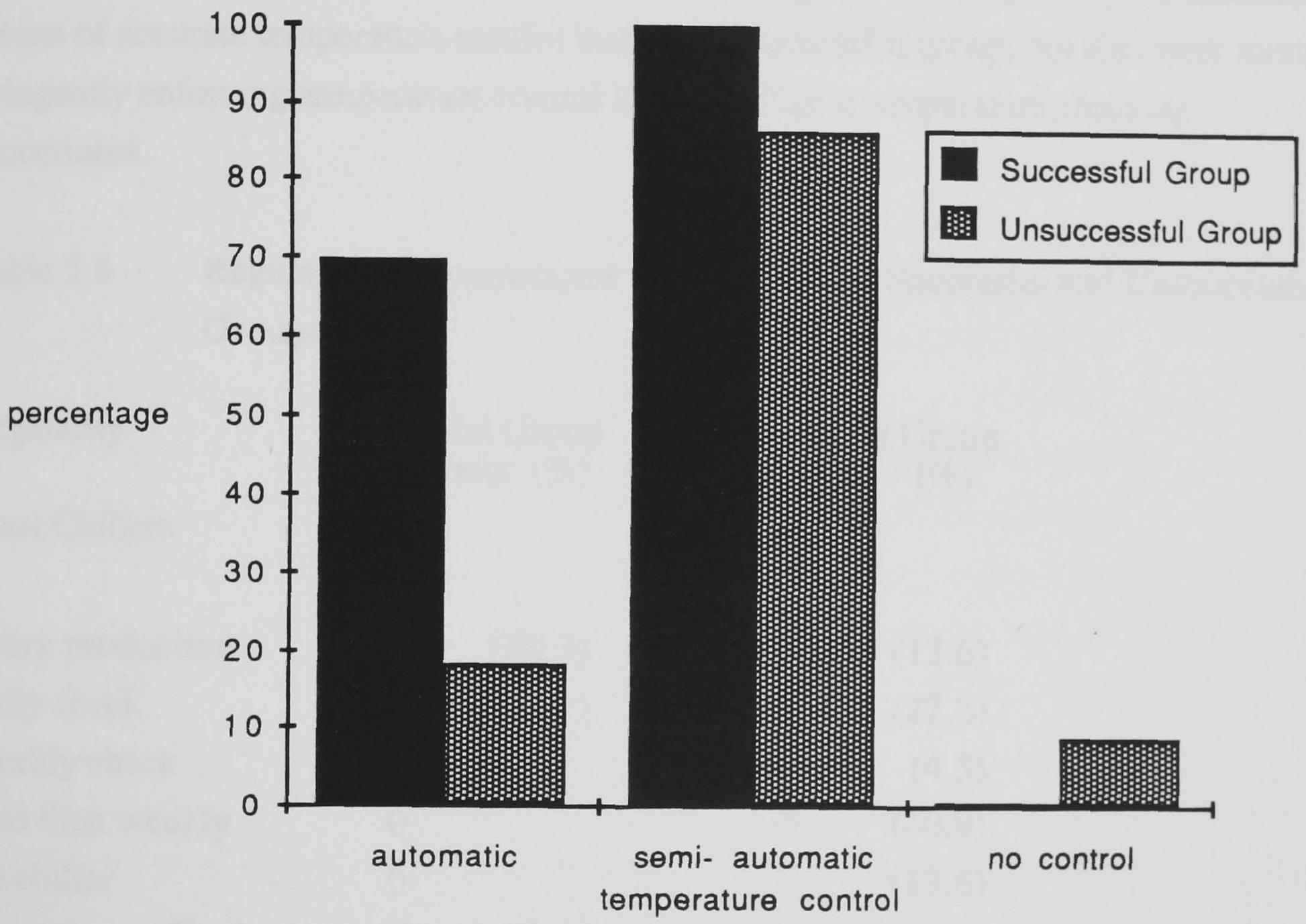
1. Fully automatic (computer controlled temperature recorders with built-in alarms, cambridge recorder)
2. Semi automatic/Manual (temperature dials, portable fast-acting temperature probes
3. No control

Figure 5.3 illustrates the differences between the successful and unsuccessful groups with regard to the use of temperature controls. The successful group made much greater use of fully automatic temperature controls with built-in permanent records, than the unsuccessful group, a difference which was statistically significant.[24] The temperature control used by these successful organisations was, usually, continuous with built-in alarms which were activated if the temperature rose above 3°C. A further advantage of such technology was the permanent recording of temperatures either continually (in the case of graph recorders) or at pre-set time intervals (in the case of computer controls). This enabled respondents from operations with this type of control to be aware of any temperature fluctuations at any point in time. In addition these organisations supplemented fully automatic temperature control with semi-automatic methods.

The semi-automatic methods involved the use of temperature gauges which were built-in to the equipment - for example, temperature dials, and digital displays or fast acting portable temperature probes. Each one gives an accurate measure of temperature but leaves no permanent record.[25] The key difference between the two groups with regard to this type of temperature control was that for the unsuccessful group this was, in the main, their primary source of temperature control and as such gave them limited control of, or awareness of, fluctuations in temperature of the chilled storage areas during unattended periods such as overnight and at weekends. Furthermore, this type of temperature control could in itself cause fluctuations in temperature, by allowing the temperature to rise as the door is opened to record temperatures of the food. In contrast,

the successful group were using semi-automatic methods more as a supplementary method of temperature control.

Figure 5.3 Incidence of Temperature Control in the Successful and Unsuccessful Groups




In a few cases in the unsuccessful group, the respondents reported no systematic methods of controlling temperature. In such cases, the fact that they were in possession of a refrigerator was enough to convince them that temperature was being sufficiently controlled. Clearly this was an unsatisfactory method of temperature control.

The existence of devices for controlling temperature, however, did not in themselves guarantee successful temperature control. Despite the existence of automatic temperature indicators, unless the temperature measurements were carefully monitored and any fluctuations in temperature remedied, temperature control remained nebulous. Therefore, an essential consideration alongside methods for temperature control was the frequency of temperature checks. Two crucial areas for temperature control were identified as being in the blast chiller and in the chilled storage area. Information was collected with regard to the frequency of temperature checks in these two critical areas.

Table 5.6 shows the differences between the two groups with regard to frequency of temperature checks for both the blast chiller and chilled storage areas. Overwhelmingly the successful group were more vigilant in this respect than the unsuccessful group. Indeed, the occurrence of lax methods of temperature control in 59.1% of the unsuccessful group gave grave cause for concern. A cross tabulation of success group and regularity of temperature check was statistically significant.[26]

In short, the evidence here shows that the successful group not only had more technical means of accurate temperature control than the unsuccessful group, but also were more stringently enforcing temperature control by their diligent temperature checking procedures.

Table 5.6 Regularity of Temperature Checking in the Successful and Unsuccessful Groups.

| Regularity | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) |
|---|---|---|---|---|
| Blast Chillers | | | | |
| Every production | 14 | (60.3) | 3 | (13.6) |
| Daily check | 9 | (39.1) | 6 | (27.3) |
| Weekly check | 0 | | 1 | (4.5) |
| Less than weekly | 0 | | 9 | (40.9) |
| No chiller | 0 | | 3 | (13.6) |
| Total | 23 | (100.0) | 22 | (100.0) |
| Chilled Storage Area | | | | |
| Regular set intervals throughout day | 20 | (87.0) | 7 | (31.8) |
| Daily check | 3 | (13.0) | 3 | (13.0) |
| Weekly check | 0 | (0.0) | 2 | (9.1) |
| Less than weekly | 0 | (0.0) | 7 | (31.8) |
| Never | 0 | (0.0) | 3 | (13.6) |
| Total | 23 | (100.0) | 22 | (100.0) |

## Microbiological Control

Historically, caterers have been advised against reheated or 'rechauffe' dishes, because of the potential risk of microbiological contamination. The process involved in reheating previously cooked food is potentially hazardous and therefore needs to be carried out under strictly controlled conditions. ALCOCK (1980) reports that reheating cooked food is a "most dangerous practice" (1980,224), if not properly controlled.

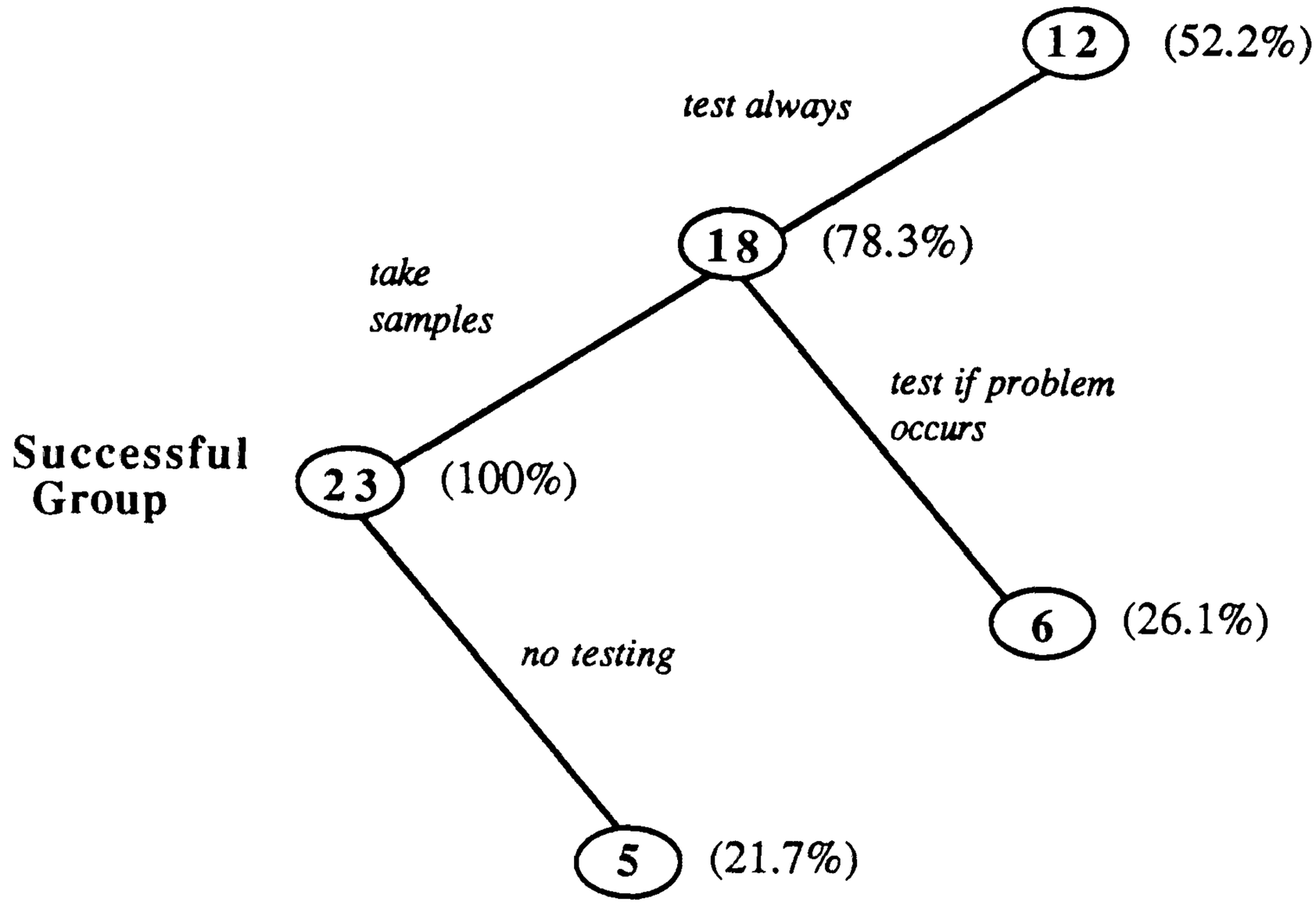
For the microbiological testing of foods, the DHSS guidelines (1980) state the following:

> "15.1. These are not intended to be used for routine testing of all branches of food and are not standards for the acceptance or rejection of any batch. Rather, they should be used when setting up a new cook chill kitchen or when establishing a new cook chill process to assist the responsible person, the local authority food inspector or industrial quality control or hygiene officer, to assure himself that a satisfactory standard is reached. They can similarly be used at appropriate intervals at the discretion of the responsible officer to check that the process continues to function correctly and efficiently...15.2 It is suggested that one sample of each item of food be taken from each batch tested" (DHSS,1980,15).

The guidelines state clearly the recommendations for microbiological control and advise that full microbiological testing should be carried out when establishing a new cook chill process.

Figure 5.4 shows the incidence of microbiological testing amongst the successful and unsuccessful groups.[27] There was a statistically significant difference between the two groups with respect to their use of any form of microbiological analysis.[28] In the successful group 18 units (78.3%) actively took food samples for the sole purpose of microbiological testing compared with 11 units (50.0%) in the unsuccessful group. The majority of the units in the unsuccessful group who purposely took samples (6 units, 26.1%) only tested the samples microbiologically if a problem (such as a food poisoning incident) occurred. In contrast, the majority of the successful group (12 units, 52.2%) systematically carried out microbiological tests on the food. Of these 12 units there was a difference in the frequency of these tests. Seven units (58.3%) were involved with random tests at irregular intervals whereas 5 units (41.7%) conducted routine tests at set intervals. The unsuccessful group had only 5 units (22.7%) who were involved with actual microbiological testing and there was a distinct tendency amongst these units to be

Figure 5.4 Incidence of Microbiological Testing in the Successful and Unsuccessful Groups



involved in routine testing at set intervals. However, arguments exist as to the validity of either method and there was no evidence to show that random testing was a superior method to regular interval testing or vice versa.

In summary, more units in the successful group were taking samples for microbiological analysis than in the unsuccessful group and of those that were taking samples, the units in the successful group were more likely to be carrying out actual microbiological analysis than those units in the unsuccessful group.

## Recipes

There has been some controversy over the necessity to alter recipes for use in a cook chill situation (see Chapter 4). Much of the early thought regarded recipe development as unnecessary. However, evidence from users themselves shows that recipe development tailored to individual organisational needs is certainly beneficial. This sub-section investigated problems experienced with recipe items at the implementation phase and whether these problems had been tackled.

Despite the fact that most of the successful group and a few of the unsuccessful group had been involved in pre-cook chill recipe development (see Chapter 4) operations in both groups experienced problems with recipes at the implementation stage. There were a number of reasons for this. First, scaling-up recipes from a small quantity in tests into large-scale production often caused problems for certain recipe items. Second, inadequate or inappropriate recipe development carried out previous to the implementation phase (largely in the unsuccessful group) and third, some recipes or food items were incompatible large or small scale with the installed system. Every organisation in the unsuccessful group (22 units) experienced some problems with recipes as did a large proportion of the successful group (15 units, 65.2%). However, the majority of the successful group had overcome most of their *major* recipe problems and were more involved with correcting *minor* problems. However, the unsuccessful group reported some serious malfunctions as a result of recipe problems. The most common recipe problems involved fried products (particularly battered fish, chipped potatoes and fried eggs). Statistically, there were significantly more units in the unsuccessful group (21 units, 95.5%) who experienced severe problems with fried products at the implementation phase than the successful group (15 units, 65.2%).[29] The successful group had solved most of their recipe problems by modification of recipes or methods, alteration of the regeneration equipment used or eliminating unsuccessful products from their menus. Those units in both the successful and unsuccessful groups

who had been involved in recipe development prior to the implementation of cook chill had less of a problem with recipes at the implementation phase than those who had completed no recipe development pre-implementation.

For example, responses from some of the catering managers in the successful group demonstrated how recipe problems were tackled:

> "Chips were either soggy (regenerated in microwave or with lid on in infra red oven) or too crisp (variety of regeneration ovens and lid off). The only solution was to install a fryer at the regeneration unit (CC, 28)...We had to develop a variety of regeneration techniques for different products, for example, eggs are refreshed in hot water just prior to service, Yorkshire pudding is just reheated in ordinary regeneration ovens as they were totally unsatisfactory in the infra red ovens (CC, 22)...We now find that there are no foods which are unsuccessful, it all depends on the method of regeneration. However, it's more feasible to cook frozen chips at the end units rather than send chips through the cook chill process. (CC,10)...For fried foods conventional cook chill is no good, there must be a fryer at the regeneration end or else leave out of the cook chill process (CC, 70). There were a few imperfections but cook chill is a vast improvement on the ot-transported system we had previously (CC,44)...We had problems with chips and fried eggs, soups and sauces (mainly because of transportation difficulties), these products are all prepared at the satellite unit and it works really well. (CC, 20)...Some vegetables were unpredictable and often overcooked and we had a problem with chips. We now utilize prepared vegetables at the end units and frozen chips are fried there too (CC,33)".

These extracts exemplify some of the methods used during the implementation phase to overcome problems with recipes. Similar responses amongst the unsuccessful group were given by those who had been involved with recipe development pre-cook chill, but more typically the unsuccessful displayed an 'indifferent attitude'.

> "Eggs need great care, we put them through, but the customers aren't too happy. We don't even bother with fish and chips or any battered products (CC, 72)...We have lots of problems with food, we utilize leftovers from banquets, any food which is returned is trayed and chilled ready for regeneration (CC, 18)....We have a real problem with curried eggs when

they're on the menu because they tend to explode in the microwave. Similarly, omelettes dehydrate (CC, 29)...Fried food comes out soggy, it's acceptable but not comparable with freshly fried items (CC, 69)...Deep fried foods like corned beef fritter are not satisfactory, but they're eaten (CC, 51)...The fried foods are acceptable, but not good, bread goods go a bit stale...but it they're heated up they're O.K. (CC, 46)...The success of the food is dependent on the capabilities of the operative (CC, 60)...We use it so little we don't have many food problems, we only use it for foods we know would definitely work (CC, 71)".

From the excerpts from both the successful and the unsuccessful groups, it is evident that a common problem recurred with fried foods. The successful group, however, had attempted to rectify the problems by a variation of techniques or recipes. This had helped towards the achievement of a successful cook chill unit and activities at both the initiation phase and the implementation phase had contributed to this.

## Operative Perceived Problems

ROGERS (1983) suggested that "the problems of implementation are likely to be of a greater concern in an organisation (than an individual) as the implementers are often different people to the decision makers" (1983,124). In addition, the organisational structure that gives stability and continuity to an organisation may be a resistant force to the implementation of an innovation. This sub-section seeks to identify the extent and type of technologically related problems apparent at the implementation phase as viewed by the operatives and their attitudes to them. A greater number of employees were interviewed from the successful group than the unsuccessful group, but, nevertheless, the responses obtained were enlightening. The perceptions of the managers interviewed were generally reflected by the employees in both the successful and unsuccessful groups. The main difference between the two was in the attention to detail paid by employees with the problems they reported. Most of the technologically related problems reported were seen, by the operatives, to be associated with shortcomings of equipment, unsuitability of recipes and procedural defects.

Table 5.7 distinguishes between the problems reported by operatives from both the successful and unsuccessful groups. Equipment related problems were reported to a similar extent in both groups. The biggest differences between the two groups were associated with recipes and procedures. The incidence of operatives reporting difficulties with recipes was much higher in the unsuccessful group (chefs 81.8%; cooks

recipe development undertaken by the unsuccessful group (see Chapter 4) had resulted in a higher incidence of recipe problems at the implementation phase in comparison with the successful group.

Procedural problems were more a direct consequences of the methods used by operatives during the production process and less a result of actual equipment or recipes. Typical problems were related to production schedules, layout of food for chilling, misuse of equipment, regeneration techniques and confusion in operating two systems alongside each other (conventional catering and cook chill). Again, there was a higher percentage of employees in the unsuccessful group reporting problems in working with the technological system. Specifically, the employees from the unsuccessful group had problems which were predominantly related to chilling and regeneration techniques whereas few of the employees in the successful group reported such difficulties. Most of the problems had been overcome by employees in the successful group at the time of interview whereas employees in the unsuccessful group were still searching for solutions. It is considered that this was a result of the differences manifested between the two groups with regard to information accretion and employee training during the initiation phase.

Table 5.7 Technology Related Problems Viewed by Operatives in the Successful and Unsuccessful Groups*

| Problem | Successful Group No of Employees | (%) | Unsuccessful Group No of Employees | (%) |
|---|---|---|---|---|
| Equipment related | 13 | (31.0) | 12 | (44.3) |
| Recipe related | 12 | (28.8) | 17 | (89.8) |
| Procedural related | 17 | (43.4) | 15 | (52.3) |
| Total reporting problems | 19 | *55.0) | 6 | (30.2) |
| Total interviewed | 39 | (100.0) | 20 | (100.0) |

* Each operative may perceive more than one type of problem.

The most striking revelation from conversations with employees was that more operatives in the successful group thought that there were *no* real problems with cook chill (chefs 46.7%; cooks 63.2%; kitchen assistants 60%) in comparison to the unsuccessful group (chefs 18.2%; cooks 12.5%; kitchen assistants 0%). Indeed some of the respondents in the successful group obviously enjoyed working with cook chill. A selection of responses of employees illustrate their feelings on the problematic nature of cook chill and, in some cases, the beauty of it. First, from the successful group:

"It works ! (cook, 3)...It runs well (cook, 3)...There were a few hiccups at first but not that much of a problem. It has many benefits, gives us time for presentation (chef, 5)...There was a problem with regeneration at the units - even the counter hands need training. There is a temperature problem with incoming food (cook 10)...No problems (kitchen assistant, 10)...Only problems in the beginning with chilling lengths and whether to reheat with the lid on or the lid off. Some foods were unsuccessful for example, fried eggs are better cooked fresh at the units...Things needed working out, but they're O.K. now (chef, 13)...No problems, I like the system, it comes naturally (cook, 13)...It's a better system than before, it's quicker - food available for the customer 2/3 days in advance and if necessary further supplies can be immediately dispatched. The only food we've had any complaints about, is battered fish - it needs careful regeneration (cook, 20)...No main problems, just small ones like you need uniform-trays in any one batch, some need extra water, but it's just down to experience (cook, 22)...I can't see any problems, I enjoy the working environment, there are many advantages, get more variety here as there are lots of different jobs to do, so get good job satisfaction. I've visited all the end kitchens and it all seems good (kitchen assistant, 28)...No real problems with cook chill, but half and half system caused confusion. Regeneration is done by the nurses and some were inexperienced - they need some more training (chef, 44)".

In comparison were the unenthusiastic responses from employees in the unsuccessful group:

> "There's no proper equipment apart from the chiller - and we have problems with that, it's used for other things besides cook chill. Reheating causes problems - often get misuse of the microwaves. regeneration ovens are too powerful causing gravy to dry up around the

edges. Quiche tends to explode in the microwave ovens and mashed potato is too dense - for chilling and reheating (chef, 17)...It cuts down variety, some foods are terrible, the chips are bad and steaks go like rubber. People who eat the food don't know much about how to use microwave ovens so we have to be careful what's put in them (cook, 18)...It seems 'dead'. The only advantage is on a nightshift. The size of vending machine is too small (for plates). The chips are soggy - the sprouts explode, meat is only O.K. if it's in a sauce, and the Yorkshire pudding is tough (cook, 40)...Burning and dehydration occurs on regeneration. Depth is a problem, by the time the correct temperature is reached, it's burnt around the edges. Anything with cornflour thickens afterwards. We just don't do chips (chef, 49)...The cost of spares for the original ovens was too high and there were too many problems with the length of regeneration. The seals were wearing out quickly - employees didn't treat them too gently. Tried another type (of oven) and we got the same problem, they just don't take the wear and tear. We now use microwaves. We get complaints about the chips and roast potatoes. The pies, chips and roasts are soggy from the microwave and things like chicken portions need more regeneration than the rest (CC, 51)...We can't have a variety of foods - there's a strict rota and we can't keep changing it due to accurate specifications needed for chilling. Everything is weighed and if wrong then it's because of problems with the chilling line. With regeneration we don't get the same results as conventional. Battered fish and chips and Yorkshire pudding all go soggy (chef, 75)".

The general impression gained from the operatives was one of optimism in the successful group and one of pessimism in the unsuccessful group. The respondents from both the successful and unsuccessful groups had reported various problems at implementation. However, the percentage of operatives reporting problems in the successful group was substantially less than the unsuccessful group. Moreover, the nature of these problems tended to be slight. In contrast, the unsuccessful group had more practical problems associated with recipes and procedures than purely equipment related problems. At the time of the survey, this group were having difficulties solving these problems.

The findings at the technical level demonstrated that the occurrence of technological problems was greatly affected by the activities carried out during the initiation phase. The low incidence of technologically related problems and the differences between the

two groups with regard to technologically related activities were largely a result of initiation phase activities.

## 5.4 Social Level

Final analysis at the implementation phase concerned activities at the social level of the successful and unsuccessful groups. The human factor within an organisation is of paramount importance. Potentially, the introduction of a wholly different technological system as replacement for the conventional catering system could introduce a work relationship structure radically different from conventional procedures. The implementation phase is the period when the changes associated with the new system come into operation and the effects on the workforce and their reaction to it could drastically affect the success of the technology transfer. RYAN (1979) argued that the consideration of the workforce was extremely important because,

> "..technological change may have implications for the employment levels, skill levels, work structures and work roles in the situations where it is introduced. Organisations should take these considerations carefully into account when changes of a technological nature are being planned and implemented. Furthermore, they must ensure that the employees who will be affected are involved in and consulted about the changes that will occur" (RYAN,1979,18).

The issues discussed in this section describe the employment changes (numbers, skill level, wage rates) experienced in the successful and unsuccessful groups, employee reactions to the technological change and consumer acceptance of the final product.

### Employment Change

It has been established in Chapters 2 and 3 that cost reductions were to be achieved by the reduction of labour. This was accomplished in a number of ways, direct and indirect reduction of personnel, the elimination of overtime and unsocial hours and increasing the amount of part-time posts at the expense of full-time posts. The introduction of new technology has the potential to seriously affect the structure of the workforce. This sub-section investigated the differences between the successful and unsuccessful groups, as a result of cook chill with regard to the changes in the numbers employed, skill levels, and wage rates.

## a) Numbers Employed

There were differences between the successful group and the unsuccessful group with regard to percentage employment change as a result of the introduction of cook chill technology. There were fewer units in the successful group whose employment levels had stayed the same or increased (5 units, 21.7%) than the unsuccessful group (9 units, 40.9%). However, there was little evidence to suggest that no change in, or an increase in, employment levels directly affected success. Rather, the overriding factor which was seen to influence a rise in employment as a result of the introduction of cook chill was the use of cook chill as an 'extra' catering service, for example, banquetting and feeding people where no previous feeding existed (nightshifts or a new factory). In both the successful and the unsuccessful group, the units whose employment had stayed the same or increased[30] as a result of cook chill were more likely to be in the hotels and leisure sector of the catering industry (4 units, 80% of those units in the successful group whose employment stayed the same or increased and 5 units, 55.6% in the unsuccessful group). For those units whose employment levels had decreased as a result of the introduction of cook chill there was little difference in the percentage employment change between the successful and unsuccessful groups (median percentage employment change -40.5 and -42.5 for the successful and unsuccessful groups respectively). However, this measurement took no account of the size of the cook chill operation. Obviously, the larger the cook chill operation, the proportionately greater the expected percentage employment loss because of the increased economies of scales.[31] A further calculation was thus carried out which took the size factor into account:

$$\text{employment change per unit capacity} = \frac{\text{percentage employment change}}{\text{maximum capacity}} \times 100$$

This calculation produced some revealing results. The units in the successful group were seen to fall within a narrow range (minimum value -4.0, maximum value -0.19, median -1.2) of percentage employment reduction per unit of capacity. In contrast, the units in the unsuccessful group occupied a much wider range of values (minimum value -45.5, maximum value -0.78, median value -4.35). This suggests that successful introduction of cook chill was affected by employment reduction per unit of capacity. In particular, too great an employment loss per unit of capacity was associated with the cook chill units in the unsuccessful group. The units in the successful group were seen to limit their employment reduction whereas the unsuccessful group were seen, in many cases, to have made too great an employment loss per unit of capacity which led to an unsuccessful transfer of cook chill technology.

The methods used to obtain reductions in employment levels also differed between the two groups. RYAN (1979) said of methods used to reduce employment levels:

> "While the introduction of new technology may not *directly* reduce employment by causing retrenchment, it may affect staff levels *indirectly*, as natural wastage is used to overcome the over-staffing that may result when employees are redeployed within a company. Thus job positions are still being lost" (RYAN,1979,18).

The successful group made more use of natural wastage methods (15 units, 83.3% of those reducing employment levels as a result of cook chill) than the unsuccessful group (6 units, 46.2%). A difference which was statistically significant.[32]

The unsuccessful group made a greater use of redundancy to reduce employment (9 units, 69.2%) than the successful group (8 units, 44.4%), but this difference was not statistically significant. Furthermore, the majority of units in the unsuccessful group utilized redundancy as their *only* method of employment reduction (5 units, 55.6%) or their *primary* method of employment reduction (3 units, 33.3%). Only one unit in the unsuccessful group was using redundancy as a secondary method of employment reduction. In contrast, the majority of units in the successful group (6 units, 75%) were utilizing redundancy methods of employment reduction *in addition* to other methods (usually natural wastage). Only 2 units (25%) used redundancy as their only source of employment reduction. There were several reasons why the methods used to reduce employment affected the success of the technology transfer. First, redundancy methods were often more expensive than the use of natural wastage methods. Particularly in the light of the fact that the majority of employees had been employed for 2 years or more (see Table 5.8). Second, the use of natural wastage methods presented less of a threat to the workforce and trade unions than the use of redundancy methods.

Table 5.8 Length of Employment in the Successful and Unsuccessful Groups

| | Numbers Employed | | | |
|---|---|---|---|---|
| | Successful Group | | Unsuccessful Group | |
| | Mean | Median | Mean | Median |
| 10 year + | 19.8 | 15.5 | 18.2 | 6.5 |
| 2-10 years | 10.2 | 5.5 | 6.3 | 3.0 |
| 1-2 years | 7.8 | 5.5 | 2.5 | 1.0 |
| 0-12 months | 3.65 | 0.0 | 7.0 | 1.5 |

In sum, successful introduction of cook chill was affected by the percentage employment change per unit of capacity, indirect methods of shedding labour were more effective than direct ones.

### b) Skill Level

The introduction of new technology into an organisation is often associated with a loss, or change, in skills for the operatives. MANSFIELD (1977) stated:

> "In some occupations, skill requirements increased...However, on other occupations, skill requirements decreased...On balance, there was no indication that new techniques required a much higher order of skill in most occupations" (MANSFIELD,1977,138-139).

This view of a change in skill requirements as a result of introducing new technologies was supported by GRAYSON (1982):

> "Many new technologies are clearly beginning to affect employment structures and occupational skills. It has also been suggested that new technology will cause further separation between the more highly skilled and the less skilled section of the workforce. This may occur because many workers with traditional manual skills are vulnerable to technical change....Whilst those with skills more allied to the new technology will find further opportunities for acquiring more skills or technician status" (GRAYSON,1982,3).

The results of the present study show that there was a range of opinion on the effects of introducing cook chill on skill level. The majority of catering managers in the successful group (13 units, 59.1%) felt that there was an overall *increase* in skill level after the introduction of cook chill (see Table 5.9). Typical responses being:

> "In some areas skill levels have increased, they have gained new knowledge, production and temperature control (CC,61)...especially for cooks as they need to get the recipes absolutely right (CC,55)...It's a clock-managed system with cook-serve - all mistakes (food disasters) are eaten. Cook chill enables chefs to apply more of the skills to catering as there is more time, which is unpressurised time, to provide a better product. Food can be properly cooked. It's the *product* that matters with

> cook chill, it's *time* that matters with cook-serve. All products are done centrally under managerial supervision, the chefs regaining their rightful place - their status is increased whereas it was abused beforehand (CC,20)".

In contrast, a narrow majority of catering managers from the unsuccessful group felt that overall skill levels had remained the same (10 units, 45.5%). However, a substantial proportion (9 units, 40.9%) said they thought overall skill levels had increased (see Table 5.9). A common response from managers of the unsuccessful group was that there was an increase of skills at the production unit and a deskilling at the regeneration units:

> "there is some deskilling at the end units (CC.49)...the need for temperature control produces an increase in skills for all employees, particularly at the CPU (CC,69)...increased skills required at the CPU, but deskilled at regeneration end (CC,46)...skills are raised in some areas, but deskilled in satellite areas (CC,24)...skills required are slightly different. Cook chill means that chefs wont be wasting their time preparing veg (CC,77)".

There were few respondents in either group who felt that skill levels had decreased as a result of cook chill.

Table 5.9 Change in Skill Levels as a Result of the Introduction of Cook Chill

| Skill Level | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) |
|---|---|---|---|---|
| More | 13 | (59.1) | 9 | (40.9) |
| Less | 5 | (22.7) | 3 | (13.6) |
| Same | 4 | (18.2) | 10 | (45.5) |
| Total | 23 | (100.0) | 22 | (100.0) |

The higher incidence of respondents in the successful group who stated an increase in skill requirement as a result of the introduction of cook chill was probably linked to the greater use of temperature and microbiological control by employees in the successful group (see section 5.3). The successful group also were more likely to have employed operatives with a degree of skill at the regeneration unit than the unsuccessful group.

In summary, managers from the successful group were more likely to acknowledge the increased need for skills both at production and regeneration levels. This was not only reflected in their apparently more selective employee reduction process but also in the wider range of resources available to employees (for example, training and appropriate technology) to enforce these new skills adequately.

### c) Wage Rates

The introduction of cook chill technology often resulted in the elimination of weekend work, unsocial hours and overtime. The peaks and troughs so familiar in catering operations were usually replaced by an even production throughout an 8 hour shift. This often affected the amount of pay in the employees wage packet. The introduction of cook chill affected the job content, particularly in large operations. This phenomenon was reported in 1968 by the NATIONAL BOARD FOR PRICES:

> "Such (technological) change obviously affects job content. When the volume of output was provided by conventional payment-by-results systems: today in the most advanced technologies - e.g. in some process industries - physical effort is often inverse ratio to output. In these industries employees must be paid less for physical effort and more for the acquired knowledge, mental skill or application and experience they bring to the job" (NATIONAL BOARD FOR PRICES,1968).

In the successful group there were more units (5, 21.7%) whose wage rates had increased as a result of cook chill than in the unsuccessful group (2 units, 9.1%). However, the overwhelming majority in both the successful (16 units, 69.6%) and the unsuccessful (18 units, 81.8%) groups experienced no change in wage rates.[33] This finding was supported by a recent report in the CATERER and HOTELKEEPER (1987) which reported a shortage of employees in the NHS sector in hospitals where cook chill systems had been introduced. However, in the successful group the effect of static wage rates since the introduction of cook chill may not have such a dramatic effect on the actual amount in the employees wage packet. This was partly because of the introduction of cook chill had resulted in an increased productivity per employee, encouraged by the introduction of productivity bonus schemes. There was a much higher incidence of such schemes in the successful group than the unsuccessful group (11 units, 47.8% and 5 units, 22.7% respectively).

In short, the successful group had shown an optimum decrease in employment per unit of capacity and had on the whole experienced an increase in skills as a result of the introduction of cook chill. In addition, they were more likely to have directly or indirectly increased or maintained previous wage rates whereas in the unsuccessful group, the converse was true.

### Employee Reactions

The reaction of employees to the introduction of new technology can seriously affect its success (see Chapter 3). BODDY and BUCHANAN (1985), in their study of the introduction of computers, emphasised the need to ensure that personnel have a close rather than a distanced relationship with the technological process. They cited several examples of employees adverse reactions as a consequence of introducing new technology. For example, boredom, inattention, apathy, unwillingness to take responsibility, little understanding of the system and how their actions affect it and an inability to adjust to the system. In addition there were instances of a complementary reaction from the employees with regard to the introduction of new technology. In such cases there were examples of more confidence in decision making and less guesswork, greater job interest and challenge, ability to adjust a system for a variety of tasks, the ability and willingness to experiment, to improve and extend system performance and the ability to deal with emergencies.

Information from the cook chill survey was analysed from the managers and the employees with regard to the reaction of the employees to the introduction of new technology. Similar adverse and complementary reactions to those highlighted by BODDY and BUCHANAN (1985) were discovered but there appeared to be no pattern between the two groups. The absence of boredom in the unsuccessful group could have been a consequence of the overall small size of the cook chill units in the group as production-line methods were inappropriate for small units and hence there was less potential for boredom. Furthermore, the activities of employees in the unsuccessful group during the initiation phase had, in many cases, severely restricted the introduction of cook chill which in itself may have prevented boredom during the implementation phase.

## 5.5 Conclusions

This Chapter has analysed in detail, the activities of both the successful and unsuccessful groups during the implementation phase. The main differences during this phase

between the two groups again demonstrated a higher degree of dedication and thoroughness from the successful group. In general, the successful group were larger and had achieved their projected size. This size factor had many ramifications on other aspects of this phase of the technology transfer process, such as the ability to exercise a greater degree of systematic food purchasing procedures, to have optimum delivery patterns and sites, and to justify economically, as well as from a safety angle, the adherence to microbiological analysis.

The successful group also had a higher expenditure per unit of capacity than the unsuccessful group, carefully harmonizing all equipment and temperature control to fit into the system rather than fitting the system around the equipment. This care in trying to harmonize the system had also extended to the employment levels with the successful group, revealing an optimum decrease in employment per unit of capacity.

However, the overriding finding was that the activities at the implementation phase were highly dependent on the depth of activity completed at the initiation phase. As such it is suggested that the activities at the implementation phase have less of an affect on the final success of the technology transfer than the initiation phase. Rather they are a result of previous activities. However, there were factors at the implementation phase which clearly affected success but more importantly it was probably the actions *after* the implementation phase (assessment of outcomes) which ensures continued or eventual success of the technology transfer. This is the subject of investigation in Chapter 6.

# Footnotes to Chapter 5

1 There seems to be some confusion regarding the definition of the implementation phase amongst the current literature. RHODES and WIELD (1985) see it as a process made up of four phases: initiation; planning; application; and consolidation. SCHEIRER (1983) stresses the importance of separating adoption, implementation and assessment of outcomes as they are three distinct processes: with regard to adoption and implementation she states :

"The adoption phase refers to the sequence of activities culminating in a more or less explicit decision to use an innovation...Implementation processes within an organisation occur after the adoption decision and involve all the activities concerned with assembling the necessary resources, assigning and training staff to use the innovation and securing sufficient change in organisational routines and support systems to foster integration into the ongoing organisation. The distinction between adoption and implementation is that 'the chooser' is frequently not 'the user'." (SCHEIRER,1983,78)

BRAUN (1985) supports the view of SCHEIRER and regards the implementation phase of technology transfer as the point at which application of the technology and utilization takes place.

2 New technology in this context refers to the technology being new to the implementing organisation. The technology itself need not be new.

3 Compare the success factor used in Chapter 3, which looked at total capital expenditure linked to maximum capacity and the purchase of considered essential equipment (ie.equipment which would be required to fulfill the DHSS (1980) guidelines for Precooked, Chilled Foods.).

4 Mann Whitney U test of total capital expenditure and success group gave U = 48.5, W = 126.5 sig. 0.068.

5 As opposed to the total catering operation.

6 Mann Whitney U test of percentage of total catering attributable to cook chill with success group was statistically significant at U =82.5 W =325.5 Z = -3.8 2 tailed P sig 0.0001

7 Non-parametric correlation of maximum capacity and total capital expenditure was statistically significant at 0.000 level.

8 Index of equipment expenditure calculated as : $\frac{\text{maximum capacity}}{\text{total equipment expenditure}} \times 100$

Index for the remainder of expenditure = $\frac{\text{maximum capacity}}{\text{(redundancy costs + consultancy costs) + training costs + buildings costs)}} \times 100$

9 Mann Whitney U test of Index of total capital expenditure and success group was statistically significant U = 43.0, W = 121.0, sig = 0.035.
Mann Whitney U test of Index of expenditure for equipment and success group was statistically significant. U = 20, W = 145, 2 tailed P significant at 0.014.

10 Mann Whitney U test of success group and future use of outside contracts was statistically significant U = 153, W= 262, 2 tailed P sig 0.05.

11 Pearsons non-parametric correlation of success group and centralised production significant at 0.02. level

12 Mann Whitney U test of percentage of total catering output attributable to cook chill with success group was statistically significant. U = 82.5 W = 335.5, 2 tailed P sig 0.001 EF none.

13 Cross tabulation of type 1 and success group gave a chi-squared of 3.2 DF = 1 sig 0.08.

14 Mann Whitney U test of number of satellites units against success group was statistically significant. U = 125.5, W = 378.5 2 tailed P sig at 0.003 level.

15 Providing of course that suitable refrigerated transport was in use (see later).

16 Cross tabulation of success group and locating of satellite kitchens gave chi-squared 8.5 DF2 sig at 0.01. level EF none.

17 Delivery time is defined as the time period which elapses after the removal of food from refrigerated storage at the CPU until the arrival of the food into refrigerated storage at the satellite unit.

18 Mann Whitney U test of delivery time and success group gave U = 167.0, W = 398.0 and a 2 tailed P significance 0.08.

19 Again, providing adequate refrigerated transport exists (see next section).

20 Especially as no refrigerated transport was in use.

21 Cross tabulation of use of refrigerated for transportation and success group gave chi-squared 2.84 , DF 1 sig at 0.09. level EF none.

22 The differences have already been discussed in detail earlier in this Chapter.

23 Cross tabulation of success group and use of infra red ovens was statistically significant chi-squared 5.04 DF 2 sig at 0.08. level EF none Cross tabulation of success group and use of combination ovens was statistically significant chi squared 5.9 DF1 sig at t 0.01 level EF 25%.

24 Cross tabulation of success group and use of fully automated temperature controls was statistically significant chi square 8.4 DF 1 sig 0.003

25 Unless of course it is manually recorded.

26 The regularity of checking was condensed into 2 groups.
Group 1 - check temperature at least once per day
Group 2 - check temperature less regularly than once per day.
Cross tabulation gave
for blast chillers : chi squared 14.4 DF 1 sig 0.001 EF none
for chilled storage area : chi squared 16.3 DF 1 sig 0.001 EF none

27 This included microbiological testing of both raw foods and cooked, chilled products. However, no distinction was made between the two.

28 Cross tabulation of success group and participation in microbiological analysis was statistically significant: chi-squared 2.78 DF 1 sig 0.09.

29 Cross tabulation of success group and incidence of fried product related problems was statistically significant. Chi-squared 4.67 DF 1 sig 0.03,EF 50%.

30 That is the number of full-time equivalents employed.

31 Larger organisations were found to be using large scale labour saving production equipment for example which further reduced staff.

32 Cross-tabulation of success group and use of natural wastage as the method of employment reduction was statistically significant. Chi-squared 3.4 DF 1 significant at 0.065 level, EF 50%.

33 Change in wage levels took account of inflationary increases.

# Chapter 6

# An Assessment of Outcomes in the Successful and Unsuccessful Groups

## 6.1 Introduction

This chapter in its assessment of outcomes investigates the changes that result from the introduction of cook chill. The consequences of introducing new technology highlight the *impact* an innovation or technology transfer has on an organisation (ROGERS,1983). The importance of studying this phase was pointed out by SCHEIRER (1983):

> "It is essential to measure separately the extent of implementation versus the assessment of outcomes, particularly if analysis is intended to examine other variables which may account for or explain variability in either implementation or outcomes" (SCHEIRER,1983,78).

Studying the outcomes of the technology transfer process allows a critical assessment of the effects of the introduction of new technology and the ability to assess future developments. It also indicates whether the effects of new technology have been equal for different individuals within the system. For example, whether there have been beneficial or detrimental effects for everybody or whether one group of individuals have faired much better than others as a result of the technology transfer. ROGERS (1983) stressed that the evaluation phase is of obvious importance for study, but as yet had received little attention in studies of the technology transfer process.

Indeed, most research on the technology transfer process has been limited to an analysis of the *decision to adopt* a new idea and ignored how technology was implemented and with what consequences. Furthermore, there have been few studies which have looked at the user uptake phase[1] in general and thus, the result has been scant coverage not only of the implementation phase (Chapter 5) but also the assessment phases of the technology transfer process.

ROGERS (1983) suggested that over-emphasis upon the initiation phase and the mere assumption of positive consequences of technology transfer is largely a result of a difficulty in measurement. This is not only because of the degree of subjectivity involved (which is influenced by the cultural norms, personal experiences, educational background and philosophical viewpoint of the assessor), but also because the consequences are often confounded by other aspects of the organisation. In addition, ROGERS (1983) argued that one-shot survey techniques were not the best way to gather information, since consequences usually occur over extended periods of time and are therefore best measured using a long-range longitudinal approach so that outcomes can be analysed as they unfold over time. He goes on to suggest that the consequences of

adopting new technology are not always fully apparent to individuals. Thus, any study that rests entirely on respondents reports may lead to incomplete and misleading conclusions. In the present study an analysis of the outcomes phase depended on the perceptions of individuals because of the time and financial constraints. However, analysis was not confined to the responses of one informant alone. Rather, information was obtained not only from the catering managers, but also from a number of operatives and (where possible) consumers. The range of information obtained from such a wide set of people affected by the implementation of cook chill helped to overcome some of the difficulties in measuring the impact of introducing such technological systems.

This Chapter will concentrate on assessing the outcomes of the introduction of cook chill in both the successful and unsuccessful groups, by focussing on the main consequences at the functional, technical and social levels.

## 6.2 The Functional Level

The functional level was analysed in terms of; the future use of cook chill, the need for improvements as viewed by operatives, and an evaluation of whether the introduction of cook chill was seen as 'money well spent'.

### Future Use

The success of the introduction of a cook chill operation can be assessed in part by the future plans for each operation. This sub-section illustrates the differences between the successful and unsuccessful groups in this respect. It shows that the successful group were more likely to be expanding and developing their cook chill system whilst the unsuccessful group were more likely to be running down or radically altering their cook chill systems.

Table 6.1 shows the major changes intended for units in both the successful and unsuccessful groups. The outstanding difference lay in the number of units in the successful group who were going to expand their cook chill system further (14 units, 60.9%) compared with 5 units (22.7%) in the unsuccessful group. This difference was statistically significant.[2] Expansion in the successful group was to be achieved usually by a combination of means; for example, building new CPU's (5 units, 21.7%), opening new satellite units using the existing CPU (8 units, 36.4%), increased use of outside contracts (7 units, 31.8%) and the use of more sophisticated techniques such as sous-vide or cryogenic chilling (6 units, 27.7%). In contrast, few of the unsuccessful group

were involved in similar plans for expansion at the time of interview (see Table 6.1). This finding amplifies the earlier differences found between the two groups with regard to projected and actual percentage of the total catering attributable to cook chill (see Chapter 5). The unsuccessful group had little success in achieving their projected targets and as shown by their lack of commitment to the development of cook chill, were unlikely to do so in the future. Indeed, the results in Table 6.1 show that a large percentage of units in the unsuccessful group (59.1%) were either running down, had abandoned or were re-assessing the total cook chill operation in an effort to become successful.

Table 6.1 Future Intentions for cook chill Operations in the Successful and Unsuccessful Groups.

| | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) |
|---|---|---|---|---|
| Expansion * | 14 | (60.9) | 5 | (22.7) |
| - New CPU | 5 | (21.7) | 2 | (9.1) |
| - New Satellites | 8 | (36.4) | 2 | (9.1) |
| - Contracts | 7 | (31.8) | 2 | (9.1) |
| - Sophisticated techniques | 6 | (27.7) | 2 | (9.1) |
| Total Restart | 0 | (0.0) | 8 | (36.4) |
| Rundown/Finish | 0 | (0.0) | 5 | (22.7) |
| No change | 9 | (39.1) | 4 | (18.2) |
| Total No of Units in Group | 23 | (100.0) | 22 | (100.0) |

* Result statistically significant at 0.02 level.

In short, the successful group sought to take full advantage of the success achieved so far by further developing their systems whereas the unsuccessful group were hampered by the problems created by earlier misdirection and were thus having to restart or abandon their cook chill systems.

## The Need for Improvements

This sub-section investigates the need for improvements as viewed by the operatives. It is pertinent to consider the views of the operatives here, not least because they are the people closest to the system and, working with it everyday, they are often more aware of its faults than the catering managers themselves. This is important because as SCHEIRER (1983) pointed out, very often, when new technology is introduced "the

chooser is frequently not the user" (1983,78).[3] Thus, the chooser (in this case the catering manager or equivalent) may be unaware of operating faults within the system.

Not unexpectedly, comments of operatives from the successful group differed remarkably from operatives in the unsuccessful group. The operatives in the successful group expressed a greater degree of satisfaction with how the system was operated. The following comments were typical of responses by operatives in the successful group with regard to the need for improvements in their cook chill system.

> "We have no real problems with it now (cook, 52)...Basically the system is good. We need more experience (new unit) and we do get a shortage of staff now and again due to the increased level of function work since cook chill (chef, 42). Any system needs improving, but with this one, I just dont know what it is (cook, 28)...No improvements needed, it works well (cook, 13)...It works well because of its simplicity. A purpose built production unit would be perfect but the money is not available (chef, 13)...No improvements necessary (KA, 10)...It's OK as it is (KA, 20)"

The only possible problem cited here, is that there was 'not enough' cook chill in some of these operations. These expressions of optimism and a desire to perfect the system were *not* echoed by operatives in the unsuccessful group. Rather, the views of operatives in the unsuccessful group illustrated a general feeling of despondency regarding their cook chill systems:

> "We need more time to be spent on the food itself to make it look more appetising to our customers once it's been regenerated. However, it may not make any difference in this situation (chef, 23)...the satellite unit finishers need training. It (cook chill) can be dangerous - it needs care (chef, 24)...Menu needs wider variety, need to buy better quality foods, but working against the money problem ( cook, 24)...There's not much else we can do now (closing down) (chef, 29). It's hard to tell how to improve it, we've seen nothing to compare it with (KA, 32)...It needs a lot of research to get it right here, but there's no time. It'd be OK for a bigger operation, say in a big buffet, then it might work (cook, 40)...We never put any meals in it now, so I can't say (cook, 40)...The CPU is too small, we need more equipment and experimentation with different foods to see which regenerate properly (chef, 46)...Could do with own CPU especially for cook chill. Chefs need specific training for cook chill. However,

> cook chill is better than the hot boxes we had before. It's self service at most regeneration areas and often people take too much and the last in the queue don't get fed (cook, 50)...We would like to see the other end to see what happens (cook,64)."

These quotes highlight some of the major differences between the successful and unsuccessful groups. Clearly, the differences between the activities of the managers in the successful and unsuccessful groups in earlier phases (initiation and implementation) strongly influenced this. In particular, the failure of managers in the unsuccessful group to complete for example, adequate background research, carry out specific training programmes for all grades of staff and place enough emphasis on adequate temperature and microbiological controls, exacerbated the need for future improvements.
In short, the operatives from the successful group were satisifed with the existing cook chill system and any improvements suggested were minor. In contrast, the operatives from the unsuccessful group were obviously unhappy with their cook chill system and had little hope for its future survival.

## Evaluation of Capital Expenditure

There is a difficulty in relying on the catering managers responses on the question of whether their decision to introduce cook chill was a wise investment of capital funds. Often, people are unwilling to admit mistakes, especially where large amounts of capital are involved. Nevertheless, some responses were enlightening and candid.

Surprisingly, even respondents from the successful group (4 units, 17.4%) reported that if they started again, they could have achieved a catering operation which was as good (or better) using similar amounts of capital expenditure on an alternative system, for example, refinement of a conventional system or buying in pre-prepared food from elsewhere. In comparison, substantially more respondents from the unsuccessful group (7 units, 31.8%) reported that their capital would have been as well or better spent on a different system. However, the major difference between the four respondents in the successful group and the seven respondents in the unsuccessful group was that those in the successful group were, *at the same time*, satisfied with their cook chill system. In contrast, those from the unsuccessful group viewed the introduction of cook chill as misguided or a problem which required immediate action. In addition, 12 units (54.3%) from the unsuccessful group reported that a decrease in product quality resulted directly from the introduction of cook chill. Despite the fact that immediately after the introduction of cook chill a cost saving had been experienced (which was in general, the

main aim of the unsuccessful group), it had been achieved at the expense of product quality, employee satisfaction and consumer acceptance and thus in the long term was likely to result in an *increase* in overall capital and operating expenditures.

In summary, the successful group were satisfied that they had achieved 'value for money' were planning expansion which included the use of sophisticated techniques and had a workforce who were more enthusiastic about the cook chill system. In contrast, the unsuccessful group were more likely to think that their investment could have been better spent elsewhere, had doubts about any future commitment, and were more likely to have a discontented workforce.

## 6.3 The Technical Level

An analysis of outcomes with regard to the introduction of cook chill at the technical level in the successful and unsuccessful groups concentrated on the need for technological improvement and further research and development. In addition a 'technological information gap' was identified. Specifically, this refers to the lack of information at an appropriate level with regard to microbiological safety.

### Technological Improvements

Many of the improvements suggested by the operatives interviewed in both the successful and unsuccessful groups were not related directly to the technology itself (see previous section). In fact, they were more involved with the 'people' aspects of the cook chill system. However, there were a number of features which operatives felt required improvement or modification and which were directly related to the technology. The major difference between the responses from operatives in the successful group and from operatives in the unsuccessful group was the nature of the improvements suggested. The operatives in the successful group reported little need for modification of the basic technology (chillers, chilled stores and temperature monitors). Rather, they were more concerned with introducing more advanced methods (such as cryogenic chilling and computer control systems) and extending the shelf life of products.

> "The use of liquid nitrogen and a cryogenically refrigerated van would certainly help (chef, 80)...The control panel needs simplifying, some of the controls are not needed (chef, 70)...The computer needs to be used as a sister-system. We need more flexibility rather than the strict control

enforced at present (chef, 61)...An extended shelf-life would give much more flexibility (chef, 58)."

These quotes illustrate a greater perception and awareness to the potential of cook chill amongst the operatives of cook chill units in the successful group. The following extracts from interviews with the operatives in the unsuccessful group show by way of contrast a pre-occupation with technical problems.

"We need bigger plates, often the food is crammed on the plate and therefore the depth increases and it then becomes difficult to get the temperature down. The chillers are obsolete. We need more refrigerators - these are over-used. The chiller does not bring food down as quickly as it should. The door is opened and closed a lot. It's used for non-cook chill products as well and this seriously affects it (chef, 17)...The regeneration needs improvement (cook, 49)...Up to the blast chill and chill store it is OK but the regeneration is the big problem. It all goes wrong then (cook, 51)...It's a small kitchen, only one chiller. Sometimes there's a backlog of food waiting to go into the chiller (chef, 75)".

Obviously, the different amount and type of improvements deemed necessary by the operatives interviewed from both the successful and unsuccessful groups were intrinsically linked to the activities that had been carried out in both the initiation and implementation phases. The greater care and thought shown by the managers in the successful group with regard to equipment selection and purchase and the greater background research in general had helped avoid possible problems at later stages. In contrast, the lack of research on the most appropriate equipment and catering methods to use, by the catering managers in the unsuccessful group, had increased the number of problems experienced at the implementation phase and thus, resulted in a much more serious need to re-think strategies at the evaluation phase.

In short, the operatives from the unsuccessful group saw an urgent need to improve the primary technology of the cook chill system; whereas the successful group had already achieved a harmonious cook chill operation and they were looking to more sophisticated techniques for further fine-tuning rather than any fundamental changes.

## Further Research and Development

The question of the need for further research and development on cook chill is a difficult one. Clearly, from the evidence of the catering managers, the existence of problems (functional, technical and social) necessitates further research and development. However, the responses of managers in both groups illustrated a limited vision of what further research and development was necessary. In particular, the managers in the unsuccessful group were so involved with 'muddling through' with their own cook chill system that the need for further research and development had not been considered until this question was specifically put to them. Indeed, the reactivity rather than proactivity, which was demonstrated repeatedly in earlier phases[4],was again to the fore vis-a-vis further research.

Coupled with this, managers from both groups tended to see the role of research and development, as far as the technology itself was concerned, to be primarily the responsibility of the equipment manufacturers. The reason for this is that, in the past, there has been little communication between the equipment manufacturers and caterers with regard to equipment needs.[5] It has been more a question of the manufacturers selling existing equipment to the caterer rather than developing equipment to meet a caterers' need. However, there were many examples, specifically from the successful group, where this pattern had been broken. The complicated process and the depth of background work completed by the catering managers from the successful group enabled them to exert pressure on manufacturers to produce equipment to fit their particular requirements. However, in general, these were larger cook chill operations and hence had a superior purchasing power over the equipment manufacturers than the smaller units,

Despite the lack of proactivity with regard to the need for future research and development, there were a number of suggestions put forward from managers from both the successful and unsuccessful cook chill units. Table 6.2 shows the main areas of research and development thought necessary by the catering managers in the successful and unsuccessful groups. There was a certain amount of agreement amongst the two groups on the need for recipe development, in particular, recipe experimentation specific to their own menus. This view was supported recently by DAVIS (1987) who stressed the need for thorough "testing of every item on the menu before going cook chill" (1987,18).

Not surprisingly, the major differences shown in Table 6.2 relate to the greater involvement of the successful group in the introduction of advanced techniques, such as, sous-vide. Specifically, the need for increased storage time and better production techniques were cited more frequently by managers in the successful group than the managers in the unsuccessful group.

Table 6.2 Suggestions for Future Research and Development from the Successful and Unsuccessful Catering Management

| Research and Development type | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) |
|---|---|---|---|---|
| Equipment | 6 | (26.1) | 4 | (18.2) |
| Recipes | 7 | (30.4) | 7 | (31.8) |
| Storage length | 7 | (30.4) | 4 | (18.2) |
| Production techniques | 8 | (34.8) | 4 | (18.2) |
| Total No of Units in Group | 23 | (100.0) | 22 | (100.0) |

Overall, there were few responses to the need for further research and development. However, the managers of the cook chill units in the successful group did show a somewhat greater degree of awareness of the need for further research and development, particularly with regard to more advanced cook chill production techniques, than the unsuccessful group.

## Technological Information Gap

One of the most difficult aspects of the introduction of new technological systems is the ability to cope with inevitable changes in working practices (BODDY and BUCHANON,1985). The need for background research, information gathering and training with regard to all aspects of introducing cook chill systems has already been illustrated in Chapters 4 and 5. In particular, specific areas for concentration included chilling, temperature control, microbiological control and regeneration techniques.

Further difficulties arose[6] with the cook chill system if information on new procedures was difficult to find or unavailable. Very often, the information existed, but was either unobtainable or was in a form unusable by the caterer. The results of this survey show that there was some agreement between managers of the successful and unsuccessful

groups who found information on microbiological safety difficult to find, or if found, to be either too basic or too technical. Over half the managers in both the successful and unsuccessful group said that there was a critical lack of suitable information available to them with regard to microbiological safety. Indeed, the following quotes from managers in the successful group illustrated the difficulty found in extracting information on microbiological aspects.

> "We had to do a lot of research on it ourselves. The information is there and some refrigeration companies were helpful - but we had to do a lot of digging for ourselves (CC,44)...The guidelines are not good enough, they're not tight enough. There needs to be some more widely available knowledge and increased training in those areas (CC,48)...We talked to a lot of people and they were very vague on times and temperatures, very little has been done on time and temperature. It says allow meat to cool quickly, but how quickly? These things are not defined precisely enough. College courses (City and Guilds) don't stress it enough. A lot of operators find the cheapest way to produce food, but haven't got the knowledge of what's happening to food during the chill process. The DHSS guidelines are only a recommendation, they should be made law - in fact, it's a *must*. (CC,70)...There is a lack of resources spent on informing caterers of microbiological safety. The DHSS don't know what's going on (CC,10). The information is there but is difficult to find. You also need the time to sift through it and pick out the important bits. It would be advisable if chefs were made more aware by sending leaflets direct to them as well as or instead of managers. (CC,80)...The information is either very basic or highly technical, there's no middle ground. Translation to operatives is difficult without frightening people (CC,2)...There's not enough concern on the sales front (CC,6)...The knowledge can be difficult to get hold of (CC,74)".

It is worth remembering that these are the views expressed by members of the successful group who had achieved a suitable level of knowledge with regard to the microbiological aspects, but who acknowledged the difficulty and time required in order to obtain this knowledge. However, this was not the view of all the managers in the successful group. The rest of the managers in the successful group were, in general, satisfied that enough information was available and that the need for extremely detailed knowledge was unnecessary. In fact, it was felt by some managers that too much emphasis was made of the microbiological aspect of cook chill. Indeed, in most of these cases it was

suggested that the procedures used in cook chill were safer than in conventional systems, where dubious practices of reheating left-overs and uncontrolled cooling of food were commonplace. The need for an accurate basic knowledge of food microbiology, however, was strongly acknowledged by these managers as a must for all users of cook chill operations - indeed for all caterers. Thus, the need to attain *awareness* of microbiological safety was viewed to be of paramount importance.

According to the responses from managers in the unsuccessful group, the difficulty of obtaining reliable primary information had prevented further investigation. More alarming perhaps, was the fact that some managers were unaware of the need to search for further information.

> "The only bit of information we could find was in the equipment manufacturers hand book (C,17)...I think the knowledge should be more widely available, not only for cook chill, but in general (CC,51)...There's hardly any information available and what there is, is difficult to obtain. It's difficult to get information in a form where non-scientists can grasp its importance (CC,77)...There's no information available, apart from the DHSS guidelines which don't tell you much. We rely on the EHO for assurance. I'm not so sure if we need the information as the EHO is about. We know the basics and if we stick to them then I'm sure it's safe (CC,46)...Information is available, it's just whether you can understand it. It should be in a simple language (CC,69)...We've only used the DHSS guidelines - there's not enough information. No-one bothers about what you know and don't know. We could get away with not knowing anything. The installers didn't know anything and other people we visited had little information (CC,49)...It's learnt by trail and error - it's not an indigenous part of the catering training in this organisation (CC,59)...Nobody ever came up with a view on what's what regarding microbiological safety - nobody ever came up with guide on various levels of micro safety. We need to know more about critical times and temperatures and what affects food (CC,23)...It's available but we've not made full use of it (CC,26)...I don't know of any information relating to this subject (CC,18)".

Clearly, the opinions expressed by these managers of unsuccessful cook chill units, highlight a clear absence of awareness of the need to be fully conversant with the microbiological aspects of cook chill. The fact that the difficulty in finding information

had prevented these managers from gaining the necessary knowledge was disturbing, but the responses from managers of cook chill units 59, 26 and 18 was alarming and potentially dangerous. In short, these results have highlighted the existence of a clear '*technological information gap*' with regard to microbiological aspects of cook chill.

In summary, an evaluation at the technical level revealed striking differences between the successful and unsuccessful groups with regard to the amount and nature of future improvements and developments, particularly with regard to the use of more sophisticated techniques. However, there was some degree of agreement between the two group concerning the existence of a 'technological information gap', essentially with regard to microbiological information.

## 6.4 Social Level

The main foci of attention at the social level was the effects of introducing cook chill on the labourforce and the level of consumer satisfaction apparent since the implementation of cook chill.

### Effects on the Labourforce

There is no doubt that technological change affects employees. MASSEY and MEEGAN (1982) point out that employment loss is often one of the necessary partners of technological change which results from a drive for increased profitability and competitiveness. The introduction of technological systems can result in employees involvement in new or altered jobs. This raises the question of whether employees acquire new skills (reskilling) or are deskilled as a consequence of the introduction of technology. There has already been much discussion and debate on this issue, (MANSFIELD,1969; ROTHWELL and ZEGVELD,1979; GRAYSON,1982; BODDY and BUCHANON,1985) and thus it is unnecessary to repeat it here. Suffice to say that in some instances a reduction in skills is experienced (for example at satellite units) and in others new skills are acquired (for example, temperature control). BODDY and BUCHANON (1985) found that the introduction of new technology would either distance employees from their work which would isolate operatives from their task, or be complementary, which would marry together both technical capabilities and human skills. They gave several examples of the consequences of introducing new technology on the workforce in a number of different industries.

> "The doughmen complained that their jobs were now boring, had little variety, gave them little control over the process and with little opportunity for contact with other workers. [Typists] had higher pay, better career prospects...but they regretted the loss of variety...and the unrelenting pace of work (in the groups there had been peaks and troughs in the work load). They also felt that the system made them careless...and did not learn to cope with the style or technical terms of particular authors. The effects of centralisation was however to create a greater distance (physically and organisationally) between typists and authors and between authors and the technology used to produce their work" (BODDY and BUCHANON,1985,29).

The feelings reflected by BODDY and BUCHANON were supported by the findings in the current research on cook chill organisations. Operatives from a variety of cook chill units in the sample as a whole (80 units) expressed feelings of boredom and a reduction in the variety of work, especially in larger operations. The peaks and troughs of typists work patterns noted by BODDY and BUCHANON were echoed by operatives in a number of cook chill units. For example, in one instance, cook chill was described as taking away the exciting flurry of activity immediately prior to meal times which is widely apparent in conventional catering systems. However, the most prominent view was that of a feeling of isolation from consumers at the point of service. More often than not, service was divorced from production, not only physically but also temporally. Customers were receiving food which had been produced sometimes as much as 5 days previously.[7]

In an analysis of the effects of the introduction of cook chill on employment, there were some clear differences between the successful and unsuccessful groups. In the successful group, only 10 managers (from 8 units, 34.8%)) had left employment after the introduction of cook chill compared with 17 managers (from 10 units, 45.5%) in the unsuccessful group. This reflected the greater commitment to cook chill by managers in the successful group, shown in the previous phases (initiation - Chapter 4 and implementation - Chapter 5). In addition, the failure of cook chill in the unsuccessful units could have prompted some managers of these units to leave.

The numbers of employees leaving employment *after* the introduction of cook chill, was much greater in the successful group (173 employees from 16 (69.6%) units) than the unsuccessful group (55 employees from 11 (50.0%) units).[8] Table 6.3 shows the reasons for these departures. In the successful group there was more voluntary

employment loss (for example, early retirement, other employment) and less enforced employment loss (redundancy and dismissal) than in the unsuccessful group.

One explanation for this is that cook chill units in the successful group may have retained staff who were willing to adapt and conform to the new system whilst staff, who became discontented had left for alternative employment. In contrast, employee dissatisfaction and resistance in the unsuccessful group had a telling influence on the future of cook chill and probably contributed to the higher levels of redundancy and dismissal apparent in this group. In a number of cases this had led to abandonment or a much reduced usage of cook chill. However, a substantial number of cook chill units, particularly from the unsuccessful group, had experienced little reaction from employees with regard to their cook chill operation. This may have been a result of the lack of heavy commitment to cook chill in these units. Indeed two operations only had two employees involved with their cook chill system and in one case, only one employee was involved with cook chill.

Table 6.3 Main Reasons of Departure of Employees leaving work post cook chill in the Successful and Unsuccessful Groups.

| Reasons for leaving | Successful Group No of Units | (%) | Unsuccessful Group No of Units | (%) |
|---|---|---|---|---|
| Retirement | 7 | (43.8) | 5 | (45.5) |
| Other employment | 15 | (93.8) | 8 | (72.7) |
| Early retirement | 4 | (25.0) | 1 | (9.1) |
| Further Redundancy * | 1 | (6.3) | 3 | (27.3) |
| Dismissal | 3 | (18.8) | 6 | (54.5) |
| Other | 9 | (56.3) | 4 | (36.4) |
| Total no of leavers | 173 | | 55 | |
| Totals no of Units experiencing job loss | 16 | (100.0) | 11 | (100.0) |

* This is in addition to redundancy carried out pre-cook chill and at implementation

## Customer Satisfaction

The level of customer satisfaction with the food they receive is probably one of the most easily identifiable factors which could affect the success of any catering operation regardless of its involvement with cook chill. If the food does not reach the expectations of the consumer, it is likely to be rejected and further custom from those dissatisfied,

uncertain. In time, therefore, such organisations which fail to please the consumer will perhaps become economically unviable (due for example, to high wastage or low sales).

Table 6.4 summarises the majority of comments offered by consumers in the successful and unsuccessful groups into the eleven categories shown. The most outstanding differences between the two groups were the generally favourable view of the food eaten and the service given (i.e. speed, and efficiency of system) amongst consumers in the successful group. In contrast there was an overall unfavourable view of food and service by consumers from the unsuccessful group. Cook chill operations in both groups received criticism from the consumers regarding limited choice, portion sizes, cost and the temperature of food served. Thus, even in the successful group, there was some evidence of cook chill restricting choice (because of the unsuitability of some foods to the process), encouraging small portion size (probably because of chilling/reheating procedures - especially in individually portioned dishes), causing an adverse effect to costs (in part, because of smaller portion size or increased production costs), and creating temperature problems with food (a result of poor reheating practice). However, it was unusual for consumers in the unsuccessful group to give any favourable comments (7, 24.1% of respondents who gave comments) whilst in the successful group it was more common (87, 37.7% of respondents who gave comments).

Table 6.4 Customer Responses Regarding Food Served in Establishments in the Successful and Unsuccessful Group.

| | Successful Group | | | | Unsuccessful Group | | | |
|---|---|---|---|---|---|---|---|---|
| | Favourable | | Adverse | | Good | | Adverse | |
| | No of Consumers | (%) | No of Consumers | (%) | No of Consumers | (%) | No of Consumers | (%) |
| Choice | 11 | 4.8 | 51 | 22.1 | 1 | 3.4 | 7 | 24.1 |
| Cost | 10 | 4.3 | 16 | 6.9 | 1 | 3.4 | 1 | 3.4 |
| Heat | 2 | 0.9 | 20 | 8.7 | 0 | 0.0 | 2 | 6.9 |
| Portion size | 1 | 0.4 | 22 | 9.5 | 0 | 0.0 | 3 | 10.3 |
| Health food | 3 | 1.3 | 9 | 3.9 | 0 | 0.0 | 0 | 0.0 |
| Dehydrated | 0 | 0.0 | 7 | 3.0 | 0 | 0.0 | 0 | 0.0 |
| 'Soggy' | 0 | 0.0 | 10 | 4.3 | 0 | 0.0 | 0 | 0.0 |
| Texture | 1 | 0.4 | 9 | 3.9 | 0 | 0.0 | 2 | 6.9 |
| Service | 23 | 9.9 | 7 | 3.0 | 3 | 10.3 | 2 | 6.9 |
| General | 36 | 15.6 | 16 | 6.9 | 2 | 6.9 | 12 | 41.4 |
| Other | 0 | 0.0 | 14 | 6.1 | 0 | 0.0 | 6 | 20.7 |
| Total customers giving comments | | | 231 | (100.0) | | | 29 | (100.0) |
| Total no of customers responding to questionnaires | | | 364 | | | | 57 | |

Typical favourable comments from consumers in the successful group were as follows.

> "Excellent choice and tasty (CC,1)...A lovely choice everyday (CC,1)...Quick and reasonably priced (CC,54) A fantastic change to really excellent meals brought in with this new system (CC,42)...the food before was incredibly bad. Now it's pretty neat! (CC,42)...Friendly, helpful, efficient and understanding service; pleasant relaxing atmosphere (CC,16)...everything is OK (CC,6)...Good value for money and very good quality. Would like canteen to stay open later at night (CC,5)...Good choice of menu and food well cooked. Seldom any cause for complaint (CC,2)...Highest commendation, well cooked, well served and tasteful in every way (CC,2)".

However, there were comments put forward which suggested that even amongst the relatively successful group of cook chill units, things were not yet perfect.

> "Would prefer food to be fresh (CC,61)...fresh food each day, real food not cook chill (CC,61)...portions tend to be on the small side (CC,42)... Food is consistently cold. Fried fish is very poor (CC,22)... Potatoes.chips not always hot, the batter on fried fish could be improved (CC,22)...Vegetables are badly cooked, particularly boiled potatoes (CC,22)... There has been a reduction in choice (CC,10)...Since cook chill came in the quality and the choice has deteriorated (CC,10)".

Although these quotes were clearly critical of the food received in these units of the successful group, the comments put forward reflected, in part, many of the opinions of the catering managers and operatives themselves. In particular, problems with regeneration, fried foods and the unsuitability of the system for some foods were picked up unknowingly by consumers. The feelings of consumers in the unsuccessful group were clear.

> "The food is unimaginative and there is a shortage of staff at lunchtime (CC,24)...standards are poor, even by institutionalised standards. Generally, there's an attitude of take it or leave it. Food is usually cold and by the time you've lined up to pay it's even colder(CC,24)... Unimaginative (CC,24)...It does not compare with the food we were used to before the existing firm (contract caterer) took over (CC,32).. Inconsistent quality (CC,32)..Over the years the food has gone from very

bad to totally inedible (CC,51)..standard of food drops off over weekends (CC,59)".

The general impression of the food received by these consumers was gloomy, which reflected an overall tendency towards despondency shown by both managers and operatives in these organisations.[9]

In summary, analysis at the social level showed that the successful group had a stable management force, were trimming employment levels indirectly by non-replacement of staff as they left (usually) voluntarily.[10] Furthermore, there was a reasonably high level of satisfaction manifested by consumers in this group. In contrast, the unsuccessful group had a higher turnover of managerial staff and had met more resistance from the workforce with regard to employment loss. Moreover, the problems throughout the system were reflected in the general level of dissatisfaction amongst consumers.

## 6.5 Conclusions

This Chapter has assessed some of the outcomes of the transfer of cook chill technology in the successful and unsuccessful groups. A major finding unveils a possible clue to explain the high degree of proactivity associated with the successful group and the tendency to reactivity or even passivity manifested by the unsuccessful group, which was clearly apparent in both this and earlier Chapters.[11] In addition, this assessment has provided a valuable sequel to the overall technology transfer process.

It was highly probably that the instability of management in the unsuccessful group, caused by its relatively high turnover, was instrumental in discouraging the progression of cook chill. Even enthusiastic managers may have had some difficulty in repairing the damage (particularly attitudinal) to the technology transfer process, caused by earlier mismanagement. In contrast, the relatively stable, well-informed management which existed in the successful group had stimulated a successful transfer process where forward-thinking was considered essential.

The future of some units in the unsuccessful group, with regard to cook chill, remains uncertain, largely because the attitudes of employees within these units may greatly influence its use. Clearly, analysis revealed dissatisfaction amongst employees, instilled in them for a number of reasons. Not least, the methods used to reduce labour. It was apparent that the natural wastage methods utilized by managers of the successful group were more satisfactory than enforced methods of shedding unwanted labour more

common amongst the unsuccessful group. Redundancy and dismissal appeared to nurture feelings of discontent amongst the remaining workforce. Unfortunately, these effects on employees may have a serious bearing on the use of cook chill within these particular operations. Indeed, a number of cook chill units in the unsuccessful group had already abandoned their cook chill system completely and others were in the process of doing so.

These differences were heightened by a range of findings. For example, the majority of the successful group had achieved a valuable return on their capital expenditure, were planning the use of more sophisticated techniques, and had a workforce who not only welcomed cook chill but were in favour of further development. In contrast, the majority of the unsuccessful group felt that investment in cook chill had been inexpedient and thus were planning a radical change to, or running down, their cook chill operations. In addition, they had a relatively dissatisfied labourforce.

However, both groups *were* in agreement of the existence of a '*technological information gap*' with regard to microbiological aspects, which suggest an urgent neeed for the production of a suitable document which could be utilized in cook chill situations specifically.

Finally, there was evidence to show that even those operations in the successful group had short falls. In particular, consumer reaction was not always complimentary, despite the comprehensive attention paid by the successful group to the total technology transfer process. The main deficiency was, in general, limited to a lack of choice (perhaps evidence of the existence of foods which deteriorate during the cook chill process). Whereas in the unsuccessful group, however, consumers complaints frequently covered a far wider range.

This Chapter has revealed that proactivity is beneficial to the overall technology transfer process and clearly is a function of a stable management force. It is suggested that future research should investigate outcomes in more depth including the use of longitudinal studies.

## Footnotes to Chapter 6

1 The third phase of the diffusion of technology which was identified in Chapters 1 and 2.

2 Cross-tabulation of success group and intention to expand was statistically significant. Chi-squared 5.23 DFI sig 0.02. EF= none

3 See also LEONARD-BARTON (1982).

4 For example with regard to the need for in-depth pre-cook chill research, recipe development and involvement of staff.

5 However, the recent formation of a catering equipment users association (CEQUA) may help to bridge this communication gap.

6 That is in addition to the problems that arose because of a lack of early background research and preparation.

7 And in some dubious cases, even longer!

8 These figures are overall figures of employees leaving employment and are not specific to the part of the catering unit specifically designated for cook chill. However, they do give an indication of the level of staff turnover since the introduction of cook chill although cannot be used to account for the influences of size on the numbers leaving.

9 Although some were showing signs of improvement for the future.

10 Although the extent to which the introduction of cook chill had caused these departures was unknown.

11 See Chapters 4 and 5.

# Chapter 7

# Conclusions

## 7.1 Introduction

This research examines the user uptake phase of a technology transfer process in the catering industry; namely the introduction and implementation of cook chill technology. The main aim of the thesis has been to determine how successfully the technology has been transferred. To achieve this satisfactorily there was a need to develop a robust, multi-faceted measure of success. This then enabled comparisons between the activities of the most successful and the least successful cook chill units throughout the technology transfer process.

A study of cook chill catering operations in the UK was seen as a useful vehicle to determine factors which could be used to *measure* success and investigate and explain factors which *affect* the success of the technology transfer process. Thus, the conclusions of this study may be seen to have two major aspects:

i) the implications for other technologies and the transfer of technology in the catering and other industries

ii) the direct implications for cook chill in the catering industry.

## 7.2 Conclusions - The Transfer of Technology

By investigating technology transfer at the level of the user, the findings of this study have made a contribution to understanding the activities conducive to success throughout the technology transfer process.

*A key outcome in this study has been the development of a multi-faceted measurement of success.* Despite many calls for a multi-faceted and empirical analysis of successful technology transfer,[1] there have been few such studies attempted. Moreover, the few studies which do tentatively explore a multi-faceted definition of success, do not exhaustively examine, or clearly explain the relationship between the many factors at work. What emerges from this research is a resistant and sensitive way of ascertaining levels of relative success. Given that the outcomes of success are a multi-faceted phenomenon, the only realistic method of assessing success must involve a systematic measurement of its multi-dimensional characteristics. This measurement was achieved using a variety of statistical methods and qualitative information to score ten success factors and culminated in the formation of a 'success table' of the cook chill operations surveyed. This approach to measuring success should be applicable in other studies of

technology transfer. However, there is a need to relate the factors chosen to the specific technologies and industries being investigated. In other words, the multi-faceted approach is technology- and industry-specific. Following this assessment of each cook chill operations' relative success, rigorous analytical investigations of successful and unsuccessful cook chill units were undertaken.

*Throughout the comparative exploration of factors affecting success a recurring theme was that the decision makers in the successful group were proactive whereas those in the unsuccessful group were merely reactive.* This finding is first apparent in the exploration of, for example, training needs and alteration to premises (Chapter 4), but is reinforced by findings in Chapters 5 and 6. The successful group were generally more forward thinking, anticipated problems and investigated the potential of cook chill in greater detail than the unsuccessful group. The latter were often blind to any possible adverse consequences of cook chill and tended to react to problems after the event, if at all.

This was particularly evident over premise alteration. The forethought manifested by decision makers in the successful group in fulfilling the necessary alterations prior to the incorporation of cook chill (for example, buildings, power supplies and storage space) demonstrated their *proactivity*. In contrast, decision makers in the unsuccessful group had failed to anticipate the need for such changes, for example, necessary changes to premises to accommodate cook chill were undertaken *after* the introduction of cook chill - a prime example of the tendency of the unsuccessful group towards *reactivity*.

Apart from the overall theme of proactivity and reactivity, a diagnosis of why cook chill units were, respectively, successful and unsuccessful revealed some striking differences between the activities of the two groups. Although, as ROTHWELL (1972) pointed out there can be no surefire recipe for automatic success; technical and market uncertainties are such that success can never be guaranteed. However, steps can be taken to maximise the chances of success. Analysis of the primary data in this study clearly showed that the factors affecting success were multi-faceted.

*There was greater employment stability amongst the managers and decision makers in the successful group than the unsuccessful group.* The managers in the successful group not only displayed and communicated more enthusiasm to cook chill but were more likely to follow the technology transfer process through to fruition. In contrast, the high turnover of managers in the unsuccessful group, indicated that, for them, the converse was true. One consequence of this unstable foundation was a growth in the opposition

to cook chill; the more they floundered the more restless the employees became. The one-eyed leading the blind can and often does result in disaster, especially when the handicap is self-induced. Undoubtedly, success was implicitly linked to a positive management attitude which filtered through the whole organisation. Conversely an unenthusiastic management force instilled disharmony amongst the labourforce.

*The successful group tended to have a sound reason for the introduction of technology which related to the need of the particular operation in question.* These reasons were not limited to cost reduction alone (in contrast with the unsuccessful group). Other reasons were cited as key influences; namely, improving quality, feeding remote consumers and a need to improve productivity within a confined area. In comparison, some cases in the unsuccessful group were lured into making a decision to use cook chill by the early cook chill publicity claiming it to be the answer to all the catering industry's problems (an idea recently much refuted) or based the decision solely on a salesman's promise of reduced labour costs. This finding is in agreement with ETTLIE (1973) who suggested that the successful users of CNC machine tools were better able to justify the adoption of such tools than unsuccessful users.

*There was evidence of an optimum decision time to assess the value of introducing cook chill in the particular operation in question, but this was intrinsically linked to thorough in-depth development work.* The successful group consulted a wider range of information sources, carried out more detailed planning and invested in equipment and training which maximised the chances of success. In contrast, the unsuccessful group carried out superficial development work and utilised decision times inefficiently.[2] Similarly, ROTHWELL (1972,1974) concluded that successful firms carried out development work more efficiently but not necessarily more quickly than unsuccessful firms.[3] In an analysis of the primary data from the cook chill survey, the unsuccessful group were also found to rely heavily on technological gatekeepers[4] with interests outside the cook chill operation in question and whose advice and/or claims could be open to misinterpretation. ALLEN (1971) termed such information channels as "an ineffective medium for technology transfer" (1971,37). Thus, it is not sufficient to rely merely on a range of random information sources. Rather, a wide range of *relevant* information sources are of paramount importance.

*The successful group were more orientated towards research and development than the unsuccessful group.* This was manifested in the approach by both groups towards product development prior to cook chill start-up. The successful group utilised a planned series of formal experiments on menu items before introducing them into the

cook chill system 'proper'. The unsuccessful group, however, relied upon trial and error alone. The tendency of the successful group to be more heavily involved with research and development programmes was evident. In contrast, the unsuccessful group neglected this vital area of the technology transfer process. However, this finding is probably not surprising given the widespread tendency of caterers in general to undervalue research and development and trivialise its importance. This may be a result of the fight to keep running costs to an absolute minimum and research and development is thus seen as a costly and unnecessary luxury and *not* the responsibility of the caterer.

*Prima facie evidence suggested that the size of a cook chill operation influenced success.* The cook chill units in the successful group were, on the whole, larger (in terms of maximum capacity and the percentage of the total catering operation dedicated to cook chill) however, size *per se* was not a pre-determinant of success. There were cases of highly successful small units and unsuccessful larger units. Nevertheless, the size factor had ramifications on other activities resulting from the transfer of cook chill technology. Not least, economies of scale enabled larger cook chill units to take advantage of systematic food purchasing procedures from suppliers, having greater leverage in terms of purchasing power to demand products to specification. In addition, they had the ability to optimise delivery patterns and could justify expenditure on widespread microbiological analysis.

*Despite having the advantage of economies of scale, the successful group had a higher capital expenditure per unit of capacity than the unsuccessful group.* Moreover, the successful group had patently achieved greater return for their money in the form of an improved catering system, contented workforce and satisfied customers. The unsuccessful group however, had invested in the unfounded belief that acquiring the technology alone was the key to success.

Undoubtedly, as a detailed analysis of the activities of both groups has shown, harmonisation of the equipment into the whole catering system was critical. This finding alone demonstrates the importance of studying the implementation phase, successful technology transfer is not reliant on the activities leading up to implementation alone. Indeed, the activities which take place during implementation have been shown to have a profound effect on the eventual success of the transfer of technology. The next point also serves to illustrate that technology alone does not guarantees success; the employees play a crucial role in effecting success.

*Effective communication was a salient feature of successful cook chill units, whereas communication in unsuccessful cook chill units was, at best, inadequate or, at worst, completely lacking.* Employees in the successful units were involved in the decision making process and were given much wider and more in-depth training and experience with cook chill than those in the unsuccessful group. The often conciliatory attitude with regard to trade unions employed by decision makers from the successful units was more effective in achieving goodwill and support with regard to labour shedding than the 'take it or leave it' approach followed by some units in the unsuccessful units. Moreover, the labour shedding strategies of the successful group were more effective than the unsuccessful units. There was evidence to suggest that a skeleton staff was *not* conducive to successful transfer of cook chill technology. Rather, the gradual reduction of labour, by the use of natural wastage methods, resulted in a more accurate estimation of required employment levels based on the needs of the individual cook chill system.

In sum, success was associated with: (i) a proactive management enthusiastic about and committed to cook chill, having a sound basis for embarking on a cook chill technology transfer project. (ii) Research and development work which was conducted thoroughly and efficiently and was neither carried out in a rushed, 'spur of the moment' manner nor drawn out over an excessively long period resulting in a non-productive waste of valuable resources.[5] (iii) A high percentage of the total catering operation was dedicated to cook chill within individual operations. (iv) The discerning ability of decision makers to allocate sufficient resources to vital areas, for example, essential pieces of equipment (chillers, chilled stores, temperature controls), microbiological analysis, training and building requirements, resulting in a higher initial capital outlay per unit of capacity than the unsuccessful group. (v) A greater emphasis on employee consultation, involvement and contribution to the overall technology transfer process.

## 7.3 Implications for Cook Chill

There has been an increasing use of technology in previously 'low-tech' industries, such as catering, therefore, emphasis must be placed on the value of understanding the technology transfer process, in order to maximise success potential. The implications from this study for the future development of cook chill relate to a number of major areas of concern. The evidence presented refutes once and for all any possibility that cook chill can be implemented without full consideration for the consequences of introducing the system. Success was most likely where the technology transfer had been carried out thoroughly and systematically; such cases served to illustrate that successful introduction

of technology is possible and necessary particularly in a situation where people's health may be threatened.[6]

It is hardly surprising, therefore, that cook chill has recently received such hard-hitting criticism (SHEPPARD,1987; FINANCIAL TIMES,1987; DAILY TELEGRAPH,1987), especially in the light of the rather startling, ad-hoc, malpractices which were uncovered in a number of units in the unsuccessful group.. It has been stressed on numerous occasions (DHSS,1980; BRYAN and LYON,1984; GLEW,1985; ARMSTRONG,1985; HOSPITAL CATERER,1987) that strict temperature control within cook chill systems is vital. *Why, then, were there cook chill systems in operation which showed a total disregard for the most fundamental aspects of a cook chill system?*

This ignorance was highlighted by the finding that, despite all the recent publicity and furore, some decision makers in the unsuccessful group were totally unaware of the existence of the DHSS temperature control guidelines for cooked chilled foods (1980).[7] The implication of this is that legislation is required which enforces the adherence to these guidelines by all cook chill users. In order for this to be possible, all cook chill units would need to be registered or licensed perhaps in the same way as catering organisations have to be licensed to serve intoxicating liquor. The evidence from the cook chill survey suggests that adherence to the DHSS guidelines (1980) is problematic, since a mere awareness of their existence does not lead to compliance. Furthermore, an awareness of these guidelines without attempting to enforce them amounts to wilful neglect.

The total lack of awareness, with regard to microbiological safety and temperature control, exhibited by some of the key decision makers in some of the units in the unsuccessful group, was simply dangerous, when the full hazardous potentials of such malpractices are taken into account. It is suggested therefore, that there should be more extensive documentation on microbiological safety together with the training of staff.

With respect to the acceptance of a new cook chill system, the successful group showed greater empathy towards their employees. Evidently, employees in the successful group were more receptive to the idea of cook chill because of the greater involvement, communication and attention given to them during the decision making process. The promise of improved working conditions through the introduction of cook chill have, in some cases, proved unfounded. The majority of managers indicated that a motive for introducing cook chill was indeed to reduce labour costs. The main difference between the successful units and the unsuccessful units was that the successful units had achieved this relatively painlessly and without a fight, whereas the unsuccessful units had not.

Indeed, not only did some employees experience a decrease in skill level, but the introduction of, for example, an eight hour production shift, resulted in a loss of overtime and weekend work which was not counterbalanced by an increase in basic wage rates. The net result being that cook chill catering workers have remained amongst the lowest paid workers in Britain. This shows a disparity with workers in some other industries where the introduction of new technology is often accompanied by an increase in status and pay.

Finally, the results of this survey indicated that some of the cook chill units in the unsuccessful group were 'sold' equipment for cook chill rather than having a purposeful reason for its introduction. Moreover, the equipment purchased was often inappropriate for the needs of the organisation. It is suggested therefore, that there is a need to develop a code of practice, with regard to cook chill for use by equipment manufacturers, consultants and caterers themselves.

In sum, these findings have shown that although cook chill can be introduced effectively, the system is open to abuse, through short-cuts in the technology transfer process. Consequently, in some cases, hazardous malpractices were evident.

## 7.3 Implications for Future Research

This study has attempted to fill a gap in the technology transfer literature base by studying factors affecting success during the transfer of cook chill technology at the user uptake phase. A multi-dimensional technique was utilised for defining levels of relative success. The use of multi-variate statistical techniques were explored and, it is suggested, may have a valuable contribution to make in future studies of this kind. However, the measurements used in Chapter 3 assume commonality for each success factor. Despite the fact that the comparisons made in Chapters 4 to 6 revealed some remarkable differences between the cook chill units classed as successful and those classed as unsuccessful, future empirical studies of the technology transfer process may obtain more absolute findings through the introduction of success factor 'loadings'. The existence of technology- and industry-specific factors both for the measurement of success and for exploring factors which affect success has been established. Thus, it is imperative for all future studies of technology transfer to incorporate multi-faceted measures of success which include factors specific to the technology in question.

In the light of these observations there are a number of areas which require further research. First, there is a need to study other technologies in other industries using

similar measures of defining and factors affecting success, to those developed here. This would test how unique ( or generalisable) the investigation of the cook chill process actually was.

Second, there is a need for studies which adopt a more diagnostic approach, i.e., explaining any differences in management reactivity/proactivity; and examining differences in pre-planning and development; explaining differences in style of implementation - especially with regard to communication.

Finally, more in-depth examinations are required of key aspects of the cook chill process, in particular, the effect of cook chill technology on levels of employment and the skill content of jobs.

## Footnotes to Chapter 7

1 See, for example,FISCHER (1976), RYAN (1976), GOLD (1980) and SCHEIRER (1983).

2 Decision time was seen as being inefficiently utilised as the unsuccessful group had failed to find out in any depth the implications and requirements for introducing cook chill. Their information seeking techniques were scant. In some cases decision time covered a longer time period than the unsuccessful group and in others decision time was virtually non-existent, but in any case, the decision time was spent gathering only superficial information

3 This was with reference to firms in chemical and scientific industries.

4 People who transfer specialist technological information or knowledge to others with lesser knowledge of that technology.

5 In terms of financial expenditure and management time.

6 For example through food poisoning outbreaks.

7 With particular reference to the time, temperature and microbiological guidelines contained therein.

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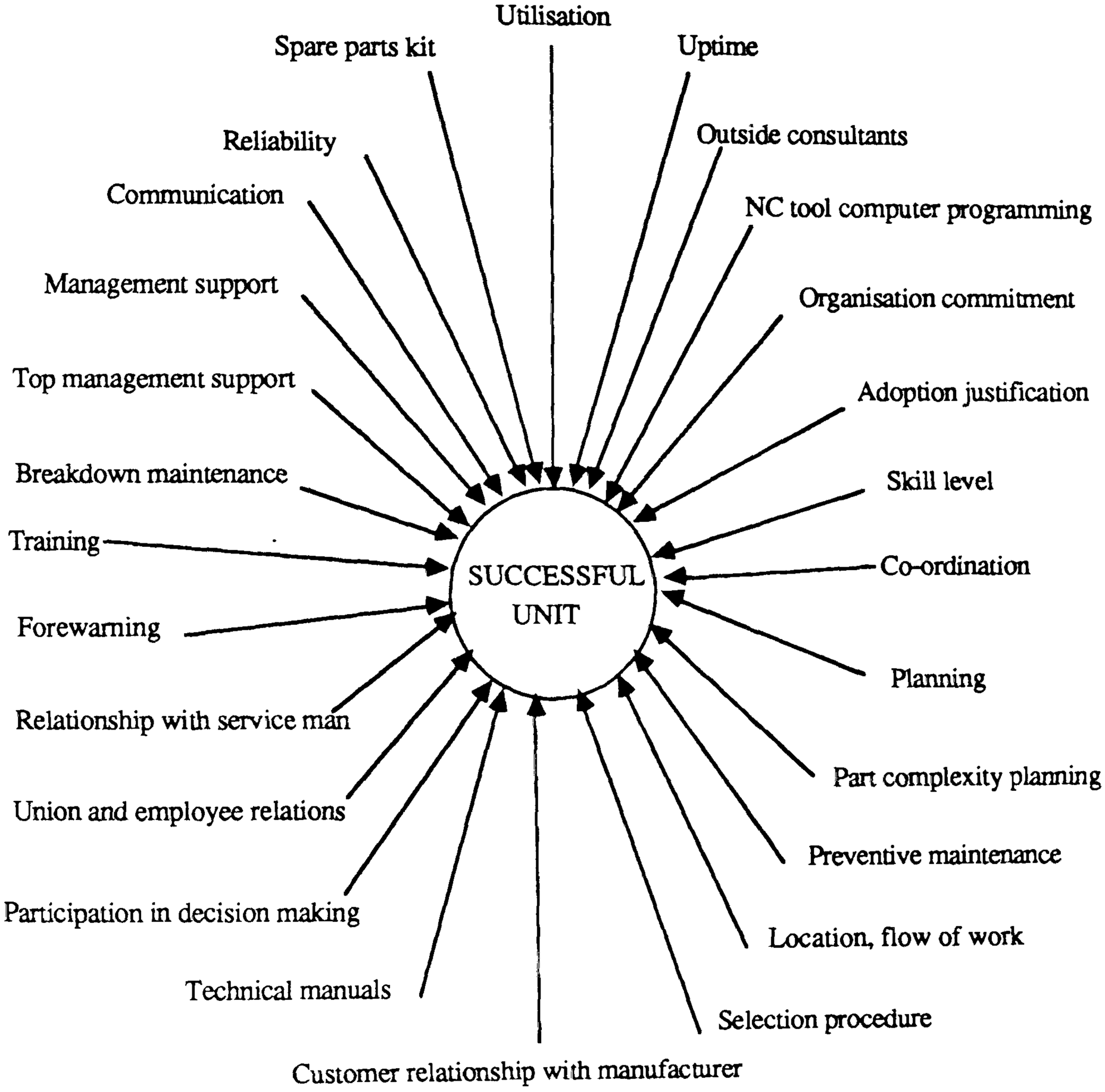
## Appendix 1a

Figure 1 Factors Significant in Affecting the Success of the Implementation of NC Machine Tools.




Adapted from ETTLIE (1973).

**Appendix 2a**

HOSPITALITY QUESTIONNAIRE

DORSET INSTITUTE OF HIGHER EDUCATION

# COOK-CHILL SURVEY

You will know from last month's issue that we are conducting an important survey into cook-chill operations in this country. If you are involved in cook-chill *or* are interested in using the technique *please help us* by completing this questionnaire (by ticking the appropriate boxes) and returning it to Miss Anne Walker at the address below.

**1** Do you currently use cook-chill ☐ or are you thinking of using it? ☐

**2** Is cook-chill used for all your catering requirements, ☐
at least 50% of the catering ☐ or much less than 50%? ☐

**3** How long have you used cook-chill? Up to 6 months, ☐
6 months–18 months ☐ 18 months–3 years ☐ or
longer than 3 years ☐

**4** Please state the nature of your company's business

.....

**5** Please write your name and the name and address of your company below.

Department of Catering and Hotel Administration
Wallisdown, Poole, Dorset BH12 5BB
Telephone: (0202) 524111 ext. 249

This project is funded by the Ministry of Agriculture, Fisheries and Food.

**Appendix 2b**

Introductory Letter

Merge Date

Merge Address

**COOK CHILL PROJECT**

Dear

There is currently an increasing interest in the use of cook chill systems within all sectors of the catering industry. As establishments look to rationalise their systems, they are becoming more aware of the use of a cook chill system as a possible alternative. As a result of this, it is clear that some guidelines for caterers would be extremely beneficial when installing such a system.

I am undertaking a survey with the aim of producing such guidelines, in order to try and reduce some of the problems encountered with the introduction of a cook chill system. This survey is being supported and funded by the Ministry of Agriculture, Fisheries and Food. The survey will cover establishments already using a cook chill system.

Your establishment is one of a number of places I would like to visit. I would like to ask you to help with this study, on a voluntary basis, by discussing the development of your particular cook chill system. Only by obtaining interviews with a very high proportion of the establishments approached will it be possible to obtain a reliable understanding of the procedures required to set up a successful cook chill operation.

I would like to stress that all information disclosed in the interview will be regarded as strictly confidential. Results will be presented only as statistical tables and neither the information you give not the views you express will be linked in any way to your establishment.

I will contact you within the next few days to see if you are willing to take part, and if so to arrange a meeting, which I would expect to last for about an hour. If you would like any more information about this survey you might like to contact me at the above address or telephone number.

Yours sincerely,

Anne Walker
Research Assistant

**Appendix 2c**

MAIN QUESTIONNAIRE.

Name of Firm _____ Firm No ☐☐☐☐

Date of Interview _____ Start time ☐☐☐☐

Interviewee _____ End tme ☐☐☐☐

Position _____

**ALL INFORMATION GIVEN WILL BE TREATED IN THE STRICTEST CONFIDENCE**

1. What is the nature of your company's main business?

_____

2. What type of organisation is it?

PLC ☐ Private limited ☐

Nationalised/NHS ☐ Local authority ☐

Other _____

3. How long has this establishment had a catering operation?

_____

4. When did you have a Cook Chill system installed? _____

5. What type of system is installed here?

Cryogenic ☐ Sous Vide/Vacuum ☐

Electro-mechanical ☐ capkold ☐

Other _____

5b. What type of regneration is used?

Infra red ☐ Microwave ☐

FAC ☐ Combi ☐

c/c vend m/wave ☐ Other ☐

If other please state _____

5c. What is the average storage length of the chilled food? _____

6. What system was in use before the introduction of Cook Chill?

**SHOW CARD A**

| | | | |
|---|---|---|---|
| Cook serve | ☐ | Cook freeze | ☐ |
| Vending | ☐ | Non | ☐ |
| Fast food | ☐ | Other | _____ |

7. Why did you decide to investigate the use of Cook Chill?

| | | | |
|---|---|---|---|
| Reduce costs | ☐ | Increase productivity | ☐ |
| Improve quality | ☐ | Centralisation | ☐ |
| New building | ☐ | Feed shift workers | ☐ |
| Standardise quality | ☐ | Geographical | ☐ |

Other _____

8. What other systems (if any) were considered?

| | | | |
|---|---|---|---|
| Cook serve | ☐ | No catering | ☐ |
| Cook freeze | ☐ | Vending | ☐ |

Other _____

(If none, go to Question 10).

9. How seriously were these systems considered?

Brief (1) extensive (2) some depth (3) not applicable (8) ☐

10. Why did you reject other catering systems in favour of Cook Chill?

**RANK IN ORDER OF IMPORTANCE FOR EACH RESPONSE.**

| | |
|---|---|
| Lack of space | ☐ |
| Lack of information available | ☐ |
| Lack of equipment available | ☐ |
| Costs - which _____ | ☐ |
| Limited use | ☐ |
| Quality | ☐ |
| Flexibility | ☐ |
| Other _____ | |

11. Approximately, how long was it between the decision to change the previous system and the decision to definitely install Cook Chill (i.e. placing and order for the equipment)? (in months) ☐☐

12. Where did you receive most of your information and/or advice about Cook Chill systems?

**SHOW CARD B**

| Source of Information | Use | Aware | Rank |
|---|---|---|---|
| Equipment Manufacturers | ☐ | ☐ | |
| Zanussi | ☐ | | ☐ |
| Roboserve | ☐ | | ☐ |
| Socamel | ☐ | | ☐ |
| Regethermic | ☐ | | ☐ |
| Fosters | ☐ | | ☐ |
| Cook Chill alternative | ☐ | | ☐ |
| Other | ☐ | | ☐ |
| Trade Magazines | ☐ | ☐ | |
| Caterer | ☐ | | ☐ |
| Grocer | ☐ | | ☐ |
| Frozen & Chilled foods | ☐ | | ☐ |
| Hospitality | ☐ | | ☐ |
| Other | ☐ | | ☐ |
| Advertisements | ☐ | ☐ | ☐ |
| Consultants | ☐ | ☐ | ☐ |
| Which? | _____ | | |

Other Cook Chill Users ☐ ☐ ☐

Who? _____

Seminars/Conferences ☐ ☐ ☐

Which? _____

Electricity Council ☐ ☐ ☐

DHSS Guidelines ☐ ☐ ☐

Planning for Cook Chill ☐ ☐ ☐

B.O.C. ☐ ☐ ☐

None ☐ ☐ ☐

Experienced Knowledge ☐ ☐ ☐

Contract Caterer Employed ☐ ☐ ☐

Other (state) ☐ ☐ ☐

_____

13. Did you undertake a feasibility study? - if so is it possible to have a copy of it?

_____

13a. What did this include?

If no study completed ask next question, otherwise go to question 15.

_____

_____

14. Why was a feasibility study omitted?

No information available ☐

Going to install anyway ☐

Not necessary ☐

Timescale ☐

Other ☐

15. Is your Cook Chill operation run by:

In house caterers (1) Contract caterers (2) name ☐

Other (3) _____

16. When the system was introduced did the operation run smoothly immediately?

Yes ☐ No ☐

If no, what were the reasons for this?

Equipment ☐

Staffing ☐

Dehydration ☐

Customer acceptance ☐

Inexperience ☐

Lack of space ☐

Transport ☐

Operational practices ☐

Other ☐

17. Did you have to have any major alterations made to the premises in order to install Cook Chill? prompt - electricity, gas, water.

Yes (1) No (0) ☐

18. Was the catering operation in full operation during the time of the conversion from the old system to the Cook Chill system?

Yes (1) No (0) ☐

## PRODUCTION CAPACITY - SIZE OF OPERATION

19a. What percentage of your Catering Operation is covered by Cook Chill? ☐☐☐

19b. Please could you give me the capavity levels of the present Cook Chill systen, in terms of numbers of portions per day.

_____

19c. Is this

Less (0) Same (1) More (2) ☐ as the previous system?

19d. Is this figure likey to be

Less (0) Same (1) More (2) ☐ in the future?

20. Do production levels alter at all during the course of a year? ☐

21. Do you use any other catering system alongside Cook Chill?

**SHOW CARD A**

Cook serve ☐

Cook freeze ☐

Vending ☐

Snacks ☐

Other _____

22. How many central production units are there? ☐☐

23. Please could you tell me how many satellite kitchens you have? ☐☐☐

23a. Are these satellites

Adjacent ☐

Remote ☐

Other ☐ from the CPU?

23b. Please could you indicate the average time taken for deliveries to satellite areas, ☐☐☐

from the central production unit?

23c. How frequently do deliveries occur?

Monday ☐ Tuesday ☐

Wednesday ☐ Thursday ☐

Friday ☐ Saturday ☐

Sunday ☐ Other ☐

23d. Please could you indicate the total number of Cook Chill customers per day? ☐☐☐☐☐

## FOR WHOM CATERING CARRIED OUT

24. What percentage of your total production is accounted for by outside contract work? ☐☐☐

(None - go to Question 26).

25. What is the approximate value of these contracts in monetary terms? ☐☐☐☐☐☐☐

(Insert bands of money)

26. Are there any plans to becme further involved with outside contracts? ☐

Yes (1) No (0)

## FINANCE

27. Please could you indicate the approximate annual turnover/budget used by the catering department? ☐☐☐☐☐☐☐

28. Please could you indicate the approximate profit/loss margin for:

The year prior to Cook Chill ☐ 0 = loss 1 = profit

First year of Cook Chill ☐ 2 = even 3 = subsidised

Estimated this year ☐

29. Please could you indicate the total amount of capital spent on the following items, for the introduction of Cook Chill? **SHOW CARD C**

Equipment ☐☐☐☐☐☐☐

Redundancy pa ☐☐☐☐☐☐☐

Consultancy fees ☐☐☐☐☐☐☐

Building conversion ☐☐☐☐☐☐☐

Training costs ☐☐☐☐☐☐☐

Other _____

30. How was this financed? _____

31. What was the original aniticpated payback period of this capital, if any?

_____

If no payback period, go to Question 34.

32. Will the actual payback period be shorter, longer or the same as the anticipated?

Shorter (0) Longer (1) Same (2) ☐

33. How is this capital to be recovered?

Reduction in staff numbers ☐

Cheaper purchasing methods ☐

Revenue ☐

Higher productivity ☐

Outside contracts ☐

Other _____

## THE CURRENT CATERING SYSTEM FROM PURCHASE TO REGENERATION

34. What is the procedure for the purchase of food?

Established suppliers ☐

Buy what is available ☐

Centralised buying system ☐

Other ☐

35. What is the difference, if any between the purchasing procedure since the introduction of Cook Chill and the procedure before Cook Chill?

_____

_____

36. What difficulties, if any, are experienced with receiving the products you require?

_____

_____

37. Were these difficulties encountered before the introduction of Cook Chill?

Yes (1) No (0) ☐

38. Could you rank the following attributes in the order which you consider the most important when selecting food? **SHOW CARD E**

| Attribute | Ranking |
|---|---|
| Cost | ☐ |
| Quality | ☐ |
| Quantity | ☐ |
| Delivery | ☐ |
| Value for money | ☐ |
| Other (state _____) | |

39. How did you decide on the particular pieces of equipment purchased?

| | |
|---|---|
| Experience | ☐ |
| Other users | ☐ |
| Equipment manufacturers recommendation | ☐ |
| Need for increased productivity | ☐ |
| Advertisements | ☐ |
| Seminars/conference information | ☐ |
| Costs | ☐ |
| Owned already | ☐ |
| New on market | ☐ |
| Other _____ | |

40. Which pieces of equipment do you possess, are they in regular use and are there any pieces of equipment which you would like but have not got?

**SHOW CARD F**

| Equipment | Possession (number) | Regular Use Y/N | Equipment would like |
|---|---|---|---|
| Bratt pans | ☐ | ☐ | ☐ |
| Conveyor belt | ☐ | ☐ | ☐ |
| Auto pastry roller | ☐ | ☐ | ☐ |
| Donut maker | ☐ | ☐ | ☐ |
| Mincer/shredder | ☐ | ☐ | ☐ |
| Refrigerator | ☐ | ☐ | ☐ |
| I/R oven | ☐ | ☐ | ☐ |
| Liquid N tank | ☐ | ☐ | ☐ |
| Boilers | ☐ | ☐ | ☐ |
| Hob/range | ☐ | ☐ | ☐ |
| HP steamer | ☐ | ☐ | ☐ |
| Sausage maker | ☐ | ☐ | ☐ |
| Liquidiser | ☐ | ☐ | ☐ |
| Cold room | ☐ | ☐ | ☐ |
| M/W oven | ☐ | ☐ | ☐ |
| FAC oven | ☐ | ☐ | ☐ |
| Fryers | ☐ | ☐ | ☐ |
| LP steamer | ☐ | ☐ | ☐ |
| Pie machine | ☐ | ☐ | ☐ |
| Freezer | ☐ | ☐ | ☐ |
| Rumbler | ☐ | ☐ | ☐ |

| | | | |
|---|---|---|---|
| Combi oven | ☐ | ☐ | ☐ |
| Grills | ☐ | ☐ | ☐ |
| Meat slicer | ☐ | ☐ | ☐ |
| Mixer | ☐ | ☐ | ☐ |
| Beefburger maker | ☐ | ☐ | ☐ |
| Blast chiller | ☐ | ☐ | ☐ |
| Chipper | ☐ | ☐ | ☐ |
| Steam injection oven | ☐ | ☐ | ☐ |
| Other | ☐ | ☐ | ☐ |

42. Who is responsible for the maintenance of equipment in the central production unit and the satellites (finishing) kitchens?

In house (0) Contractors (1) Manufacturers (2)

Manager (3) Other (4) _____ ☐

43. Following the introduction of Cook Chill what kind, if any, of the recipes neded some sort of alteration?

| | | | |
|---|---|---|---|
| All recipes | ☐ | Sauces | ☐ |
| Batter dishes | ☐ | Fried fish | ☐ |
| Fried eggs/omelettes | ☐ | Methods | ☐ |
| Liquid content | ☐ | Other | ☐ |

44. How was the development of a satisfactory product reached?

SHOW CARD G

Trial and error ☐

Series of experiments conducted in house ☐

Experiments completed by an outside body - state _____

Recipes received from others users ☐

Other _____

45. How long did this development stage take?

66 still going on

one week

one month

6 months

year

other _____

88 n/a

46. Please indicate any foods that are still unsuccessful using the Cook Chill system.

Certain veg

Fried foods

Yorkshire pudding/batteries

Chips

Eggs

Joints

Grilled meats

Other _____

47. How do chefs obtain recipes required?

Experience

Computer

Books

Files

Other _____

48. What sort of menu pattern is operated?

No particular pattern

Specification of contract

Weekly cyclical (insert number of cycle)

Monthly cyclical

Other _____

49. How often, if ever, do you find it necessary to have any samples taken for microbiological analysis?

| Frequency | Site Analysis |
|---|---|
| daily (0) | own labs (0) |
| weekly (1) | local labs (1) |
| monthly (2) | local college (2) |
| yearly (3) | other (3) |
| never (4) | other (5) |

☐☐

50. What temperature is the Cook Chill storage area kept at? ☐☐

51. What measures are taken to ensure correct temperature maintenance?

**SHOW CARD H**

None ☐

Digital readout ☐

Cambridge recorder ☐

Alarms ☐

Temp probe ☐

Random temp testing ☐

Computer controlled temp monitors ☐

Other ☐

52. How often are temperatures recorded in:

a The Chillers b. Storage area

53. What happens if the temperature rises above the allowed maximum temperature?

Food discarded ☐

Depends on temp ☐

Food removed & equpt checked ☐

Depends on time at higher temp ☐

Food tested ☐

Other ☐

54. Do you think enough knowledge is made available to you about the microbiological safety of Cook Chilled foods?

Yes (1) No (0) ☐

55. Could you comment further on this?

_____

_____

56. What type of containers and/or packaging do you use?

Aluminium ☐

Stainless steel ☐

Disposable multi portion ☐

Dispodable individual ☐

Ceramic multi portion ☐

Plates ☐

Other _____

57. How is the chilled food transported to the satellite units?

**SHOW CARD I**

| **Equipment** | **Numer** | **Rank in Ideal Preference** |
|---|---|---|
| Refrigerated van | ☐ | ☐ |
| Insulated boxes | ☐ | ☐ |
| Refrigerated trolley | ☐ | ☐ |
| Trolley | ☐ | ☐ |
| Insulated trolley | ☐ | ☐ |
| Van only | ☐ | ☐ |

Other _____

58. Which meals are served by the Cook Chill system?

Daily at meal times ☐

Nightshift ☐

Continuously ☐

Special occasions ☐

Other _____

59. What methods of service are operated? **SHOW CARD J**

Canteen style ☐

Self service ☐

Full meal vending ☐

Snack vending ☐

Waitress service ☐

Other _____

60. What happens to left over reheated food?

thrown (0) nothing (1) depends (2) ☐

used next time (3) other (4) _____

61. Compared with the old system, how does the incidence of waste with the new Cook Chill system compare?

more waste (0) less waste (1) same (2) n/a (8) ☐

62. Please could you give me any figures on waste ? (at satellites) in terms of numbers of portions per day? _____

63. What happens to the containers after the meal?

washed by hand on site (1) washed by hand at CPU (2)

washed by machine on site (3) washed by machine at CPU (4)

washed by hand on site & machine at CPU (5) discarded (0)

other (6) _____ ☐

## DECISION MAKING, MANAGERS JOB, INVOLVEMENT, STAFF INVOLVEMENT, R & D, STAFFING/QUALIFICATION

64. What percentage of your time is spent at the CPU and satellites? ☐☐☐

65. What facilities exist, if any, for research and development within the catering operation here?

---

66. Which areas, if any, require further research and development?

None ☐

Equipment ☐

Recipes ☐

Storage length ☐

Production techniques ☐

Visual impact ☐

Other _____

67. How many, if any, of the the managerial staff have left employment since the introduction of Cook Chill? ☐☐

## STAFFING/LABOUR FORCE

68. Does the number of staff employed over the year fluctuate?

Yes (1) No (0) ☐

(If no, go to Question 71)

69. What are the reasons for this fluctuation?

Seasonal ☐

Casual labour ☐

Contracts ☐

Holidays ☐ Other _____

70. How many of your staff have been employed here: **SHOW CARD K**

5 years + ☐

2-5 years ☐

1-2 years ☐

up to 12 months ☐

71. How many staff have left this employment since the introduction of Cook Chill?

None ☐

Number _____

(If none, go to Question 74)

72. What was the reason for each member of staff leaving? **SHOW CARD L**

| **Reason** | **No of Staff** |
|---|---|
| Redundant | ☐ |
| Dismissal | ☐ |
| Retirement | ☐ |
| Other employment | ☐ |
| Casual labour | ☐ |
| Early retirement | ☐ |
| Other | _____ |

73. Would you say that staff turnover was

Lower (0) Higher (1) Same (2) ☐

than before the introduction of Cook Chill?

74. Please could you give me a rough picture of the number of staff employed

| | **Total Nos of Staff** | **No in CPU** |
|---|---|---|
| Prior to Cook Chill | ☐☐☐ | |
| Since introduction of Cook Chill | ☐☐☐ | ☐☐ |
| Estimated future picture | | |

Less (0) More (1) Same (2) ☐

75a. How were these changes in staff numbers achieved? **SHOW CARD M**

Redundancy ☐

Natural wastage ☐

Relocation of staff ☐

Recruitment ☐

Other _____

75b. Have the rates of pay

Decreased (0) Increased (1) Stayed the same (2) ☐

since the introduction of Cook Chill (taking account of inflationary increases).

75c. What other, if any, incentive schemes are offered to the staff?

Pension schemes ☐

Bonuses ☐

Free meals ☐

Low cost meals ☐

Discounts ☐

Further qualifications ☐

Health schemes ☐

Profit sharing ☐

Emergency loans ☐

Free accommodation ☐

Transport facilities ☐

None ☐

Other _____

76. Would you say that the introduction of Cook Chill has raised or lowered the overall skill level of the workforce or has it remained the same?

Lower (0) Higher (1) Same (2) ☐

77. Do new staff receive any particular form of training?

Attendance of courses ☐

Work alongside other employees - informal ☐

Formal in house training ☐

Induction training ☐

None ☐

Other _____

78. How often, if ever, do existing staff undergo any form of training/retraining?

Every ☐☐ months

At start of employment only ☐

Other ☐

Never ☐

79. What form does this training take? **SHOW CARD N**

Lectures ☐

Video ☐

Slides ☐

Booklet ☐

Demonstrations ☐

Visits ☐

Courses ☐

Observation ☐

Film ☐

Other _____

80. Would you say that the training given is

Excellent (4) Good (3) Satisfactory (2) ☐

Fair (1) Poor (0)

81. At what stages from the idea of Cook Chill to implementation of Cook Chill, were members of staff consulted, if at all, with the decision to use Cook Chill?

| Member of Staff (level) | Earliest Consultation Stage | Continuous Consultation |
|---|---|---|
| Head Chef | ☐ | ☐ |
| Cooks | ☐ | ☐ |
| Kitchen assistants | ☐ | ☐ |
| Kitchen porters | ☐ | ☐ |

82. What problems, if any, do the staff experience with the operations of the Cook Chill system? **SHOW CARD O**

Recipes ☐

Temperature control ☐

Equipment ☐

Change to factory like production ☐

Staff attitude ☐

Change in skills ☐

Change in staff numbers ☐

Unions ☐

Production control ☐

Boredom ☐

Other ☐

83. How many, if any, of the staff are members of a trade unon? ☐

84. Which trade unions do these staff belong to?

_____

85. Which trade unions, if any, are formally recognised by the management?

_____

86. What other forms of employee representation, if any, exist within the company?

_____

87. What was the attitude of the trade unions to the introduction of Cook Chill?

_____

## CUSTOMERS

88. Who are the main users of the restuarant facilities at your various establishment(s)?

**Customer Type**

Hospital patients ☐

Office staff ☐

School children.students ☐

Casual customers ☐

Other staff ☐

Factory workers ☐

Management ☐

Other (state) _____

89. Has the customer any constraints placed on him on the tiem avaialble for eating the meal?

Lunch hour (0) Break (1) None (2) ☐

Other _____

90. Are customers aware than the food is being prepared using Cook Chill system?

Yes (1) No (0) ☐

91. What methods, if any, were employed to inform customers of a change in catering practice?

Talk ☐

Leaflet ☐

Special meal ☐

Other ☐

Video ☐

Photo display ☐

Discussion ☐

None ☐

## OPINIONS

92. Which of the following factors do you consider critical for the successful introduction of a chill system? **SHOW CARD P**

Management quality/enthusiasm ☐

Company commitment ☐

Planning/feasibility study ☐

Setting/mantaining standards ☐

Quality control ☐

Training/retraining ☐

Quality of staff ☐

Production/storage control ☐

Initial food quality ☐

Knowledge of Cook Chill ☐

Cost savings ☐

Energy savings ☐

Flexibility ☐

Purpose designed equipment ☐

Purpose designed building ☐

Other _____

93. Would it have been possible to achieve similar end products if the capital spent on cook chill had been used to upgrade the previous system? (could you expand a l ittle on this)?

Yes (1) No (0) ☐

94. How would you describe the standard of your previous system in comparison with cook chill?

Much worse (0) Worse (1) Satisfactory (2) ☐

Better (3) Much better (4)

95. In what ways, if any, has the Cook Chill system NOT lived up to its expectations? **SHOW CARD Q**

Not achieving expected cost savings ☐

Equipment not to specificaiton ☐

Transport difficulties ☐

Regeneration poor ☐

Rolling budget requirement ☐

Need more skills than expected ☐

Limited use ☐

Other (state) _____

96. What are the major problems, which you have experienced, with your Cook Chill system?

Inexperience ☐

Chilling ☐

Regeneration ☐

Recipes ☐

Equipment ☐

Customer attitudes ☐

Other _____

97. Would you encourage the use of Cook Chill elsewhere?

Yes (1) No (0) ☐

98. What further developments, if any, are planned for this operaton?

Expansion ☐

New CPU ☐

New sats ☐

Contracts ☐

Vending ☐

Cryogenics ☐

Sous vide/capkold ☐

Refinement of techniques ☐

Other _____

Past user/current non-user (0) Current user (1) ☐

Future user/pilot (2) Running down (3) ☐

I would now like to thank you very much for your help.

**Appendix 2c (cont)**

Operatives Information Schedule Serial No. _____

1 Job title/position _____

2 Length of service _____

3 Employed here prior to cook chill _____

4 First awareness of installation of cook chill _____

5 Describe training

6 Describe problems/advantages

7 Unsuccessful foods

8 Any improvements

# CUSTOMER SURVEY

Please help with a special survey being conducted by The Dorset Institute of Higher Education by answering the simple questions below.Please answer as accurately as possible!

Tick boxes where appropriate

1.How often do you eat at this establishment ?

Daily ☐ Weekly ☐ Several times per week ☐

Once a fortnight ☐ once a month ☐ once a year ☐

Other ( please state).....

2.What sort of a meal do you usually eat here ?

Breakfast ☐ Lunch ☐ Snack ☐

Sandwich ☐ Special occasion ☐ Dinner ☐

Other (please state ).....

3.What was the meal you have just eaten?

.....

.....

4.How would you compare the food you have just eaten with food you have eaten in this establishment previously?

Much better ☐ Better ☐ Same ☐ Worse ☐ Much worse ☐

Not eaten here before ☐

5.How would you rate the food normally served in this establishment ?

Excellent ☐ Good ☐ Satisfactory ☐ Fair ☐ Poor ☐

6.Please give any other comments which you feel are useful about the food served in this establishment

.....

.....

Thank you very much for your help with this survey.

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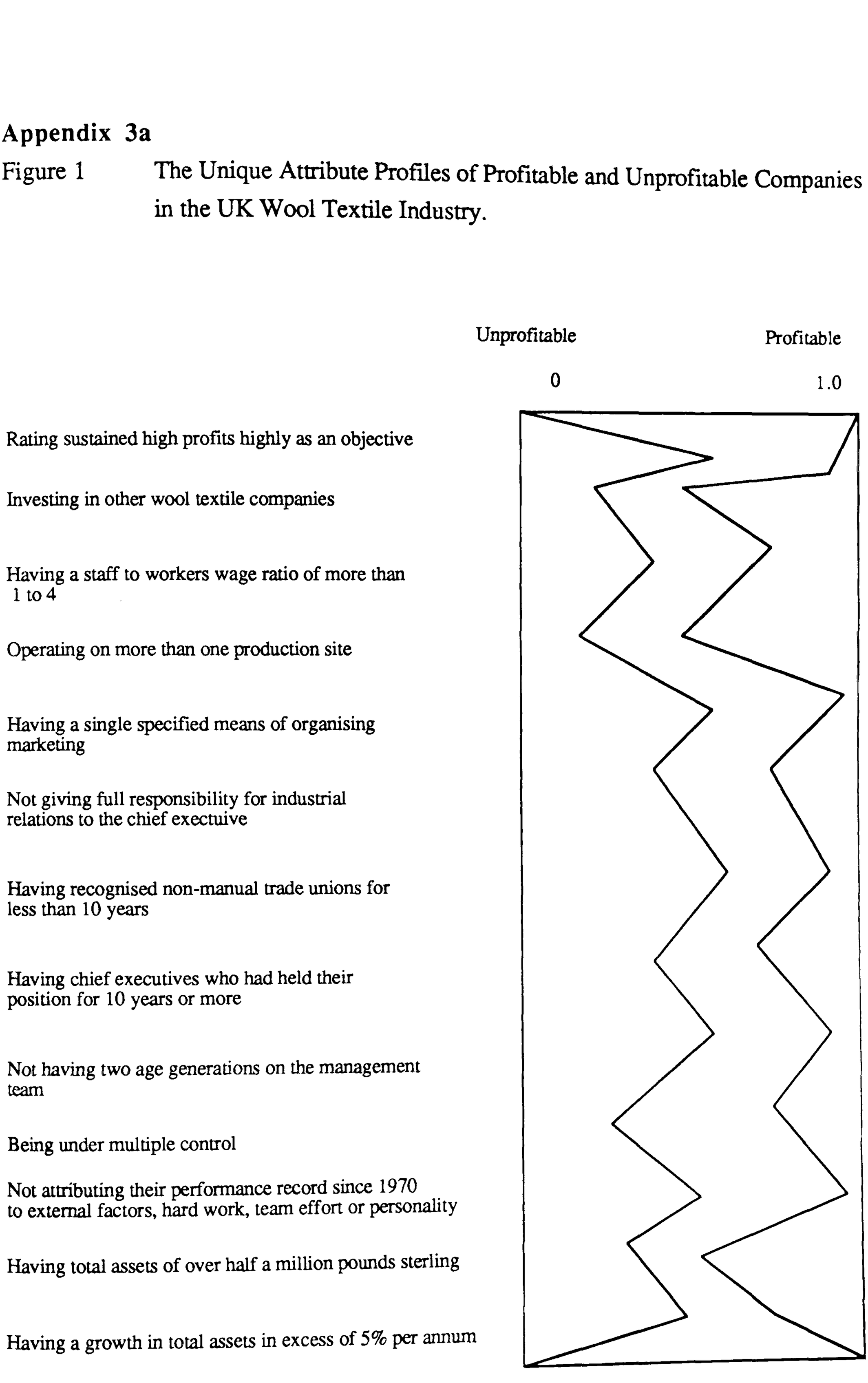
EDUCATIOI

## Appendix 3a

Figure 1 The Unique Attribute Profiles of Profitable and Unprofitable Companies in the UK Wool Textile Industry.




Source: GILLINGHAM (1980)

## Appendix 3a

Figure 2 Selected Criteria and Responses for the Assessment of Entrepreneurial Characteristics in New Manufacturing Enterprises

| | -1 | 0 | +1 |
|---|---|---|---|
| Education | minimum eg O levels | higher tech | science degree Professional |
| Future plans | no planned investment | aim to sell | plans for growth |

Source: NICHOLSON and BRINKLEY (1982).

## Appendix 3b

Table 1 Success Table of Complete Factors Plus Incomplete Factors 8 (finance) and 9 (employees)

| Serial No | Usage | Utilisation | Aims | Temp Control | Waste | Problems | Future | Finance | Employees | Total Score |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 34 |
| 20 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 34 |
| 52 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 33 |
| 28 | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 33 |
| 6 | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 3 | 32 |
| 2 | 4 | 4 | 4 | 3 | 4 | 4 | 2 | 3 | 4 | 32 |
| 54 | 4 | 1 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 32 |
| 13 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 32 |
| 48 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 31 |
| 36 | 4 | 2 | 4 | 4 | 4 | 2 | 3 | 4 | 4 | 31 |
| 80 | 4 | 4 | 5 | 2 | 3 | 2 | 3 | 4 | 4 | 31 |
| 1 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 3 | 2 | 30 |
| 3 | 4 | 3 | 4 | 4 | 2 | 3 | 4 | 4 | 2 | 30 |
| 10 | 4 | 3 | 2 | 3 | 4 | 3 | 4 | 4 | 3 | 30 |
| 58 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 1 | 30 |
| 22 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 3 | 1 | 29 |
| 42 | 4 | 4 | 2 | 3 | 3 | 3 | 4 | 4 | 2 | 29 |
| 44 | 4 | 2 | 4 | 3 | 4 | 3 | 4 | 3 | 2 | 29 |
| 41 | 4 | 4 | 1 | 4 | 4 | 1 | 4 | 4 | 3 | 29 |
| 30 | 4 | 1 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 29 |
| 70 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 1 | 3 | 28 |
| 39 | 4 | 3 | 3 | 3 | 2 | 4 | 2 | 4 | 3 | 28 |
| 43 | 4 | 2 | 3 | 3 | 4 | 3 | 3 | 2 | 4 | 28 |
| 16 | 4 | 1 | 2 | 3 | 4 | 4 | 4 | 4 | 2 | 28 |
| 12 | 4 | 2 | 3 | 2 | 4 | 3 | 4 | 4 | 2 | 28 |
| 8 | 4 | 4 | 2 | 3 | 4 | 1 | 4 | 3 | 3 | 28 |
| 79 | 4 | 3 | 3 | 3 | 4 | 2 | 3 | 3 | 3 | 28 |
| 61 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 1 | 1 | 27 |
| 11 | 4 | 3 | 3 | 3 | 4 | 2 | 2 | 2 | 4 | 27 |
| 14 | 4 | 4 | 2 | 2 | 4 | 3 | 3 | 4 | 1 | 27 |
| 35 | 4 | 1 | 3 | 3 | 4 | 4 | 2 | 4 | 2 | 27 |
| 63 | 4 | 3 | 3 | 4 | 2 | 3 | 3 | 1 | 4 | 27 |
| 37 | 4 | 3 | 2 | 3 | 2 | 1 | 4 | 4 | 4 | 27 |
| 25 | 4 | 3 | 2 | 2 | 4 | 2 | 4 | 4 | 2 | 27 |
| 53 | 4 | 2 | 3 | 2 | 4 | 2 | 3 | 3 | 4 | 27 |
| 78 | 4 | 2 | 3 | 1 | 4 | 4 | 3 | 3 | 2 | 26 |
| 38 | 4 | 3 | 2 | 3 | 2 | 2 | 4 | 4 | 1 | 25 |
| 57 | 4 | 1 | 2 | 3 | 4 | 2 | 4 | 4 | 1 | 25 |
| 62 | 4 | 3 | 2 | 4 | 3 | 3 | 1 | 4 | 1 | 25 |
| 31 | 4 | 3 | 3 | 2 | 2 | 3 | 3 | 1 | 4 | 25 |
| 24 | 4 | 3 | 3 | 3 | 2 | 1 | 2 | 4 | 3 | 25 |
| 23 | 4 | 1 | 3 | 2 | 4 | 2 | 3 | 2 | 4 | 25 |
| 32 | 4 | 4 | 3 | 1 | 2 | 2 | 3 | 1 | 4 | 24 |
| 59 | 4 | 2 | 2 | 2 | 4 | 4 | 1 | 2 | 3 | 24 |
| 34 | 4 | 2 | 2 | 3 | 2 | 2 | 4 | 2 | 3 | 24 |
| 27 | 4 | 4 | 1 | 3 | 3 | 2 | 4 | 1 | 1 | 23 |
| 15 | 4 | 2 | 2 | 1 | 2 | 4 | 4 | 2 | 2 | 23 |
| 72 | 4 | 1 | 3 | 3 | 2 | 2 | 3 | 1 | 4 | 23 |
| 75 | 2 | 4 | 3 | 4 | 1 | 2 | 1 | 4 | 2 | 23 |
| 64 | 4 | 1 | 2 | 3 | 3 | 2 | 1 | 4 | 3 | 23 |
| 51 | 4 | 2 | 1 | 3 | 3 | 2 | 2 | 4 | 1 | 22 |
| 65 | 4 | 3 | 1 | 2 | 2 | 3 | 4 | 1 | 2 | 22 |
| 49 | 4 | 3 | 1 | 4 | 3 | 3 | 1 | 1 | 1 | 21 |

## Appendix 3b

Table 1 (continued)

| Serial No | Usage | Utilisation | Aims | Temp Control | Waste | Problems | Future | Finance | Employees | Total Score |
|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 2 | 1 | 2 | 2 | 4 | 4 | 1 | 2 | 3 | 21 |
| 19 | 4 | 1 | 3 | 3 | 1 | 2 | 3 | 2 | 1 | 20 |
| 40 | 2 | 1 | 3 | 3 | 4 | 3 | 1 | 1 | 1 | 19 |
| 17 | 4 | 2 | 1 | 3 | 1 | 3 | 3 | 1 | 1 | 19 |
| 18 | 4 | 2 | 1 | 2 | 2 | 2 | 3 | 1 | 2 | 19 |
| 69 | 2 | 1 | 3 | 4 | 2 | 1 | 1 | 2 | 2 | 18 |
| 45 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| 46 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| 77 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |

## Appendix 3b

Table 2 Success Table of Complete Factors Plus Incomplete Factors 8 (finance) and 10 (consumers)

| Serial No | Usage | Utilisation | Aims | Temp Control | Waste | Problems | Future | Finance | Consumers | Total Score |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 35 |
| 6 | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 4 | 33 |
| 54 | 4 | 1 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 32 |
| 1 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 3 | 4 | 32 |
| 22 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 3 | 4 | 32 |
| 2 | 4 | 4 | 4 | 3 | 4 | 4 | 2 | 3 | 3 | 31 |
| 3 | 4 | 3 | 4 | 4 | 2 | 3 | 4 | 4 | 2 | 30 |
| 10 | 4 | 3 | 2 | 3 | 4 | 3 | 4 | 4 | 3 | 30 |
| 36 | 4 | 2 | 4 | 4 | 4 | 2 | 3 | 4 | 2 | 29 |
| 42 | 4 | 4 | 2 | 3 | 3 | 3 | 4 | 4 | 2 | 29 |
| 39 | 4 | 3 | 3 | 3 | 2 | 4 | 2 | 4 | 4 | 29 |
| 70 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 1 | 3 | 28 |
| 55 | 4 | 2 | 4 | 3 | 4 | 4 | 4 | 2 | 1 | 28 |
| 16 | 4 | 1 | 2 | 3 | 4 | 4 | 4 | 4 | 1 | 27 |
| 61 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 1 | 1 | 27 |
| 38 | 4 | 3 | 2 | 3 | 2 | 2 | 4 | 4 | 3 | 27 |
| 57 | 4 | 1 | 2 | 3 | 4 | 2 | 4 | 4 | 3 | 27 |
| 30 | 4 | 1 | 3 | 3 | 3 | 3 | 4 | 4 | 1 | 26 |
| 43 | 4 | 2 | 3 | 3 | 4 | 3 | 3 | 2 | 2 | 26 |
| 35 | 4 | 1 | 3 | 3 | 4 | 4 | 2 | 4 | 1 | 26 |
| 37 | 4 | 3 | 2 | 3 | 2 | 1 | 4 | 4 | 3 | 26 |
| 11 | 4 | 3 | 3 | 3 | 4 | 2 | 2 | 2 | 2 | 25 |
| 24 | 4 | 3 | 3 | 3 | 2 | 1 | 2 | 4 | 1 | 23 |
| 32 | 4 | 4 | 3 | 1 | 2 | 2 | 3 | 1 | 3 | 23 |
| 59 | 4 | 2 | 2 | 2 | 4 | 4 | 1 | 2 | 2 | 23 |
| 51 | 4 | 2 | 1 | 3 | 3 | 2 | 2 | 4 | 2 | 23 |
| 45 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| 46 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| 77 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |

## Appendix 3b

Table 3 Success Table of Complete Factors Plus Incomplete Factors 9 (employees) and 10 (consumers)

| Serial No | Usage | Utilisation | Aims | Temp Control | Waste | Problems | Future | Employees | Consumers | Total Score |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 34 |
| 6 | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 4 | 33 |
| 54 | 4 | 1 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 32 |
| 2 | 4 | 4 | 4 | 3 | 4 | 4 | 2 | 4 | 3 | 32 |
| 1 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 2 | 4 | 31 |
| 22 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 1 | 4 | 30 |
| 70 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 3 | 30 |
| 10 | 4 | 3 | 2 | 3 | 4 | 3 | 4 | 3 | 3 | 29 |
| 36 | 4 | 2 | 4 | 4 | 4 | 2 | 3 | 4 | 2 | 29 |
| 3 | 4 | 3 | 4 | 4 | 2 | 3 | 4 | 2 | 2 | 28 |
| 39 | 4 | 3 | 3 | 3 | 2 | 4 | 2 | 3 | 4 | 28 |
| 43 | 4 | 2 | 3 | 3 | 4 | 3 | 3 | 4 | 2 | 28 |
| 42 | 4 | 4 | 2 | 3 | 3 | 3 | 4 | 2 | 2 | 27 |
| 61 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 1 | 1 | 27 |
| 11 | 4 | 3 | 3 | 3 | 4 | 2 | 2 | 4 | 2 | 27 |
| 30 | 4 | 1 | 3 | 3 | 3 | 3 | 4 | 4 | 1 | 26 |
| 37 | 4 | 3 | 2 | 3 | 2 | 1 | 4 | 4 | 3 | 26 |
| 32 | 4 | 4 | 3 | 1 | 2 | 2 | 3 | 4 | 3 | 26 |
| 16 | 4 | 1 | 2 | 3 | 4 | 4 | 4 | 2 | 1 | 25 |
| 38 | 4 | 3 | 2 | 3 | 2 | 2 | 4 | 1 | 3 | 24 |
| 57 | 4 | 1 | 2 | 3 | 4 | 2 | 4 | 1 | 3 | 24 |
| 35 | 4 | 1 | 3 | 3 | 4 | 4 | 2 | 2 | 1 | 24 |
| 59 | 4 | 2 | 2 | 2 | 4 | 4 | 1 | 3 | 2 | 24 |
| 24 | 4 | 3 | 3 | 3 | 2 | 1 | 2 | 3 | 1 | 22 |
| 51 | 4 | 2 | 1 | 3 | 3 | 2 | 2 | 1 | 2 | 20 |
| 45 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| 46 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| 77 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |

## Appendix 3b

Table 4 Success Table of Complete Factors Plus Incomplete Factors 8, (finance) 9 (employees) and 10 (consumers)

| Serial No | Usage | Utili-sation | Aims | Temp Control | Waste | Problems | Future | Finance | Emp-loyees | Cons-umers | Total Score |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 38 |
| 6 | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 3 | 4 | 36 |
| 54 | 4 | 1 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 36 |
| 2 | 4 | 4 | 4 | 3 | 4 | 4 | 2 | 3 | 4 | 3 | 35 |
| 1 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 3 | 2 | 4 | 34 |
| 22 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 3 | 1 | 4 | 33 |
| 10 | 4 | 3 | 2 | 3 | 4 | 3 | 4 | 4 | 3 | 3 | 33 |
| 36 | 4 | 2 | 4 | 4 | 4 | 2 | 3 | 4 | 4 | 2 | 33 |
| 3 | 4 | 3 | 4 | 4 | 2 | 3 | 4 | 4 | 2 | 2 | 32 |
| 39 | 4 | 3 | 3 | 3 | 2 | 4 | 2 | 4 | 3 | 4 | 32 |
| 70 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 1 | 3 | 3 | 31 |
| 42 | 4 | 4 | 2 | 3 | 3 | 3 | 4 | 4 | 2 | 2 | 31 |
| 43 | 4 | 2 | 3 | 3 | 4 | 3 | 3 | 2 | 4 | 2 | 30 |
| 30 | 4 | 1 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 1 | 30 |
| 37 | 4 | 3 | 2 | 3 | 2 | 1 | 4 | 4 | 4 | 3 | 30 |
| 11 | 4 | 3 | 3 | 3 | 4 | 2 | 2 | 2 | 4 | 2 | 29 |
| 16 | 4 | 1 | 2 | 3 | 4 | 4 | 4 | 4 | 2 | 1 | 29 |
| 61 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 1 | 1 | 1 | 28 |
| 38 | 4 | 3 | 2 | 3 | 2 | 2 | 4 | 4 | 1 | 3 | 28 |
| 57 | 4 | 1 | 2 | 3 | 4 | 2 | 4 | 4 | 1 | 3 | 28 |
| 35 | 4 | 1 | 3 | 3 | 4 | 4 | 2 | 4 | 2 | 1 | 28 |
| 32 | 4 | 4 | 3 | 1 | 2 | 2 | 3 | 1 | 4 | 3 | 27 |
| 59 | 4 | 2 | 2 | 2 | 4 | 4 | 1 | 2 | 3 | 2 | 26 |
| 24 | 4 | 3 | 3 | 3 | 2 | 1 | 2 | 4 | 3 | 1 | 26 |
| 51 | 4 | 2 | 1 | 3 | 3 | 2 | 2 | 4 | 1 | 2 | 24 |
| 45 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 11 |
| 46 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| 77 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |

Figure 1 Positional Change Effects of Factors 8 (finance) and 9 (employees) on Table 3.1

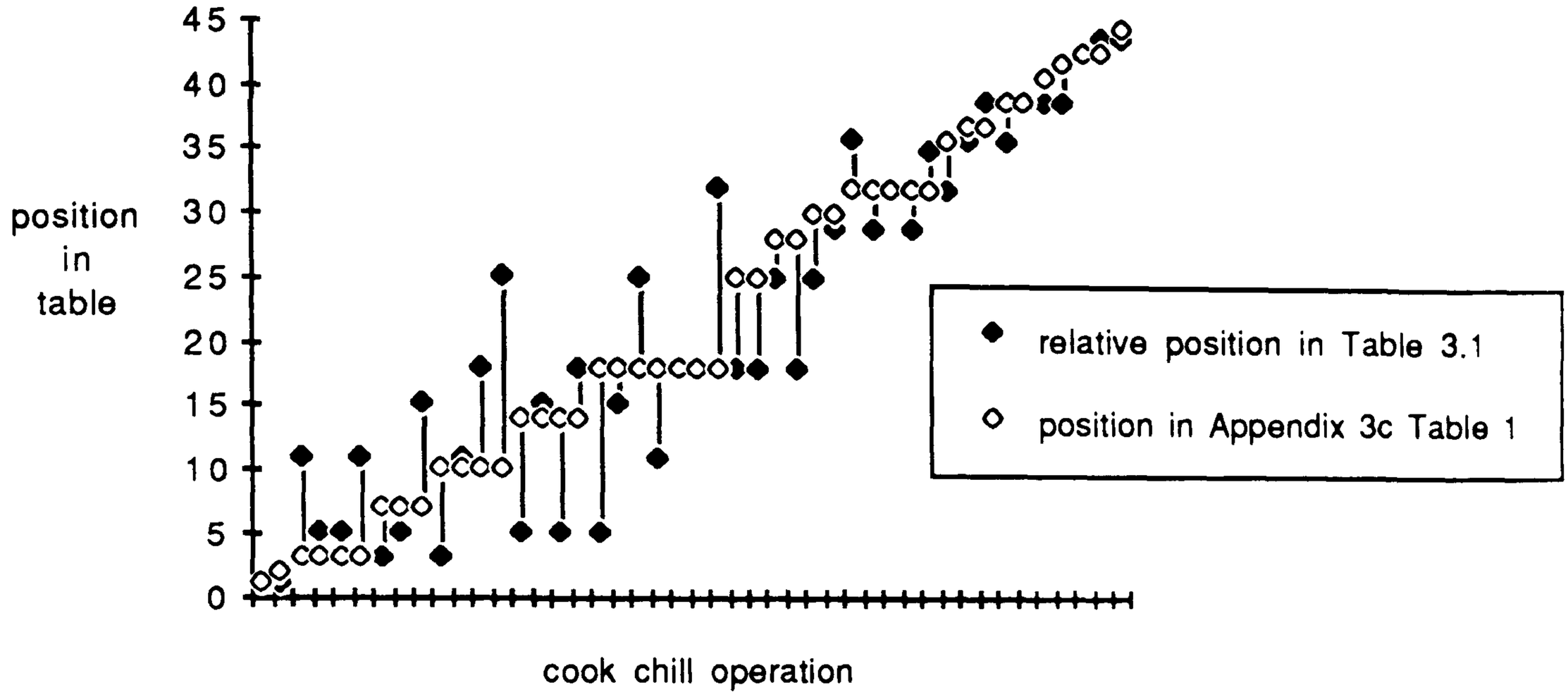
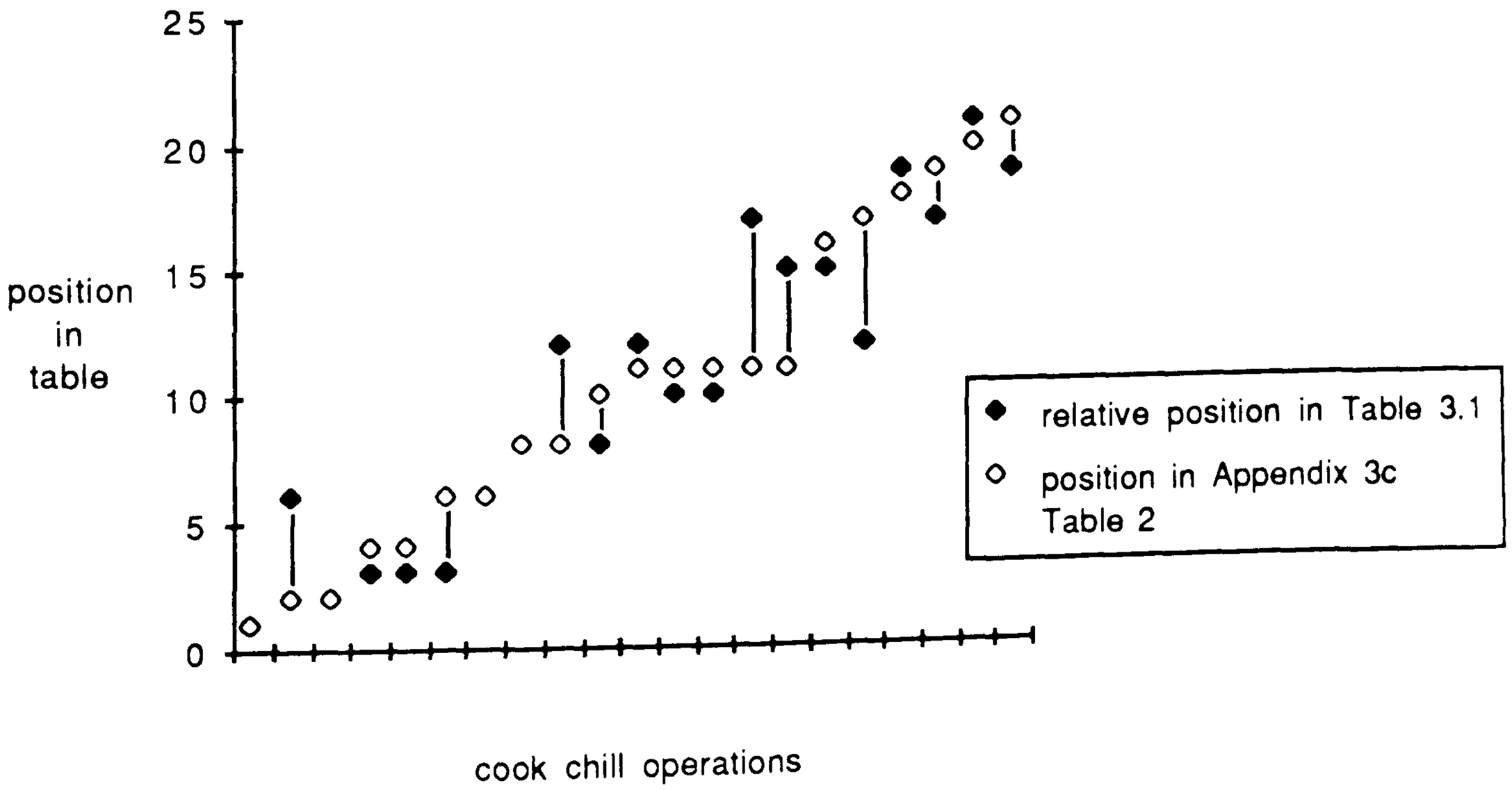



Figure 2 Positional Change Effects of Factors 8 (finance) and 10 (consumers) on Table 3.1



## Appendix 3c

Figure 3 Positional Change Effects of Factors 9 (employees) and 10 (consumers) on Table 3.1

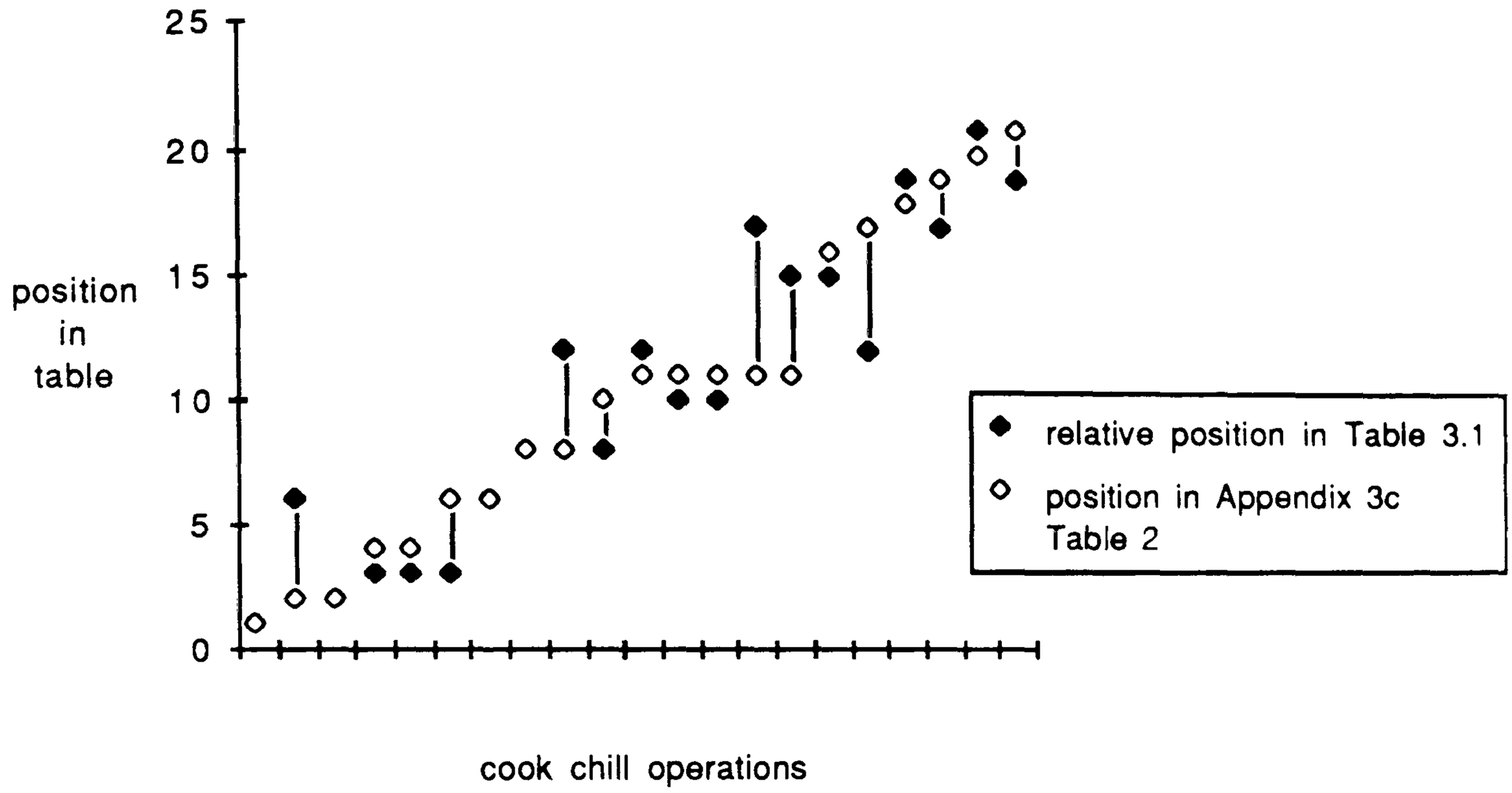
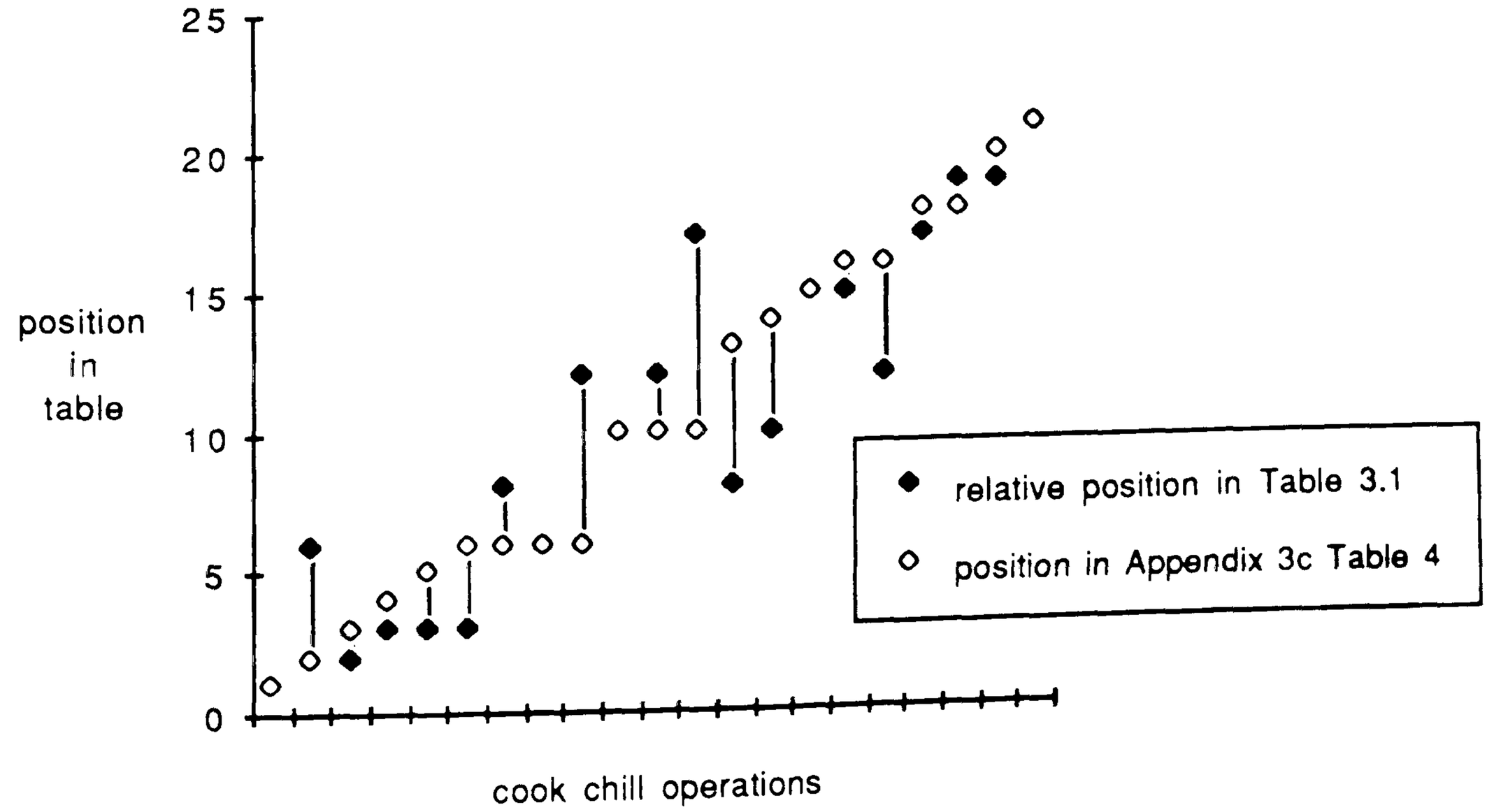



Figure 4 Positional Change Effects of Factors 8 (finance), 9 (employees) and 10 (consumers) on Table 3.1



## Appendix 3d

Figure 1 Correlation Matrix of Positional Change Effects of Incomplete Factors on Table 3.1 •

| Relative position in Table 3.1 with respect to operating in: | Position in Table 3.2 | Table 3.3 | Table 3.4 | Appendix 3b Table 1 | Appendix 3b Table 2 | Appendix 3b Table 3 | Appendix 3b Table 4 |
|---|---|---|---|---|---|---|---|
| Table 3.2 | .8371** | .8575** | .6976** | .7685** | .6293** | .7277** | .6149** |
| Table 3.3 | .9252** | .9022** | .7325** | .8568** | .7639** | .7825** | .6954** |
| Table 3.4 | .8662** | .9004** | .7325** | .8201** | .6758** | .7795** | .6611** |
| App3b Table1 | .7492** | .8649** | .8872** | .6685** | .7405** | .8205** | .6858** |
| App3b Table2 | .9097** | .8965** | .7175** | .8560** | .7565** | .7807** | .7019** |
| App3b Table3 | .8775** | .8748** | .8787** | .8380** | .9163** | .8708** | .8726** |
| App3b Table4 | .7544** | .8767** | .8851** | .7023** | .7451** | .8380** | .7173** |

** significant ≤ .001
•calcualted as Pearson correlation coefficients