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The European Network of Excellence on Serious Games

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ABSTRACT	This report reviews the progress of WP7 in the second year. The aims and work plans for the year are reviewed. The activities and results of the year's work are reported. In the second year, work on the SG Integration Framework was completed and published; cases of integration of SGs in companies were collected and a preliminary analysis completed. Work on SG metrics for companies continued and a report included as a chapter. The community building activities continued with online communication and physical events. The plans for work in year three were presented.
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SEVENTH FRAMEWORK PROGRAMME

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ABBREVIATIONS

2D   2 Dimensional (graphics)

3D   3 Dimensional (graphics)

CEO   Chief Executive Officer

COTS   Commercial Off The Shelf (software)

DOI   Diffusion of Innovation

iCALT   International Conference on Advanced Learning Technologies

IT   Information Technology

LMS   Learning Management System

MAN   Carol I Defense University, Bucharest

NATO   North Atlantic Treaty Organization

NURC   NATO Undersea Research Centre

OEB   Online Educa Berlin

SG   Serious Game

SME   Small and Medium size Enterprise

SVW   Serious Virtual World

TAM   Technology Acceptance Model

VRC   (VRC) Virtual Research Centre

EXECUTIVE SUMMARY

This document presents the second annual report of Workpackage 7 – SG Integration in Corporate Training. There were three main streams of work in the second year: SG integration case studies, SG metrics for companies and community building. Scientific publications were produced from the results of the research carried out in the first two years on SG adoption and integration.

On SG integration the classification framework of the ways serious games can be integrated in to companies was validated through a collection of SG cases relevant to business/industry. The four ways of integrating SGs In companies are: as training, as corporate change/strategy interventions, through viral diffusion and as gamification. The results of this work are presented in chapter two and were also published at the Tier 1 iCALT 2012 conference.

A review of the literature on technology adoption was prepared to produce a hybrid research framework which was used to inform the research on integration – sections 3.1 and 3.2. This framework combined the insights from the technology acceptance model and the diffusion of innovation literatures. The factors which can influence SG adoption were identified as: organizational, individual, environmental, and SG specific, etc.

The five cases of SG integration we collected were from large organizations (>1,000 employees) to very large organizations (>100,000 employees). Also the organizations had a positive attitude to new technology and this is thus a prerequisite for serious games use. There was use of serious games for training (three cases) and for corporate change interventions (two cases); but not for gamification. In most of the cases a single serious games was in use. Only in two cases was more than one serious game in use – three commissioned games in the ABN case and multiple use scenarios in the OpenSea case. In the OpenSea case the organization built a powerful and feature rich simulator which allows experimentation with different scenarios. Most of the organizations commissioned the SG from an external party and only in two cases did the organization itself develop the SG. In the two corporate change cases the serious game was commissioned as consultancy through the facilitator.

In terms of the deployment, or internal diffusion, of serious games it was mostly limited to company branches or departments; only in the case of NATO was there widespread use. The numbers of SG participants in the cases was generally quite high – in the hundreds.

The stated benefits of serious games were: they can get everyone involved; they are the modern way to learn and produce quick, cost effective learning results. In the corporate change cases the use of serious games signals a change and this helps to promote the cultural change objectives of the intervention. In the military cases the most important benefit was that SGs allow trainees to experience situations that would be impossible in the real world for reasons of safety, cost or time; they thus provide risk-free training means.

Barriers to adoption were found to be SG duration, cost, and that minimum computer skills are required. The company culture can also be a barrier, whether being technical oriented or anti-game. Barriers during the implementation of serious games also occurred – they are competitors to existing training programmes, they can require a strategic change including the reallocation of resources, the provision of PCs and dedicated physical space.

In terms of success factors the cases showed that senior management support was critical for adoption. There were a number of factors which enabled the SGs to be successful in use: SG 'product' champion, thorough advanced preparation, use of a facilitator, the SG being based on existing management theories, including the SG in online course platforms, good IT knowledge and the commitment of several stakeholders in the organization. The key finding from the analysis of the integration cases is that senior management support is critical for SG adoption in every case. Therefore, the question of how the acceptance of senior management was gained needs to be investigated in the next in-depth study stage. How was senior management convinced of the benefits and by whom?

The work on SG metrics for companies proposed that an approach for measuring the effectiveness of SGs in corporate settings requires two major paradigm shifts in the existing metrics design, the two being related to each other. First, we propose a shift from measuring an asset to measuring a process that is, measuring the process of knowledge transfer in corporate settings rather than the knowledge outcome. The knowledge transfer is understood as the transfer of what has been learned to workplace practices and the transfer of tacit to explicit knowledge - both processes are of fundamental importance in the contemporary knowledge-based economy.

Related to this is the second paradigm shift from "measure in order to control" to "measure in order to understand the field". To this end we aim at understanding the relationships between game features and use this knowledge when designing the metrics. The features reviewed were: usability, playability, engagement, immersion, presence, flow and absorption. A working paper prepared on our metrics framework was presented at the VS-Games 2012 conference in October.

 In the second phase of our work on metrics we are moving towards conducting concrete empirical studies that can inform the design of metrics. Our goal, besides the understanding of how game mechanics/ features are related to learning outcomes, is to incorporate the results of the empirical studies into the refined metrics design. We aim to create metrics that can inform the game design at different stages of the game development so that any significant changes in the game can be done early and timely and not when the game is finished, when all changes are very costly. Work on metrics for measuring the effectiveness of the integration of SGs in companies will be brought into focus in year three.

The link between training provision for employees and job performance is affected by a number of factors. In the training process, incentives behind training for employees, the appropriateness of training designs, management support and employees' individual characteristics tend to be factors which have influences on the training effectiveness. Meanwhile, the successful transfer of learning, which is obtained in the training, into improved job performance is also influenced by a series of factors: Employees' individual characteristics, work organisation, resources available and finally management's complementary strategies.

The work on community building for Business and Industry continued with the multiple strategies of online LinkedIn groups, events and the preparation of publications. The LinkedIn group on SGs is still growing and a new group on Gamification was started. Many events were organized and participated in, building on the first year's momentum.

Metrics for the workpackage were identified and a table of achieved against target included. In terms of publications 7 conference papers were published, 5 case studies collected and 11 industry events organized.

Finally, this document reviewed the future work in WP7 for the third year of the project – the in-depth case studies, the compilation of guidelines for SG integration, the preparation of articles for publication in the industry and professional press and continuing the events and community building.

1   Introduction

This document (Deliverable D7.2) describes the results of the work progress achieved in Work Package 7 SG Integration in Corporate Training of the GaLA Network during the second 12 months of the project. The document describes the approach taken to carry out the work and provides an outlook on the activities for the third year. There were three main streams of work in the second year: SG integration case studies, SG metrics for companies and community building. Scientific publications were produced from the results of the research carried out in the first two years on SG adoption and integration.

On SG integration the classification framework of the ways serious games can be integrated in to companies was validated through a collection of SG cases relevant to business/industry – chapter two. The four ways of integrating SGs In companies are: as training, as corporate change/strategy interventions, through viral diffusion and as gamification.

A review of the literature on technology adoption was prepared to produce a hybrid research framework which was used to inform the research on integration – sections 3.1 and 3.2. This framework combined the insights from the technology acceptance model and the diffusion of innovation literatures. A methodology for the collection of case studies of SG integration was designed – section 3.3. This is a two-stage one of firstly collecting exploratory cases to develop understanding and theory; second, in-depth case studies focusing on the integration process. A series of five exploratory case studies were collected. This report presents these cases (sections 3.4 to 3.8) and their analysis (section 3.9). A number of conclusions and research questions were identified from the analysis (3.10).

The work SG metrics for companies was described in chapter four, including a review of the metrics currently used in the literature for assessing the impact of SG features. Secondly, a review of the factors affecting the transfer of training to job performance is presented in chapter five.

The work on community building for Business and Industry in year two is described in chapter six, with the multiple strategies of online LinkedIn groups, events and the preparation of publications. The LinkedIn group on SGs is still growing and a new group on Gamification was started. Many events were organized and participated in, building on the first year's momentum.

Metrics for the workpackage were identified and a table of achieved against target included – chapter seven. In terms of publications 7 conference papers were published, 5 case studies collected and 11 industry events organized.

Finally, the plan for years three and four is presented along with numerical targets and deadlines – chapter 8. In year three the plan is to collect in-depth case studies, compile the guidelines for SG integration, prepare articles for publication in the industry and professional press and continue the events and community building.

1.1   WP7 Objectives

WP7 objectives are:

- Investigate how to best integrate different kinds of SGs and SVWs into real corporate training

processes in different stages and in different scenarios using sound pedagogical approaches

• Elicit requirements from end-users and corporate training stakeholders, via key stakeholder groups.

• Collect, systemize and structure experimental data in order to build metrics for assessing and supporting the deployment of SG in corporate training settings.

• Elaborate specific methodologies for non-intrusive integration of SGs and SVWs in the existing training contexts

• Gather and nurture a community of corporate users and stakeholders that are interested in studying, assessing and promoting the adoption of SGs.

WP7 consists of 4 tasks (task leaders are in brackets):

- Task 7.1 Corporate user and training stakeholder requirements (CEDEP)
- Task 7.2 Metrics for SG in corporate training (Cyntelix)
- Task 7.3 Integration methodologies for corporate training (UNOTT)
- Task 7.4 Community of corporate users (NURC)

1.2   WP7 Time Plan

The chart below illustrates the time plan for different tasks within the WP7. The Workpackage lasts for the full project duration of 48 months. Each deliverable (D7.1, D7.2, D7.3 & D7.4) is due at the end of each year till the end of the project. The first deliverable (D7.1) reported on the state of the art for serious games in business and industry; proposed the SG integration classification framework; and reported on the results of the SG survey of UK companies. The work in year one mainly contributed to the identification of stakeholder requirements. The major focus of the work in year two shifted to the collection of integration case studies. The work on metrics and community building continued.
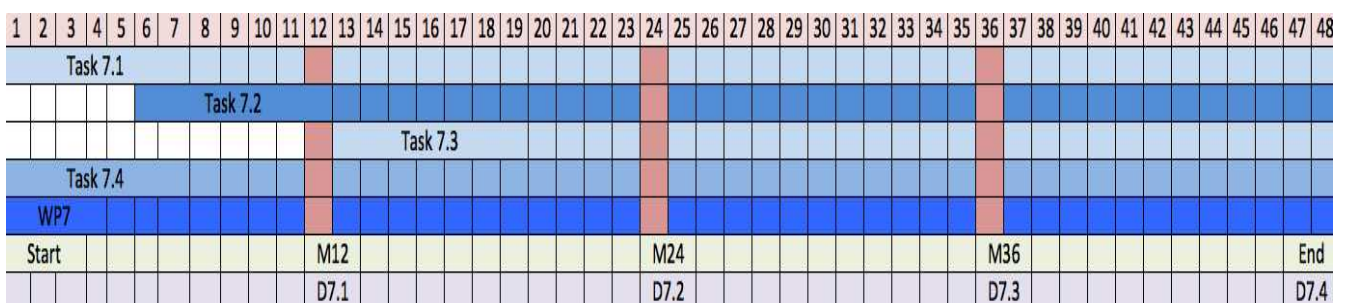

Figure 1: WP7 Time Plan

2   SG Integration Classification Framework in Companies

This consisted of the finalisation of the SG Integration Framework developed in year one (see GALA deliverable D7.1). The classification framework was developed to help understand the different ways serious games can be used in companies. The framework was designed to help understand in what alternative ways Serious Games have been, and can be, used in companies. It helps to organize the knowledge and understanding towards the integration of Serious Games in corporate settings. This will help to build theory about how companies can use serious games and how they can be integrated into companies. In year two work was undertaken to validate this framework.

In order to validate this framework, cases of serious games were identified from experts, conferences, events, developer companies and the Gala Network. These cases were reviewed to identify serious games relevant to business and management. From these, cases were collected of serious games application/use in companies. These were then classified according to the types of use in the classification framework. The identified ways serious games can be used in companies were: in corporate training, for change management, through viral diffusion and Gamification, see figure 2 below. This work was written up as a paper and published at the Tier 1 conference iCALT 2012 in July - Azadegan & Riedel (2012).
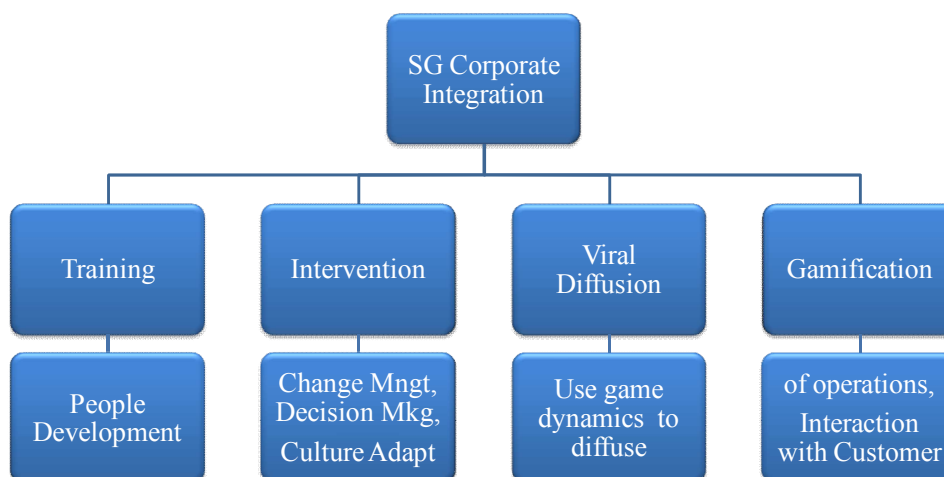
Figure 2: Classification of Serious Games Integration in Companies

The below descriptions of the four SG integration ways were first presented in the first annual report, D7.1. They are reproduced here for convenience; section 2.5 following it, describes the SG case collection method used to validate the framework.

2.1 Corporate Training

Serious Games-based learning is gaining credibility and popularity for corporate training. As more and more people play computer-based games for entertainment, corporate employees have come to engage easily with game metaphors and interfaces. Employees enjoy the interactivity, and most people will select "playing a game" as the preferred learning model when given a choice. In addition, according to the results of research on Serious Games performed within the GaLA network, the effectiveness of knowledge transfer to the job makes Serious Games a good investment for the company. An example is INNOV8 developed by IBM (2011).

2.2 Active Company Intervention

Within the tradition of change management, interventions in companies (typically by consultants) have been used to improve the company. Serious Games have also been used as interventions in companies. The aim of these interventions is not to train people, but rather to help transform the people and the company. Classic examples of this approach are LEGO® Serious Play™, a facilitated workshop, where participants are asked different questions in relation to an ongoing project, task or strategy (Lego, 2011; Lund et al, 2011)) and the SimLab™ method (Smeds et al, 2006; Smeds and Poyry-Lassila, 2011).

2.3 Viral Diffusion

Similar to viral marketing, the viral diffusion of games in the corporate environment can happen through many strategies using social networks, word of mouth and other techniques. Games integrated through viral diffusion happen outside the formal structure and training processes of companies – the Serious Games are simply made available to all the relevant staff and marketing campaigns, or tournaments organized, to encourage playing of the game (Van der Pols, 2011). This strategy for integration is new and has been enabled by employees having desktop computers and especially recently by mobile phone gaming.

2.4 Gamification

Finally, Gamification (also known as "funware") has emerged in the last couple of years. It is the use of game design techniques and mechanics to solve problems and engage audiences. Typically Gamification applies to non-game applications (Zichermann & Linder, 2010). Gamification works by making technology more engaging, by encouraging desired behaviours, and by taking advantage of humans' psychological predisposition to engage in gaming (Radoff, 2011). The technique can encourage people to perform chores that they ordinarily consider boring, such as completing surveys, shopping, or reading web sites. Gamification can be leveraged by companies as a sophisticated marketing technique (Cook, 2010), or where customers are engaged in games, while simultaneously being exposed to the company – for example Siemens' Plantville (Krampe, 2011).

2.5   SG Case Collection Methodology

The Serious Games cases were collected from different sources described below:

1) Consultation with colleagues from the GALA network: Case studies were collected from, and discussed with, GALA network partners during regular meetings and during meetings of the two special interest groups - SIG 3.1 Business and Management and SIG 3.2 Engineering and Manufacturing.

2) Reviewing the last five years of the proceedings of the International Federation for Information Processing (IFIP) Working Group 5.7 Special Interest Group (SIG) Workshop on Experimental Interactive Learning in Industrial Management: The papers published in the SIG workshop proceedings for the years 2007-2011 were reviewed: Thoben et al (2007), Riedel et al (2008), Schönsleben et al (2009), Taisch et al (2010) and Smeds (2011).

3) From consulting experts attending an industry event on Gamification (Games for Brands, London, 27 October 2011): cases of Gamification were collected by attending the presentations of the speakers who were representing Game companies active in game design and development, as well as through discussions with the experts at the event.

4) Reviewing case studies online: By doing a Google search for Serious Games developer companies' websites and looking for case studies of serious games focusing on business, management and those used in companies.

In total, 256 cases studies of serious games were reviewed and from these the number of cases that were relevant to business, management, and industry was 101. Of the 256 Serious Games identified 39% were relevant to business and management; the others were relevant to education, health, etc. However, only a small number of actual applications in industry were identified – 23% of all Serious Games identified. The number of cases of application of serious games in companies was 59. Table 1 shows the results of the case collection process.

Case Collection Source	Number of Identified Serious Games/ Cases	Number of SGs in Business and Management	Number of SGs used in Companies
GALA Network Colleagues	74	52	22
Recent IFIP SIG Proceedings	44	23	8
Games for Brands event	40	3	3
Online case studies	98	26	26
Total	**256**	**101**	**59**

Table 1: Summary of Identified Serious Games and Cases

Analyzing the identified cases we concluded that there were only a few ways that serious games can be used in companies. All 59 of the Serious Games cases used in companies were successfully classified according to the framework. This development of this framework is the first step to understanding how serious games can be used in companies. The framework forms the first element of theory needed for research. Theory building from case study research is particularly appropriate because theory building does not rely upon previous literature or prior empirical evidence (Eisenhardt, 1989).

Future work can focus on refining the integration framework by carrying out in-depth case studies of Serious Games adoption in companies. Documenting more case studies can help make a stronger justification of the framework. Work can focus on understanding the barriers, gains and benefits of serious games, and then to investigate how to improve the benefits, and overcome the barriers towards, the use of Serious Games in companies. The Framework helps us to build up understanding Serious Games integration more effectively and defines the basis for future research in the field. There is a need to carry out in-depth case studies of the implementation of Serious Games within companies for each of the identified ways of integration introduced by the framework.

3   SG Integration Case Studies in Companies

Case Studies of SG integration in companies were carried out to further the research on SG adoption and to determine how SGs can be integrated in companies. The case studies can also be used to derive the guidelines for SG integration and to provide examples for dissemination purposes. This chapter describes the theoretical background to SG adoption and the case study methodology. It then presents the cases studies and their analysis. The next section reviews the literature on technology adoption and gives an overview of the factors that affect the adoption of IT innovations.

3.1   *Serious Games Integration Theory*

Theoretical work on innovation adoption and how SGs can be seen as innovations was carried out. Scholars from a variety of disciplines have studied different perspectives of innovation and referred to innovation as a complex construct. At the corporate level, researchers have generally defined ''innovation'' as the development (generation) and/or use (adoption) of new ideas or behaviours (Damanpour and Wischnevsky 2006; Walker 2008; Zaltman, Duncan, and Holbek 1973). Organizations produce and introduce innovation for their own use or for use in other organizations. The generation of innovation is a process and the outcome is new to the corporate community (Damanpour and Wischnevsky 2006). Information technology based innovations, such as Serious Games, need to be integrated in companies, however, integration is a complex and challenging process (Online Educa, 2011).
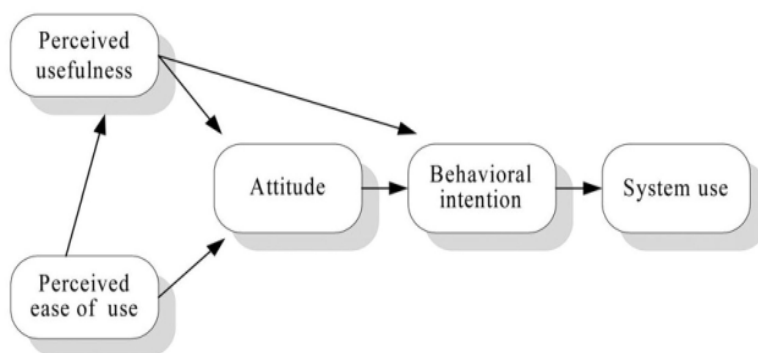
Figure 3: Technology Acceptance Model

There are two main models of IT adoption/ use – the Technology Acceptance Model (TAM) (Davis, 1989) and the Diffusion of Innovation (DOI) model (Rogers, 1985). TAM focuses on individuals involved in the adoption process and tries to predict IT system adoption based on the attitudes of these individuals (see figure 3 above). The two key factors influencing individuals' propensity to adopt are the perceived usefulness and perceived ease of use of the technology. Perceived usefulness is defined as the extent to which a person believes that using the system will enhance their job performance. Perceived ease of use is defined as the extent to which a person believes that using the system will be free of effort. TAM theorizes that the effects of external variables (e.g., system characteristics, development process, training) on intention to use are mediated by perceived usefulness and perceived ease of use. Further, according to TAM, perceived usefulness is also influenced by perceived ease of use because, all other things being equal, the easier the system is to use the more useful it can be.

The diffusion of innovation model, on the other hand, models the characteristics of an innovation that affect an organisation's propensity to adopt it. Many factors have been shown to affect diffusion and adoption of innovations. These factors can be grouped into three categories: characteristics of the innovation itself; characteristics of individual and organisational adopters; and characteristics of the environment. The characteristics of innovation that have been found to influence adoption are: relative advantage, compatibility, complexity, observability and trialability (Rogers, 1985). Individual characteristics include age, education, social status and attitude to risk. Environmental and institutional characteristics include economic factors such as market environment and social factors such as communication networks.

The table below summarises the characteristics of an innovation that have been found to affect adoption.

Relative advantage	The degree to which an innovation is perceived as better than existing solutions or competing innovations. The advantage can be in terms of cost, payback, convenience, satisfaction, or prestige.
Compatibility	The degree to which an innovation is compatible with existing values, skills, experience, practices, equipment, procedures and needs.
Complexity	The degree to which an innovation is perceived to be difficult to understand or use. The simpler an innovation is for users the faster its adoption.
Observability	The degree to which the results of an innovation are visible to others. The easier the benefits of an innovation can be seen by others the more likely they will adopt it.
Trialability	The degree to which an innovation can be experimented with on a limited basis. An innovation that is trialable presents less uncertainty to adopters and allows learning by doing.

Table 2: Rogers' Diffusion of innovation factors (1985)

The diffusion of an innovation has been shown to follow an s-curve. One of the key factors is promoting adoption is information transfer from adopters to non-adopters. Adopters will have credibility in the eyes of potential adopters. Hence, early adopters are best positioned to disseminate the learning from experience to potential adopters, and the more early adopters there are the faster this process of dissemination. Initially the needs of innovators or early adopters dominate and hence the characteristics of an innovation are most important. However, innovations tend to evolve over time due to improvements required by early adopters, which may reduce relative cost to later adopters. But early adopters are 'atypical' in that they tend to have higher technical skills, and their preferences could skew the innovation process by forcing the adoption of inferior technologies or the abandonment of superior ones.

The two TAM and DOI models have formed the basis for the development of hybrid models combining both of them and for extended models of each of them (particularly TAM). However, as Hameed et al point out:

> Adoption of IT in organizations is influenced by a wide range of factors in technology, organization, environment, and individuals. Researchers have identified several factors that either facilitate or hinder innovation adoption.   Hameed et al, 2012.

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3.2   Hybrid Research Framework

We need a framework which can be used to inform our understanding of what factors can affect adoption of SGs and to develop research questions for investigation in the case studies. We can produce a hybrid research framework which builds on the insights of TAM and DOI. The following key factors have been adapted from the recent reviews by Brown & Russell (2007) and Hameed et al (2012):-

Factor	items
Technological Factors	Compatibility, perceived benefits/ relative advantage, cost, complexity
Organisational Factors	Organizational size, IT expertise, Top management support, Resources, IS department size, IS infrastructure, Formalization, Centralization, Organizational readiness, Product champion
Environmental Factors	Competitive pressure, demands from trading partners and customers, support from government, and environmental uncertainty; external support, change agents
Contextual Factors	Industry sector, public or private organisation.
Individual Factors	CEO's knowledge of IT and his or her attitude towards IT

Table 3: Hybrid Research Framework Factors and Items - adapted from: Brown & Russell (2007) and Hameed et al (2012)

There are also a number of other factors which need to be considered: type of organization: manufacturing, service, mixed; and size of organization: large, small and medium enterprises (SMEs) (Hameed et al, 2012). Of course there will be factors which are specific to SGs – such as the type of SG (according to the SG integration classification), use of a facilitator, SG technology (2D/3D), etc. And practical factors – possession of PC equipped classrooms or intranets for online delivery. These factors will be drawn on to design the case study questionnaire (see below) and need to be kept in mind while carrying out the case studies. The next section describes the methodology for the integration cases.

3.3   Integration Case Study Methodology

As mentioned above the integration case studies have been designed as exploratory case studies. Exploratory, qualitative case studies are more appropriate to support theory development, to capture and understand the social and organizational context in which the phenomenon under investigation occurs (Yin, 2009). Further, when a phenomenon is still under development, as SGs are, a flexible and exploratory research design is required Creswell (1994) cited in Bunduchin et al (2011). We also want to gather the perceptions of the actors (regarding costs, benefits and barriers, etc) involved in the SG integration process and what the changes to practice were. A qualitative research design allows both the flexibility and exploration that are required for our investigation of the SG integration process.

The process of collecting the case studies is a two-stage one – a first stage of exploratory case studies to get a general understanding of the issues and to identify research questions and a second stage of in-depth case studies to examine the integration process. Due to the low level of adoption and awareness of SGs found by the SG Survey of UK companies (GALA D7.1, Azadegan et al 2012) it would be difficult to find companies with

whom to carry out case studies. Therefore, we needed to use GALA contacts to find suitable case studies. The exploratory case studies were collected through a GALA WP7 partner that had carried out an SG intervention in a company (preferably in recent years) or had good first-hand knowledge of an SG intervention in a company. This resulted in four new cases being collected to complement the one collected in year one. This approach has the benefit of maintaining a good relationship of trust with the case companies and avoids long negotiations with companies to gain access where we did not already have a contact. So the exploratory cases were part of a trust building process. Exploratory research is typically conducted for a research question that has not been clearly defined, and it helps determine the best research design, data collection methods and sample selection in the next stage of research. The advantage of this approach is that we get some reasonable quality data which we can analyse to identify the important research questions for further investigation in the second-stage of in-depth case studies. It does, however, have some limitations: we get only one perspective (the contact persons') and we do not get the views of different persons involved in the SG integration (eg. CEO, managers, SG participants, etc). These limitations can be overcome in the second round of in-depth case studies – where we can interview several persons involved in the SG integration to get a holistic picture of the process. These in-depth case studies will be carried out by the workpackage leader's team; whereas for the companies that have confidentiality issues the interviews will be done by the GALA contact person. The in-depth case studies will be conducted in year three. They will be based on the findings of the exploratory cases to further investigate the research questions that emerged from the analysis of the exploratory cases.

To gather the case data a questionnaire was prepared, based on the work done in year one on the SG Survey and drawing on the theoretical work on adoption described above. This questionnaire was kept short and focused on the key issues. The questionnaire was then completed by the GALA contact persons for each case study. The questionnaire (Appendix A) consisted of the following topics:-

Topic	Rationale
Organisation details	Basic details: size, industry – to see if there are any differences between industry sectors or company size.
Adopted SG, Aims of adoption, adoption attitude	The nature of the SG adopted; why it was adopted and the company's attitude to technology adoption (innovator, early adopter, etc).
SG Awareness, Rationale for adoption	How did the company become aware of SGs – this will help us target dissemination materials. Rationale – what are the important factors encouraging adoption.
Description of use	How was the SG used – as part of training courses, a special initiative, and numbers of users? This can help us understand what are the best ways to integrate SGs.
Barriers encountered	What barriers were encountered and how were they overcome. Allows us to understand if SG technology needs adapting to users, what things prevent use.

Benefits of use	Achieved benefits of using SGs – so we can promote SGs to potential adopters.
Changes to practice attributable to SG	What had to be done to use the SG? Were these changes negative or positive? If positive then can be used in promoting SGs. If negative then how can they be overcome?
How SG overcame problems	What was the impact of the SG – again for use in dissemination material.
Benefits for stakeholders (non-participants, management)	What were the benefits for the decision-makers and other stakeholders? Were they significant, useful for dissemination material?
Recommendations for practice	Useful for compiling the guidelines for SG integration.

Table 4: Rationale for SG integration questionnaire topics

The main topics in the questionnaire included the benefits and barriers, which were identified by innovation diffusion theory as being important. Questions about the company (size, industry sector) were include to see if they have any influence on SG use – for example some barriers may be experienced more in some industries than others and the same for organisational size.

Questions about the SG adopted and why it was adopted may show differences – some SGs may be easier to adopt than others. What were the reasons for adoption driven by functional, technical, economic or other reasons (social influence, bandwagon effect, etc)? What was the attitude towards new technology adoption of the organization – are they mainly early adopters/innovators or are there any late adopters?

It is also important to establish the impact of the SG on the organisation. How the barriers to adoption were overcome and the recommendations for practice can be used to develop guideline for SG integration. Another important use of the case studies is as examples in materials and articles to be disseminated to the HR and training industry and professional press.

The five SG integration cases collected are:-

- Lego Serious Play
- Wallbreakers
- ABN Bank
- Afghanistan
- OpenSea

In the following sections descriptions of the five case studies are given, following by the analysis of the cases.

3.4   *Lego Serious Play Integration Case*

The company originates from an internationally recognized Center for Sensory-Motor Interaction of a University in Denmark. NeuroCo is a subsidiary of one of the world's leading manufacturer of high

technology prostheses. It was founded in 1994 and has over 4,000 employees. NeuroCo was made aware of serious games by personal contact. The company uses serious games (SGs) infrequently as one of many methods to stimulate a different perception of various problems.

All departments in a small branch of the company were involved in the SG intervention as part of a strategic process. This was because they needed to provide employees with training to help them break the normal stereotypical views within the company. In addition, they needed a means to facilitate internal communication across the different organizational units. Therefore, the Lego Serious Play SG was chosen as the vehicle for this training. As a result of the training the challenges for communication between the mother company and the smaller branch became clearer and solutions were more easily developed. Some of the strategic images that were produced in the SG have had a lasting effect on the organization because of their strong metaphoric power. The use of an SG required major changes in the mental way of working in the company.

Figure 4: Lego Serious Play in Action

The use of the SG became a success because the management supported and participated in the process. A thorough preparation was done in advance, and this is thus seen as a key requirement. The main benefit for the main stakeholder, the CEO, was the involvement of all the employees in the process. One particular risk is that the CEO has to accept to lose control of the process. Otherwise the game just becomes a funny social event. The barrier towards the adoption of SGs is related to the long time needed for providing the SG session: each session lasted for approximately one day.

3.5   *Wallbreakers SG Integration Case*

The case of TeleCo presents the application of a serious game (Wallbreakers) to train employees to create awareness of a new strategy. Established in the late 1800s, TeleCo is one of the largest telecommunication companies in Scandinavia with more than 10,000 employees. They provide telephony, internet and TV services through fixed fibre and copper networks, as well as mobile telephony and data services. Their ambition is to become the best performing incumbent telecom player in Europe by 2012.

Figure 5: Wallbreakers in Action

The company was going through a major change process. They needed a significantly different management approach compared to the traditional top-down management approach. Therefore, they decided to adopt an SG to train employees in one branch of the company. The company used the game to create awareness of a new strategy and as a part of the implementation of the strategy. The company sees itself as a first follower and was aware of SGs through press releases and personal networks.

More than 400 employees participated in the training as the pilot project using the Wall Breakers SG. They found that by using this new SG approach of communicating the company strategy, a new and different type of involvement in the company has been created. This signals a change in the organizational culture and creates a 'window of opportunities'. The company had a technical culture and this was a barrier to the use of SGs. The Wallbreakers SG is special as it is built on specific and recognized management theories (Myers Briggs Personality Type). This legalizes the use of games and opens up employees for further reflexion and deeper knowledge. According to the training facilitator, 'if the pilot project is evaluated positively, the means for future processes is likely to change as well'. The company has said that they would develop more company specific SGs in the future.

3.6   ABN Bank Integration Case

This case presents the application of a serious game to educate and teach each employee on how they can translate core company values to everyday service. The company is an all-round bank servicing retail with private and commercial banking clients. Although the company is strongly represented in the Netherlands, the private banking company offices and services are also internationally established in 13 countries and territories. According to the latest annual report the company employs 26,000 full time employees worldwide.

Figure 6: ABN Call Centre SG

The bank decided to invest in serious games to improve its customer service. The serious games project was aimed at teaching employees of the private banking network (up to €1 million sales) how to deal with the core values of the company in everyday life as an employee. For this project one of the three company core values was selected (the core value "Trusted") and was used as a basis for the game. "These core values can become a container concept so easily; we wanted to bring the concept closer to the employee. What does it mean for me?" The serious game was developed in cooperation with an external serious game developer and after a successful launch has already been followed by two other serious games. The really innovative aspect of the application of serious games was that the game was not integrated as part of the standard training process; rather the company organized a tournament day where lots of employees played the game all in the same room. This promoted a community and competitive spirit, further enhancing the enjoyment of the game. After the tournament day the games were made available online for any employee to play. We have termed this innovative distribution mechanism "viral diffusion" as it led to most of the employees playing the game. A senior manager said: ""Serious Gaming is modern method of learning, Serious Games makes us become competent, it is fun and enjoyable; Serious Games can be applied in real world and take immediate effect."

3.7   *Afghanistan SG Integration Case*

The case of Afghanistan pre-deployment course presents the adoption of serious games (SGs) for providing military personnel with tailored training programmes of instruction according to their missions and responsibilities. The Afghanistan pre-deployment SG was developed by 'Carol I' National Defence University (MAN). The university is an important military educational institution founded in 1889. It offers many degree programs at different levels including doctoral, masters and undergraduate programs, open/ distance education, as well as other training courses. The university regards itself as an early adopter and it became aware of SGs through its participation at different conferences. It adopted SGs by considering the advantages of SGs, their attractiveness, their operating principles, the diversity of coverage areas, and the fact that more and more educational institutions consider this form of education and training useful and appropriate. However, only one department from the institution is involved in using serious games, to a large extent.
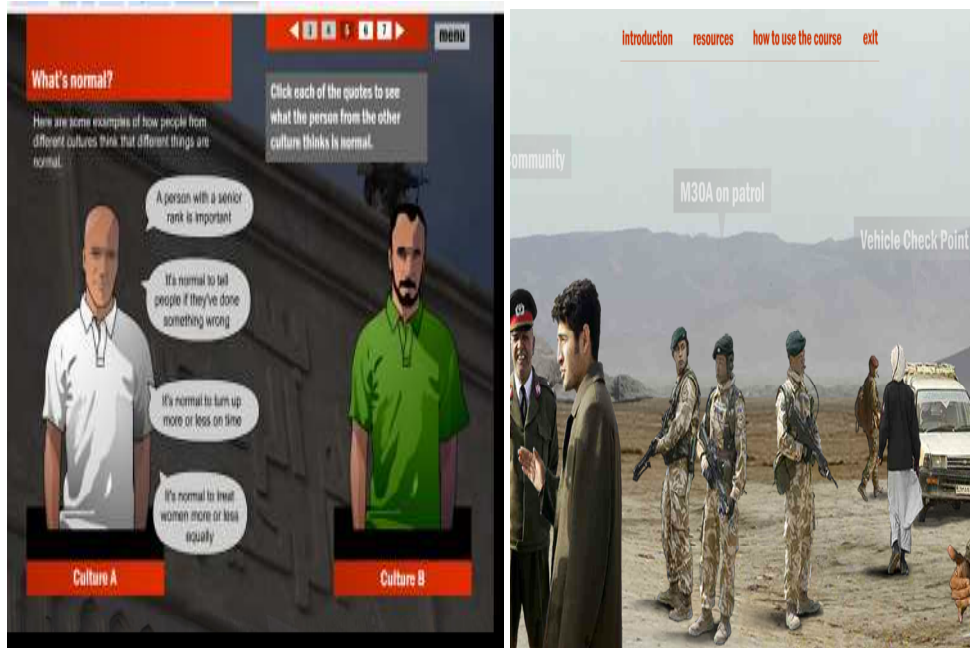
Figure 7: Afghanistan Pre-deployment SG

The target trainees are military personnel who will undertake missions in Afghanistan. The pre-deployment course is provided in an LMS – the SG can be accessed through the LMS or standalone on CD. There are more than 500 trainees annually. The SGs are used in the theatre of operations in Afghanistan to familiarize personnel with the specifics of the mission, techniques and tactics, risks that may occur during the mission, the geography of the area and the approach to the local people. Trainees receive an automatically tailored program of instruction, according to their area of responsibility, mission and mission responsibilities. During the SG training courses, the trainees are required to choose the right solution from alternatives in different situations and they can repeat an action as many times as they would like to, until their knowledge is very well established. The learning aim of the game is the successful completion of the task scenarios (demonstrating acquiring the proper cultural awareness) and not the achievement of grades. By selecting a proper solution to the situation the conflict state is maintained low, based on acknowledging cultural difference. The trainees performance on the course is judged by an online questionnaire administered after the course is completed.

The SGs have been shown to be attractive and powerful tools for acquiring knowledge, training skills and changing behaviour. For example, trainees' reaction times and visio-motor coordination, peripheral vision, way finding skills, hand and-eye coordination have been improved. The SGs also helped the trainees in improving their independent problem solving abilities. The game features include audio narratives, graphics interactivity and quizzes throughout, making learning not only interesting but also attractive. A significant benefit is that the trainees can experience situations that are impossible in the real world for reasons of safety, cost or time. Serious games are an effective way for users to safely make decisions in different scenarios, even "incorrect" ones, and thus see their possible effects. It was found that users who completed the SG were more familiar with the specifics and realities of Afghanistan than those who have not accessed it. However, the barrier toward adopting SGs is that minimum computer skills are required for trainees. Also, the costs need to be considered when developing an SG.

3.8   Open-Sea Integration Case

The North Atlantic Treaty Organization (NATO) is an intergovernmental political and military alliance, with 28 member nations in North America and Europe. The NATO Undersea Research Centre (NURC) is an established, world-class scientific research and experimentation facility that organizes and conducts scientific research and technology development, centered on the maritime domain. It delivers innovative and field tested science and technology solutions to address the defense and security needs of the Alliance. NURC is built on more than 50 years of experience and has produced a cadre of leaders in ocean science, modeling and simulation, acoustics and other disciplines.

Serious Games (SGs) are widely employed within the organization as a training method. NURC sees itself as a first follower in SGs. Several NATO Centres and departments are involved in studying, building, selecting and testing SGs: the Supreme Allied Command Transformation (SACT) Modelling & Simulation and Education & Training Sections (US), the Joint Force Training Centre (Poland), the Modelling and Simulation Centre of Excellence (Italy), NURC (Italy), and the NATO Maritime Interdiction and Operational Training Centre (Greece). Agreements with major companies in the field have been recently established in order to adopt/customize appropriate commercial products. The major fields of adoption are: operational intervention of troops mainly for defence and safety purposes; and for strategic/tactical decision making; safety operations in military environments; pre-deployment courses (foreign language courses; cultural awareness courses, etc.).

At NATO level, generally speaking, SGs are seen as successful and effective means to: (a) supplement and/or replace the current traditional techniques of "advanced distributed learning"; (b) replace troop training in mock-up physical environments; and (c) virtually create war situations which could not be simulated otherwise without any risk/ danger for the trainee. The traditional troop training in mock-up physical environments has been replaced by creating virtual war situations without any risk. According to a training facilitator of the organization, the SGs are cost effective: they provide the possibilities to train many people at the same time on situations which are hard to replicate in reality without any danger, and it is also quicker to learn.

The OpenSea Maritime Tactical Theatre Simulator was developed by the Nato Undersea Research Centre. The idea of OpenSea was initially proposed and supported by the NURC Computer and Information Services Department, whose members were particularly aware of the state of the art and of the most advanced technologies in the field of computer and information science. Several years ago programmes for creating in-house SGs started. In particular, in 2008 the Supreme Allied Command Transformation (SACT) started its programme of serious game activities by founding the Modelling & Simulation Branch. In the same year NURC proposed to the scientific committee of the Nations, who have to approve its annual programme of work, a new programme (very innovative with respect to the historical scientific core of the Centre) on the design and development of OpenSea. At that time OpenSea was seen as a new and valuable means to conduct capability development, strategic planning, as well as an advertisement of NURC's potential and capabilities. It was foreseen to be used to promote a variety of programmes, such as multistatic sonar, glider fleets through the arctic, etc. More recently, it has been mainly focused on applications such as maritime surveillance and port protection; and a new, relevant role of training has been recognized and emphasized with consequent further development.

Figure 8: The OpenSea Maritime Tactical Theatre Simulator

Within NURC, several departments are involved in either the development or exploitation of OpenSea. The Computer and Information System section and the scientific department have taken care of the development of the game from technological and scientific points of view. The Public Affairs Office and the Directorate have played the role of internal users of OpenSea as a strategic planning and external awareness tool. The Harbour Protection Table-Top Exercise (HTP2E), organized by NURC in March 2012, was a major event which consisted of multi-player dynamic engagements played in OpenSea. The major goals of this exercise were to illustrate/advertise and to train on the capabilities envisioned from integrated surveillance and response using emerging technologies. Military and civilian security providers tested new tools that can aid in the determination of hostile intent when encountering small boat and underwater threats in ports and harbours, under situations of possible ambiguity that can be expected in busy ports (false alarms, uncertainty etc.).

As regards to **barriers** to adoption of SGs any new strategic initiative can be seen as problematic at the beginning, as it can be considered as a competitor against established programmes. This was also the case for the programme proposal conceived in 2008 for the development of OpenSea. Later on, however, OpenSea has been considered one of the assets of the Centre. At the very beginning of the OpenSea proposal the major change needed was strategic, in order to accept a new initiative, which was so different from the other "historical" scientific programmes of NURC. The main changes that had to be made at NURC when the OpenSea development programme of was approved were: 1) research reallocation; 2) having new hardware tools such as computers and consoles; and 3) finding a dedicated purpose-built space to house the new hardware equipment. Now the challenge is the strategic positioning of OpenSea and the way ahead for continued advance and funding.

Generally speaking, the **benefits** of using SGs in fields such as security are: cost effectiveness; the possibility to train many more people at the same time; no danger or risk for trainees in the use-of-force scenarios; the possibility to train on situations hard to replicate in reality; and a quicker learning curve. In the case of OpenSea, specific further benefits are: communication of new ideas, support to the development of new technological equipment, and marketing and advertisement of scientific and technological capability. Before the adoption of a tactical theatre simulator, such as OpenSea, the approach to virtually test the capabilities of new technological equipment was fragmentary (very specific and partial simulations of small pieces). Now

OpenSea offers users a more comprehensive, holistic approach, which allows them to virtually experience the capabilities of a complete system, end-to-end (from threat detection, to response, to situation resolution), in complex and realistic scenarios. The major benefit brought by OpenSea to stakeholders was the possibility for creating illustrative capability demonstration videos for external programmatic visibility and buy-in, with additional scope for experimentation on a wider range of application areas.

The major key points which can be found from NATO's experience with SGs are: high fidelity and realism; high level of detail; and the need for sophisticated and advanced hardware tools/platforms. However, security restrictions may be a problem for having better SGs in the domain of interest. Particular recommendations from the NURC experience on the development of OpenSea are: to proceed progressively, by testing new features to ensure they are functioning ahead of a thorough-going SG exercise. This leads to early debugging and testing, early feedback from expert users and ensuring the early possibility to make crucial changes. Better hardware tools are foreseen to improve SGs effectiveness in the future.

In conclusion OpenSea is a very good example of successful and wide adoption of SGs in a variety of fields related to defence. Wide adoption, which is foreseen to increase in the near future, with multiple departments involved, mostly under the Supreme Allied Command Transformation (SACT), Norfolk, US, whose main objective among others is advanced training and education. SGs are developed, selected, analyzed and adopted at various levels (operational and tactical) within many NATO departments and sections. Moreover, adopted SGs are made available to member nations. The major benefits of SGs are cost-effectiveness; wide distribution; training on situations hard to simulate in reality; quick learning curve; advertisement and communication of new concepts and scientific/technological capabilities applied to defence; support to new capability development and to strategic planning.

3.9   Integration Case Studies Analysis & Findings

The following table provides an overview of the general characteristics of the case study organisations.

	Lego Serious Play	Wallbreakers	ABN Bank	Afghanistan	OpenSea
Organisation type	Private company	Private company	Private company	Military	Military
Organisation size	4,000	10,000	26,000	1,000+	140,000
Adoption attitude	Early adopter	First follower	Early adopter	Early adopter	First follower
Industry Sector	Health	Telecoms	Banking	Military	Military
Country	Denmark	Scandinavia	Netherlands	Romania	Italy+

Table 5: Summary of Serious Games Integration Cases, Organisation Characteristics

It can be seen from the above table that most of the organizations using serious games are large, with employee numbers above 1,000. There is a diversity of industry sectors represented, health, telecoms,

banking and the military. All but the military organizations are private companies. Three of the organizations are early adopters of technology and two are first followers. This is in accord with last year's UK SG survey, where 40% of respondents were either early adopters or first followers. So it seems that a positive attitude to new technology is a prerequisite for serious games use.

	Lego Serious Play	Wallbreakers	ABN Bank	Afghanistan	OpenSea
SG Use Type	Corporate change intervention	Corporate change intervention	Training/ Viral diffusion	Training	Training
SGs used	Single	Single	Multiple - 3	Single	Multiple - Several
User org is SG developer	No	No	No	Yes	Yes
Commissioned SG	As consultancy	As consultancy	Yes	Internal	Internal
Deployment level	Limited (1 branch)	Limited (1 department)	Limited (1 branch)	Limited	Wide
Participant numbers	200	400	600	500 annually	20-30

Table 6: Summary of Serious Games Integration Cases, SG Characteristics

Only two types of use of serious games were present in the cases (Table 4) – for training and for corporate change interventions. One case (ABN Bank) used the innovative technique of viral diffusion – a distribution method of making the game available to anyone who wants to play it (and not integrating the game into formal training programmes). We did not get any examples of gamification and in fact due to the non-learning aspect of gamification we do not want to focus on it.

In most of the cases a single serious games was in use. Only in two cases was more than one serious game in use – three commissioned games in the ABN case and multiple use scenarios in the OpenSea case. In the OpenSea case the organization built a simulator which allows experimentation with different scenarios. It is also powerful enough and feature rich to enable different scenarios to be enacted in it – it is something of a general purpose tool. Most of the organizations commissioned the SG from an external party and only in two cases did the organization itself develop the SG. In the two corporate change cases the serious game was commissioned as consultancy through the facilitator.

In terms of the deployment, or internal diffusion, of serious games it was mostly limited to company branches or departments; only in the case of NATO was there widespread use. The numbers of participants was generally quite high – in the hundreds, except for OpenSea which was designed for low numbers of users – the emphasis being on quality not quantity. The next table presents the benefits and barriers of SG use in the companies.

	Lego Serious Play	Wallbreakers	ABN Bank	Afghanistan	OpenSea
Benefits	SGs can get everyone involved	The change in means (to SGs) signals a change in culture as well	- modern way of learning - quick to learn	- trainees can experience situations that are impossible in the real world for reasons of safety, cost or time;	- Risk-free; - train many people at the same time - train on hard to replicate situations - cost effective - quicker learning
Barriers	SG duration (1 day) too long	technical oriented company culture	high cost	- minimum computer abilities; - SG development costs	- SGs as a competitor to established programmes - Strategic change: resources, technology & space

Table 7: Summary of Serious Games Integration Cases, SG Benefits & Barriers

A number of benefits of serious games were identified in the cases: serious games can get everyone involved; they are the modern way to learn and produce quick learning results. In the corporate change cases the use of serious games signals a change and this helps to promote the cultural change objectives of the intervention. In the military cases the most important benefit was that SGs allow trainees to experience situations that would be impossible in the real world for reasons of safety, cost or time; they thus provide risk-free training means. SGs were also found to be cost effective and allowed many people to be trained at the same time.

Barriers to adoption were found to be SG duration, cost, and that minimum computer skills are required. The company culture can also be a barrier, whether being technical oriented or anti-game. Barriers during the implementation of serious games also occurred – they are competitors to existing programmes, they can require a strategic change including the reallocation of resources, the provision of PCs and dedicated physical space.

	Lego Serious Play	Wallbreakers	ABN Bank	Afghanistan	OpenSea
Senior Management Support	Yes	Yes	Yes	Yes	Yes
'Product' champion	No	No	Yes	No	Yes, IT dept

Success factors	- Thorough preparation in advance; - use of external SG facilitator	- Use of SG based on existing management theories; - use of external SG facilitator	- Use of a tournament to diffuse the SG usage; - use of commissioned SG	Including SG in standard online course	- Commitment of several organizational stakeholders at senior level; - high IT knowledge

Table 8: Serious Games Integration Cases Success Factors

In terms of success factors the cases showed that senior management support was critical for adoption. In two of the cases an SG 'product' champion was important for successful adoption. There were a number of factors which enabled the SGs to be successful in use: thorough advanced preparation, use of a facilitator, the SG being based on existing management theories, including the SG in online course platforms, high IT knowledge and the commitment of several stakeholders in the organization.

3.10 Summary of the integration cases' analysis

The cases of SG integration we found were from large organizations (>1,000 employees) to very large organizations (>100,000 employees), so the question is to what extent are serious games appropriate for small and medium sized enterprises. Also the organizations had a positive attitude to new technology and this is thus a prerequisite for serious games use. There was use of serious games for training and for corporate change interventions; but not for gamification. In most of the cases a single serious games was in use. Only in two cases was more than one serious game in use – three commissioned games in the ABN case and multiple use scenarios in the OpenSea case. In the OpenSea case the organization built a powerful enough and feature rich simulator which allows experimentation with different scenarios – making it something of a general purpose tool. Most of the organizations commissioned the SG from an external party and only in two cases did the organization itself develop the SG. Most of the organizations commissioned the SG from an external party and only in two cases did the organization itself develop the SG. In the two corporate change cases the serious game was commissioned as consultancy through the facilitator. This means that SGs are typically appropriate for large organizations that have the resources to commission them from external developers. Small companies cannot afford to commission SGs either to develop them or as consultancy – although small companies could also have time constraints which hamper their adoption. In the in-depth case studies we can investigate why large organizations need external developers in order to adopt SGs (as they have the money but possibly not the expertise).

In terms of the deployment, or internal diffusion, of serious games it was mostly limited to company branches or departments; only in the case of NATO was there widespread use. The numbers of participants was generally quite high – in the hundreds.

The benefits of serious games were: they can get everyone involved; they are the modern way to learn and produce quick, cost effective learning results. In the corporate change cases the use of serious games signals a change and this helps to promote the cultural change objectives of the intervention. In the military cases the most important benefit was that SGs allow trainees to experience situations that would be impossible in the real world for reasons of safety, cost or time; they thus provide risk-free training means.

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In terms of success factors the cases showed that senior management support was critical for adoption. There were a number of factors which enabled the SGs to be successful in use: SG 'product' champion, thorough advanced preparation, use of a facilitator, the SG being based on existing management theories, including the SG in online course platforms, high IT knowledge and the commitment of several stakeholders in the organization

The key finding from the analysis of the integration cases is that senior management support is critical for SG adoption in every case. Therefore, the question of how the acceptance of senior management was gained needs to be investigated in the next in-depth study stage. How was senior management convinced of the benefits and by whom?

The extent of involvement of the HR department remains unclear. In two of the cases, ie. the consultancy/intervention cases, HR does not appear to have been involved in the integration process; only in the ABN bank was HR involved. So the degree of HR involvement is a question for further investigation. More generally we need to develop a model of the adoption process from initial contact through generating wider buy-in, to decision to adopt, and to implementation. And after adoption who are the involved actors. Is the role of an SG champion necessary to the success of the adoption process? How were the adoption barriers overcome?

There is an issue with determining the outcome of the serious game. Contact persons found it difficult to describe the outcome (probably due to their lack of sufficiently detailed knowledge of what happened after the SG was adopted). However, there is a difficulty in that some of the outcomes, eg. cultural change, change of mindset and change of behaviour are hard to quantify and therefore hard to measure. A triangulation approach of asking the opinions of senior management, supervising managers and participants could be used to assess these difficult to measure outcomes. Revisiting the case companies after some time has elapsed is an opportunity to examine the long-term impact of the serious game upon the company.

A final question is why was the extent of SG adoption limited; in the case studies, adoption was typically limited to a single department or branch/subsidiary of the company. So what are the factors that determine the extent of adoption, is it something to do with the customized nature or lack of generality of SGs?

The findings from the cases will contribute to the guidelines for SG integration in companies. Apart from the issue of how the initial adoption decision is made, there are several aspects which need to be taken into account when using SGs: preparation and the use of facilitators are important, as is having the necessary computers and physical space.

The next stage of the work will be to determine which companies can be candidates for in-depth case studies for follow-up interviews with the key actors in the adoption process. In parallel we will formulate an interview questionnaire consisting of the research questions identified from the analysis of the cases. It would be good to compare companies from different sectors and therefore a call for further cases will be launched to GALA members, also suitable cases from developer companies' websites can be selected.

4   SG Metrics for Business and Industry

This work is part of Task 7.2 Metrics for SG in corporate training (Task leader: Cyntelix). This task is intended to be carried out in close cooperation with the SG metrics tasks in the other WPs (T1.3 and T6.2). Task 7.2 is about metrics for the integration of SG in corporate training. According to the DoW, there are two parts for it: one addressing the integration, and the other the effectiveness of the games in the corporate setting. The two are tightly interrelated. Our work in the first year was concentrated on the first part, and we defined a maturity model for integrating SG in corporate training. This maturity model provides the categories to measure to assess to what extent games are integrated in a corporate setting, and provide the context to analyze the effectiveness of the game.

In the second year we focused more closely on the effectiveness for training in corporate settings which is of key importance for the integration of SGs. This aspect is also a part of the work envisioned in the WP7 as described in the DoW - "WP7 will also address how SG and SVWs can be evaluated, particularly their contribution to commercial outcomes, so that more empirical evidence of their benefits in different training settings can be collected, combined and disseminated". In the third year we will continue working on the two aspects outlined above as we consider both very important, in addition to being interrelated.

Cyntelix collaborated with MAN on defining requirements for metrics for SG in corporate training. The collaboration is reflected in the paper "Measuring the effectiveness of learning with Serious Games in corporate training" presented as a full paper at VS Games 2012.

In establishing a framework on how to design metrics for Serious Games (SG) in corporate training we took the following steps:

1)   We focused on the effectiveness of learning with SGs in corporate settings.
2)   We determined the factors related to the context in which SGs will be used and which will have to be taken into consideration when designing the metrics - that is, the most prominent characteristics of modern corporations. We also looked at how effectiveness of learning in corporate training is evaluated in general, without the use of SGs.
3)   We identified important relations of game features for which there are developed metrics and indications that these features have influence on the effectiveness for learning. Such relations have a direct bearing on the evaluation framework that we propose.
4)   Finally, based on the steps above, we propose a framework to evaluate SG in corporate training and we outline our future direction for work.

4.1   *Existing approaches to evaluate learning for corporate training*

In relation to 2) we evaluated the following models related to measuring the effectiveness of learning/training in corporate settings – Nonaka's SECI knowledge model (Nonaka & Takeuchi, 1995), Kirkpatrick's framework (1994) and the ROI model (Bartel, 2000).These are briefly summarised in the next section.

Nonaka's SECI knowledge model

The SECI (Socialization, Externalization, Combination, Internalization) model from Nonaka & Takeuchi (1995) has been one of the most important models to have come from the increase of attention on knowledge management. This model presents the flow between the processes of explicit and tacit knowledge. Explicit

knowledge can be expressed in formal and systematic language and for instance can be shared in the form of data or written text. Tacit knowledge is much harder to articulate (Nonaka et al, 2000). Tacit knowledge lives in action, it comes alive in and through doing things, in participation with each other in the world. Therefore, tacit knowledge can be distributed among people as a shared understanding that emerges from working together (Loureiro and Bettencourt, 2010).

Kirkpartick's framework

The framework that Donald Kirkpatrick developed has been used for more than 40 years as a basic model for the evaluation of corporate training efforts and interventions. The model presents evaluation methods and connects these to four different levels: reaction, learning, behaviour and results (Kirkpatrick, 1994). Although this framework for evaluating corporate training has been around for forty years, a recent benchmarking study found that the majority of evaluation efforts (94%) are stuck in level 1 (Rossett, 2010). Furthermore, the approach of Kirkpatrick to training evaluation was aimed at the method of classroom instruction which was predominant in those days. When trying to develop metrics for evaluating serious games use and effectiveness in modern corporate industry, a reassessment of Kirkpatrick's evaluation framework should be considered. One important characteristic of learning in today's organizations and which is not captured by Kirkpatrick's model is the introduction of social media and social learning (Rossett, 2010).

Return on Investment (ROI)

The ROI methodology uses six types of data with one consisting of the classic ROI formula for which this methodology is most used for:

> ROI (%) = (Total Program Benefits – Total Program Cost)/ Total Program Cost * 100.

When applying ROI principles to the evaluation of corporate training efforts, in general there are two approaches (Bartel, 2000):

- Data is collected from large samples of companies and compared to the experiences of companies that do invest in training against companies that do not.
- Case study method: Detailed data from a single company are collected to estimate the costs and returns from the training program of the company.

The shift towards the knowledge economy in corporate training has very strong implications on the way the effectiveness of learning is understood. We recognize two characteristics as most important:

- o Effectiveness of learning is understood not in terms of direct learning outcome (what has been learnt), but in terms of **how learning is applied** and contributes to the company's strategic outcome.
- o The knowledge asset per se is not that important; it is the **transfer of knowledge** which is the key process in the contemporary knowledge economy.

These two most important aspects have direct implications on the way effectiveness of learning in corporate setting should be measured.

Furthermore when looking at knowledge transfer, tacit knowledge is strategically the most important type of knowledge (Pöyhönen and Hong, 2006) and the measurement of the effectiveness of learning in corporate

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training should take it into consideration. Tacit knowledge is very difficult to measure as the people who have it are often not even aware of it. Again, the focus should not be on tacit knowledge as an asset, but on the processes of knowledge transfer related to it, namely the processes of externalization, combination, internalization and socialization, as described in the SECI model. A good starting point in measuring the knowledge flow related to the effectiveness of learning in corporate training is measuring the levels of social interactions. The rationale behind this is the observation that knowledge is constructed and emerges as a result of social interaction (Pöyhönen and Hong, 2006).

To meet the metrics requirements, as described above, some fundamental shifts in the prevailing paradigms for measuring the effectiveness of training and the effectiveness of SGs are needed. The measures for effectiveness of learning for SGs have to be designed from the position of 'measure in order to understand the field', rather than from the currently prevailing departure point of 'measure in order to control'. Such a shift will put an accent on measuring features describing dependencies and relations between the objects rather than features pertaining to the objects themselves. This way the accent of measurement will fall on the processes rather than on the outcomes. Understanding the processes and interdependencies related to the effectiveness of corporate training can also ensure the predictive power of the metrics.

4.2   Interdependencies of game features which are related to the effectiveness of learning

In line with this new paradigm, we first analysed the existing measurements of features related to effectiveness of SGs aiming to understand the types of relationships that exist between them. That is, all the features have been reported to have strong indications to be related to the effectiveness for learning. The exact nature of these relations is still to be investigated. Such understanding can further inform the metric design so that by measuring a particular learning outcome it is also possible to understand why it has been achieved. This way the design of metrics can lead to better understanding of the field of SG rather than just to control certain outcomes.

Our feature analysis revealed the existence of two main relations which connect all the features we focused on, that of **prerequisite** and **composed-of** (Figure 4). The relation prerequisite means that if A is a prerequisite of B, B cannot happen unless A has happened. Different authors have sometimes different views on what the same term indicates, and use the same terms in different contexts. In order therefore to harmonize these different views, the relation composed-of can also mean a generic *related-to*.

We briefly present the features (usability, playability, engagement, immersion, presence, flow and absorption) which were analysed below. More detailed descriptions of the individual measures are provided in our paper for VS-Games (Bachvarova, et al 2012).
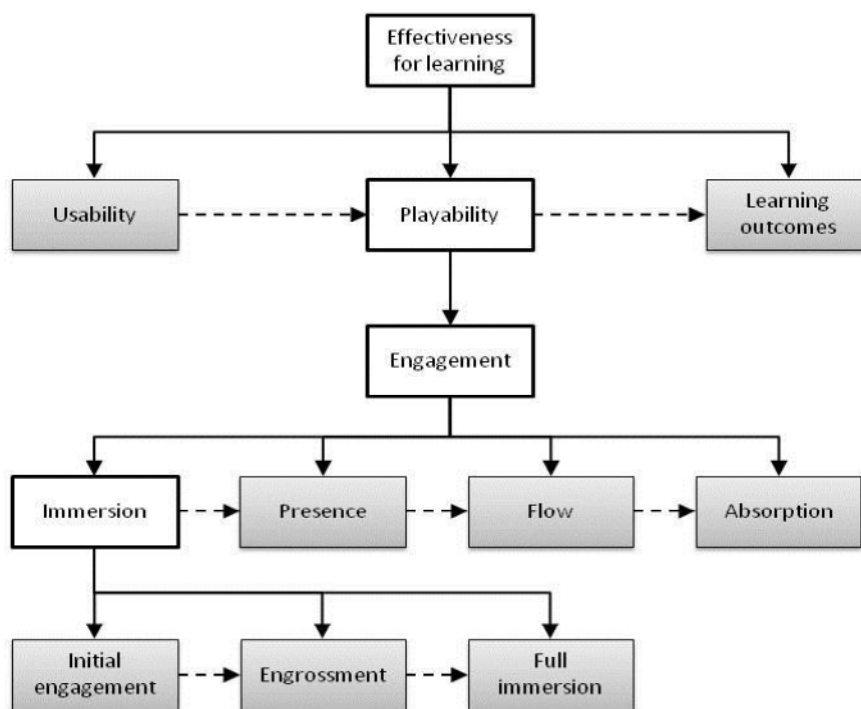
Dashed lines mean prerequisite, continuous lines mean composed-of.

Features in white boxes are measured through features they are composed by.

Figure 9: Hierarchy of game features and their relationships.

Effectiveness for learning

Olsen et al (2011) proposes an approach for measuring effectiveness for learning where effectiveness is seen as a collective measure of usability, playability and learning outcomes. They follow an already established approach to test and measure usability of systems and adapt it for SG for learning. In the staged approach described by them, firstly general usability and playability are tested. In order to have any reliable measure of playability, some basic level of usability needs to be there. Furthermore, no learning outcomes can be achieved unless there is some level of playability present. The approach allows testing games for the baseline levels of usability and playability. This test can be performed early on and subsequent corrective actions can be taken before the game is fully developed, in later stages any change is much more costly and difficult to implement.

Playability

Playability has been defined by (Resnick and Sherer, 1994) as "entertainment without fear of present or future consequences; it is fun". There aren't well developed and used measurements for playability; it is measured by using the developed scales for immersion, presence, flow and engagement (Olsen et al, 2011). In the following we further specify how playability depends on the above mentioned features by adopting a more granular decomposition of engagement as found in literature. We also assume playability can be measured based on that.

Engagement

Brockmyer et al (2009) developed a game engagement questionnaire which measures the levels of psychological engagement when playing games. Engagement is seen as passing through several stages from low to high engagement. These stages are immersion, presence, flow and absorption; where immersion indicates the lowest level of engagement and absorption is associated with the highest level of immersion. The questionnaire has the potential to identify the different levels of engagement when playing a game.

Immersion

Immersion is a psychological state characterized by perceiving oneself to be enveloped by, included in and interacting with the continuous stream of stimuli of the environment. Immersion is mainly associated with Virtual Environments, but any strong identification with characters or experiences from a particular environment is a state of immersing in this environment (Witmer and Singer, 1998).

According to the grounded theory of immersion developed by (Brown and Cairns, 2004) there are three stages of immersion where each stage is characterized by a particular barrier that needs to be removed to get access to the stage. The first stage is initial engagement (different from the previously introduced engagement) and the first barrier is accessibility. The game has to be easily accessible at the beginning which is achieved by satisfying user preferences, getting the right usability levels by providing easy to learn controls, adequate feedback, etc. Another barrier is investment of time, effort and attention. The value of investment needs to be high. Once these two barriers are passed, the gamer enters into the stage of engrossment. This stage is characterized by emotional involvement. Features related to this stage are visuals, interesting tasks and interesting plot. As the game progresses the levels of investment increases, i.e. the time and effort spent are higher and the attention needed to perform the game is higher. And while in reality the gamer's investment of time and effort is higher, their perception of the actual values is lower. The final state of immersion is full immersion. The barriers for total immersion are empathy and atmosphere. To get totally immersed in the game the gamer needs to feel empathy with the characters she is playing, feel that she is the character from the game. It has been noticed that this particular state is related to the type of the game, that is first person games and role play games seem to provide an easier access to this state. Atmosphere is related to the game constructs, like graphics, plot, etc. The last stage of immersion engages the three levels of attention: visual, auditory and mental. The increased levels of attention are tightly related to game mechanics mechanisms and more concretely reward mechanisms. In the first stages of the game each investment has to be rewarded fast and adequately. At the later stages the reward is actually employing mechanisms that lead to higher levels of attention engagement.

Presence

Presence is defined as the subjective experience of being in one place or environment, even when one is physically situated in another (Witmer and Singer, 1998). Presence is an important feature defining Virtual Environments and for which measures have been devised. We describe the measure for presence because many of the factors that appear to affect presence are also known to affect learning and performance (Witmer and Singer, 1998). This is a strong indicator that the degree of presence might also be important for establishing the learning effectiveness of SG.

When measuring presence (Witmer and Singer, 1998) take into account Sheridan's finding (Sheridan, 1992) of the subjectivity of presence as it is a mental manifestation that is not easily amenable to objective

physiological definition and measurement. Thus presence is seen as a function of individual differences and the characteristics of the environment and a presence measure should assess both.

Flow

Flow has been measured by (Csikszentmihalyi and Csikszentmihalyi, 1988), using the experience sampling method. The method measures different aspects of flow like skills and challenges, mood and motivation. As a different method (Csikszentmihalyi, 1975) developed the Flow Questionnaire which describes different flow experiences to which the respondents firstly indicate whether they had similar experiences and then they rate these experiences on 12 dimensions. Choi and Kim (2004) measured flow as it is experienced when playing computer games. The questionnaires measure the intrinsic interest for a game, the player's sense of curiosity about a game and her sense of control and immersion.

Absorption

Psychological absorption has been measured by the Tellegen Absorption Scale (Tellegen and Atkinson, 1974) and is a measure of one's tendency to experience alterations of consciousness. This is a state in which one's feelings, emotions and rational thought are not accessible in a normal state. Absorption is a state different from flow along the line of two main characteristics: motivation and affect. Negative affect, like anxiety and frustration, though experienced in game play, are not characteristics of the state of flow.

Summary

In order to measure effectiveness for learning we need to measure other features as well, that is, effectiveness for learning is a composite measure. The above identified relationships of prerequisite and composed-of have very strong implications on the measurement of effectiveness for learning. The prerequisite relationship is very important not only for the actual development of a measurement but also in the game design process. For example, before a certain level of usability is reached it is not possible to have (as well as measure) playability. Some early changes in the game should be made before the level of usability, which allows the subsequent levels of playability, is reached. In other words, the prerequisite relationship is paramount for the development of measurements that can also be used to guide the game design process.

In our future work we plan to extend our research in identifying the relations existing between game features that that can lead to a particular learning outcome. We would like to move from the existing paradigm which goes only as far as to measure the effects of learning without being able to understand how this effect has been achieved. That is, what has been measured remains a black box. Such understanding can further inform the metrics design so that by measuring a particular learning outcome it is also possible to understand why it has been achieved. In this way the design of metrics can lead to better understanding of the field of serious games rather than just measure certain outcomes.

We also propose considering Self-Determination Theory (SDT) when measuring features like flow and playability as it has the potential to provide a more thorough examination and subsequent evaluation of learning outcomes based on the intrinsic motivation of the players. Last, but not least, when designing metrics for SGs the interests/needs of the different stakeholders need to be taken into account, that is, the management, the employer, the employee, and the educational objective.

4.3   Conclusions and Future work

In our work on metrics we studied the different factors pertinent to the design of metrics for serious games. Based on our investigation we propose an approach for measuring the effectiveness of SGs in corporate setting that requires two major paradigm shifts in the existing metrics design, the two being related to each other. We propose a shift from measuring an asset to measuring a process that is, measuring the process of knowledge transfer in corporate settings rather than the knowledge outcome. The knowledge transfer is understood as the transfer of what has been learned to the workplace practices and the transfer of tacit to explicit knowledge (both processes are of fundamental importance in the contemporary knowledge-based economy).

Related to this is the second paradigm shift from "measure in order to control" to "measure in order to understand the field". To this end we aim at understanding the relationships between game features and use this knowledge when designing the metrics. In the second phase of our work on metrics we are moving towards conducting concrete empirical studies that can inform the design of metrics. We are working with a serious games company where we can use the games which they have developed and slightly change selected game features in order to conduct experiments aimed at understanding their effect on the learning processes. Our final destination, besides the understanding of how game mechanics features are related to learning outcomes, is to incorporate the results of the empirical studies into the refined metrics design.

We aim to create metrics that can inform the game design at different stages of the game development so that any significant changes in the game can be done early and timely and not when the game is finished, when all changes are very costly. Currently, we have prepared a working paper on our metrics framework – this was presented at the VS-Games 2012 conference (Bachvarova et al, 2012). The paper will be refined in year three and sent to an appropriate journal for consideration for publication.

The plan for year three is to collect data of existing evaluation practices of games in corporations; to collect additional data on integration of games in corporations to fine tune the maturity model to the different types of games; to review empirical studies to understand how game features relate to learning outcomes; and to incorporate the results of the previous steps in to the metrics design. In year four we will evaluate and correct the approach and formulate the findings as a guide for corporations to adopt different types of SGs in their training.

5   Review of Training and Job Performance

A review of the literature on the transfer of training to job performance was carried out. The review examined the factors that influence the link between training provision and job performance – illustrated in Figure 10, below.
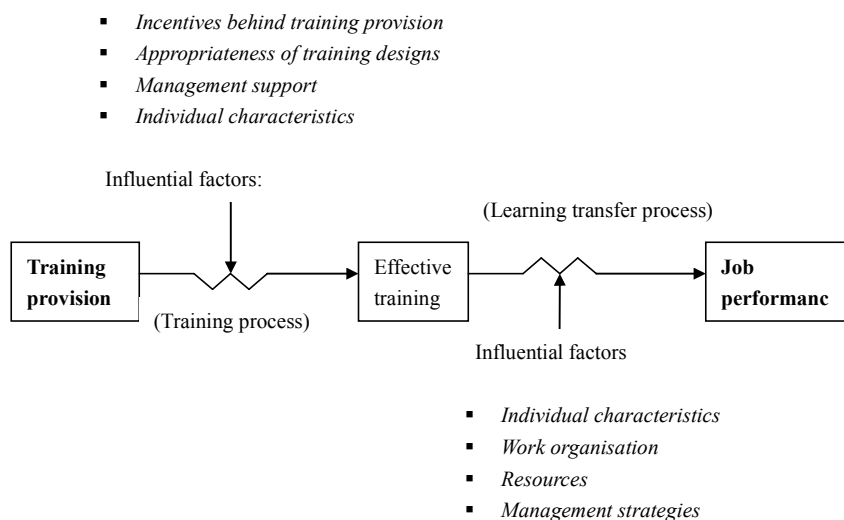
- *Incentives behind training provision*
- *Appropriateness of training designs*
- *Management support*
- *Individual characteristics*

Influential factors:

Training provision → (Training process) → Effective training → (Learning transfer process) → Job performanc

Influential factors

- *Individual characteristics*
- *Work organisation*
- *Resources*
- *Management strategies*

Figure 10: Analytical framework of the factors which might affect the link between training provision and job performance

Keep & Mayhew (2002) proposed that understanding how skills, or knowledge, are created and maintained in specific settings and in what ways learning does or does not transfer into performance are important in order to explain the transition process from training provision to job performance. In view of Mayhew's framework, illustrated in figure 10, the transition process from training investment to the performance outcomes could be divided into two parts, the training process and the learning transfer process. Thus, the factors which influence training effectiveness and the successful transfer of learning into improved job performance are analysed in the sections below.

5.1   *Factors which might influence training effectiveness*

According to Warr (2002:160), "learning behaviour is a function of both environmental and personal factors". The environmental factors refer to different training methods and the amount of support provided by organisations, while the personal factors are concerned with employees' individual characteristics (Warr, 2002). Therefore, individual characteristics, training methods and organisational support are factors which tend to affect training effectiveness.

Firstly, for the individual characteristics factor, Warr (2002) proposed that there are a number of individual characteristics which might affect learning, for instance, cognitive ability, learning motivation, aspects of personality, age and previous knowledge. Taking the factor of age as an example, it has been suggested that older workers learn more slowly than younger workers, or that older workers are more resistant to learn new methods (Arnold et al., 2005). Besides, it was also shown in Orpen's (1999) study that employees with higher organisational commitment and job involvement tend to be more motivated to perform well in the training programme. Therefore, in view of this it is obvious that individual characteristics are a factor which might influence training effectiveness.

Secondly, for the factor of training methods, Arnold et al. (2005:358) proposed that "training is only beneficial if it is based upon a needs analysis and is designed in a way that ensures this need is met". Therefore, the incentives of the training intervention delivered and the appropriateness of training designs for different employees might have impacts on training effectiveness. Concerning the incentive of the training intervention delivered for employees, Arnold et al. (2005:361) reported that training should be

provided on the basis of training needs when there exists "some sort of barrier hindering the achievement of organisational aims and objectives". Task and person needs identification are also important (Arnold et al., 2005). If the training is provided under the pressure of an external event, for instance in order to access grants, or to keep up-to-date with regulatory changes of government policies (Patton et al., 2000), the effects of training on job performance might not be obvious. Additionally, with regard to the appropriateness of training designs, is important because "training designs have an important impact upon the extent to which the knowledge and skills are acquired" (Arnold et al., 2005:364). Hence in view of the analyses, the incentives behind the training investment for employees and the appropriateness of different training designs appear to be influential factors for training effectiveness.

Thirdly, the amount of support provided by organisations was also claimed by Warr (2002) to have effects on employees' participation in training and the amount learned. Birdi et al. (1997, cited by Warr 2002) in the studies found that there is a positive relationship between support from supervisors and employees' participation in training. In addition, findings in another research conducted by Colquitt et al. (2000, cited by Warr 2002) demonstrated a positive relationship between support from supervisors and employees' raised motivation for learning. Similarly, with regard to the effects of management support on employees' learning motivation, in a survey by Orpen (1999) in examining the impact of training environment on training effectiveness, the results also revealed a significant correlation between management support at work and trainees' learning motivation. Therefore, in view of the research discussed, in the training process, organisational support also seems to have impacts on employees' training effectiveness.

5.2 *Factors which might influence the successful transfer of learning into improved job performance*

As has been discussed in the last section, there are a number of factors which have an impact on training effectiveness. However, even though based on the assumption that training is effective, whether or not the learning can be transformed into the workplace is uncertain. Arnold et al. (2005:375) suggested that "although trainees may acquire new knowledge or learn new skills, they might still not apply this learning or use these skills when they return to the place of work". Therefore, there seems to be a number of factors which might affect the application of learning into the workplace. According to Warr (2002), training transfer has two components: one is the retention of learning over time, and the other is its generalisation to new settings. More specifically, the generalisation of learning into new settings is argued to be affected by the appropriateness of the training content, trainees' individual characteristics, opportunities available and management strategies (Warr, 2002). As the 'retention of learning' and 'appropriateness of the training content' to some extent are associated with training effectiveness discussed in the last section, therefore, in this section, the other three factors (i.e. individual characteristics, opportunities available and management strategy) which might affect the generalisation of learning into the workplace are discussed in detail.

However, ensuring the successful learning transfer into the workplace is only the first step to improve job performance. Whether or not learning transfer can be used in the pursuit of management's goals (Thompson & O'Connell Davidson 1995, cited by Heyes 1998) and ultimately to improved job performance also appears to be uncertain. The factor of management complementary strategy was also claimed by Heyes (1998) to have functions on the extent to which learning transfer can be used in the pursuit of management defined goals. In the following the analyses and research evidence for these influential factors are discussed in detail.

5.2.1   Employees' individual characteristics

With regard to the employees' individual characteristics, Warr (2002) found that an individual's commitment to the organisation appear to affect training applications. In a study conducted by Colquitt et al. (2000, cited by Warr 2002), findings showed that employees reporting stronger attachment to the organisation tended to transfer more knowledge to the work. In addition, a person's confidence, which is reflected in seeking out opportunities and undertaking new behaviours, is also reported to have impacts on the transfer of learning into the workplace (Warr, 2002). In line with this claim, Ford et al. (1992, cited by Warr 2002:166) found that "employees previously describing themselves as confident in performing the trained tasks were more likely to report later had opportunities actually to perform them". Therefore, in view of these scholars' claims and research evidence, employees' personal aspects for instance levels of commitment and confidence seem to have influences on their transfer of learning into workplace.

5.2.2   Opportunities provided for trainees in the workplace

The opportunities provided for employees include the appropriateness of work organisation and the amounts of resource available in the workplace. For the appropriateness of work organisation or job design, it might affect the application of the trainees' skills in the workplace and ultimately job performance. As Delaney & Huselid (1996) stated:

> The way in which a workplace is structured should affect performance to the degree that skilled employees are directly involved in determining what work is performed and how this work gets accomplished.

"Employee participation system" (Wagner 1994, cited by Delaney & Huselid 1996), "team-based production systems" (Levine 1995, cited by Delaney & Huselid 1996) and autonomous work groups (Heery & Noon, 2001) are examples of work organisation that appear to support the application of advanced knowledge or skills to the workplace. In contrast, the work organisation which has high control and bureaucratic procedures (Arnold et al., 2005) tends to be a barrier for the transfer of learning into the workplace.

In spite of the type of work organisation discussed above, the resources provided at the workplace for skilled employees might also influence the application of skills to the workplace. Arnold et al. (2005) proposed that when employees return from a training programme, adequate resources should be ensured in order to provide a positive transfer climate. Peters and colleagues (1985, cited by Mathieu et al. 1992) identified 11 types of resources which might constrain individuals' work performance, for instance, lack of materials and supplies, lack of information and time allowed to complete tasks. It is argued that the trainees could become frustrated if the work environment constrains their application of new skills (Mathieu et al., 1992). Therefore, the amount of resources provided for trainees in the workplace also have influences on the transferring of skills into the workplace.

5.2.3 Managerial complementary strategy

Concerning managerial strategy, it not only affects trainees' transfer of learning into the workplace (Warr, 2002), but can also ensure that skills are deployed in such a way as to secure improved performance in the organisation such as quality and high productivity (Heyes, 1998).

Tracey et al. (1995), Colquitt et al (2000, cited by Warr , 2000) proposed that providing a positive 'transfer climate' which encourages and rewards the application of taught material to the workplace can not only motivate the learning transfer, but also increase the chance of training to yield positive outcomes in the work setting. In a study conducted by Heyes & Stuart (1996:17) on training the results revealed that "training was most likely to have a favourable impact on employees' motivation at work where it was linked to promotion prospects, job security and future employment prospects". Besides, findings of another study by Heyes (1998:109) in a chemical company also supported this viewpoint. It was found by Heyes that, shortly after the introduction of the training and development, "the severing of the association between tasks and rewards created tensions on the shop floor which acted to discourage teamwork and co-operation in pursuing management goals". Additionally, Tracey et al. (1995, cited by Arnold et al. 2005) found that organisational climate was directly related to post-training behaviours; hence, managers should give employees sufficient support in order to encourage skill transfer. Therefore, the complementary strategy of management tends to be a factor which might affect the transfer of learning into improved job performance.

5.3 Summaries for the factors which might affect the link between training provision and job performance

To summarise, the link between training provision for employees and job performance appears to be affected by a number of factors. In the training process, incentives behind training for employees, the appropriateness of training designs, management support and employees' individual characteristics tend to be factors which have influences on the training effectiveness. Meanwhile, the successful transfer of learning, which is obtained in the training, into improved job performance also tends to be influenced by a series of factors. Employees' individual characteristics, work organisation, resources available and finally management's complementary strategies are factors which seem to have impacts on this transfer process.

5.4 Conclusions and practical implications for further research and organisations

To conclude, simply providing training for employees may not necessarily mean that employees' job performance would be improved accordingly. To assess this cause-and-effect relationship between training provision and job performance there is a need to take into account a number of organisational and personal factors. Besides, because training investment is a long-term strategy and the benefits of training are not always immediate (Westhead and Storey 1996, 1997; Blackburn and Stokes 1998; Deakins & Freel 1998, cited by Patton et al. 2000), some of the cross-sectional research findings used in this chapter might be not completely validated. In assessing the link between training provision and job performance, more time and longitudinal studies might be necessary in order to test this theory fully (Patton et al., 2000).

Based on this conclusion, several recommendations are proposed here for organisations in order to increase training's contributions on job performance. First, the training provided should be based on objective organisational, task and individual needs analyses. Additionally, appropriate training designs for different types of employees and sufficient support from organisations are important to ensure the trainings usefulness and to enhance the trainings effectiveness. Second, supplementary management strategies, proper work organisation, and sufficient resources are pre-requisite in order to ensure the successful transfer of learning into improved work performance. Finally, different employees have various characteristics, hence to achieve better performance, it is best for organisations to identify and utilize their positive aspects.

6   Community Building for Business and Industry

The community building task (T7.4) is charged with gathering and nurturing a community of corporate users and stakeholders that are interested in studying, assessing and promoting the adoption of SGs. This activity is carried out in collaboration with WP4 and WP9. In year two complementary stakeholder engagement tasks (dissemination, promotion, exhibitions, events, community building, etc), were carried out in collaboration with WP4 and WP9. The following sections document the activities in community building in year two.

The existing community building strategy, defined in year one, of infiltrating existing dissemination groups rather than starting new groups was pursued. One conclusion of the SG awareness survey was that we need to target lead users as they are the ones who are most likely to be receptive to SGs. This means that we need to target events and outlets where lead users can be found – these events could be events and conferences on e-learning, on educational technology, etc. However, we have limited resources in WP7 and we need to use them most efficiently and attending multiple events would have a low return on investment. So the events we target will have to be carefully chosen. A better strategy is a wider dissemination of material – through online and printed publications.

6.1   Online Community Building

There are two approaches to online community building – using the GALA Virtual Research Centre (VRC) and LinkedIn.

The GALA VRC provides a number of tools for promoting the development of community building: the SIG application field pages (especially the ones relevant to WP7 – SIG 1 Business and SIG 2 Engineering and Manufacturing). Each SIG also has its own blog, where users can post news, articles and opinion. So far the VRC website has attracted quite a number of industry members (10), see GALA D8.9 (2012b).

The LinkedIn group on Serious Games started by Playgen/ Kam Star has grown by 2,000 members to 3,350 since the beginning of GALA. http://www.linkedin.com/groups/Serious-Games-Group-137156 This is a valuable means of attracting lead users as the members of LinkedIn are professionals and they would tend to use it as a means for finding out information on new things they were interested in (eg. SGs). Having a vibrant SG community on LinkedIn is one key step in building a community.

Corporate users are now far more likely to talk about 'gamification' than serious games – therefore following Playgen's presentation in Genoa in December 2011, they setup a Gamification Group – this now has over 3,700 members, which constitutes the largest global community in gamification.

6.2   Events

As part of the community building events and workshops have been organised – again in collaboration with GALA partners. These events have been focused on serious games and are designed to target lead users and early adopters. The events have been organised within the frame of bigger events (eg. Online Educa), so that, we can attract the maximum number of participants to the event (given capacity and resource constraints). Playgen have been very active in organising many workshops for potential users and this year they successfully organised workshops targeted at specific industry sectors. The following 11 events were organised:

1) Serious Games thematic workshop organized by ORT-France at Cap Digital, Paris Region, 22 September 2012. (Cap Digital is the French business cluster for digital content and services in Paris and the Ile de France region.)

2) Serious games Vendors' Exhibition at VS-Games 2012, 30-31 October 2012, Genoa. Organised by WP4. The exhibition hosted cutting-edge companies showing their products and doing networking.

3) "Are you Serious? Evidence for Learning Using Games" Half-day pre-conference workshop at Online Educa Berlin. Wednesday 28th November 2012. Jointly organised with WP5, 6 and WP9: OUNL, BIBA, UNOTT, TU Delft & UWS.

> The workshop will address as how far current research has contributed to providing real evidence for the often assumed strength of game-based learning and serious games for improving performance as well as behavioral change. Game-based Learning and serious games are often promoted for their effectiveness and attractiveness. But, what are effective and attractive learning games and how do we assess them, by what criteria?
>
> - How can learning games be evaluated regarding their effectiveness and attractiveness and what best practices and design guidelines can be applied when using games for learning, training and other purposes?
>
> - What are the challenges with respect to the design, development and research of learning games and how can these be addressed?

This workshop attracted the maximum number of attendees (30) who all paid 90 euros to attend it. The audience consisted of higher education (8), e-learning organisation (4), school (1), public administration (1), research organisation (1) and industry (10).

4) Playgen ran 5 half-day workshops called MAKE PLAY – where 80 participants working in various SMEs and organisations across health, advertising, media, charity and enterprise participated to learn about Serious Games and how to make them.

5) Playgen ran Games For Brands – 300 participants – London 27 October 2011 – exploring the opportunities for brand and content owners to discover the potential for games. Participants included Channel 4, RIM, BBC, Stardoll, LoveFilm, NHS, NESTA, Wellcome Trust, Ogivly, Hasbro, Warner Brothers, Science Museum and many more.

6) Playgen ran Games for TV – 200+ participants – London 18 April 2012 – a dedicated one-day interactive conference and workshop designed for the television, production, licensing, publishing and related sectors to understand how to turn their content into games across all platforms and devices. Participants included AETN, Agora Media, BBC Worldwide, Bossa Studios, Channel 4, ExMachina, Flare Games, Games Investor Consulting, Hide & Seek, Iconicfuture, MakieLab, PlayGen, Preloaded, Somethin Else, Spirit Digital Media, Stardoll, UKIE, Utinni, and We R Interactive.

7) Playgen also ran Games For Places – and the Play Day during the Digital Shoreditch Festival, 2012.

8) NURC established contacts to the Modelling & Simulation community in NATO and in the fields of defence, security, anti-piracy, etc. They attended two workshops on Modelling & Simulation and SGs. They

also established contacts with other defence institutes and schools in order to coordinate shared e-learning test/training activities in Year 3.

6.3   Planned Events

ORT is planning a seminar on best practises in serious games to be held towards the end of January 2013 (timed to coincide with the BETT (British Educational & Training Technology) Show, http://www.bettshow.com). As mentioned above we need to carefully target out attendance at events to make best use of our resources. In this regard we will identify one big HR/training event, preferably European, to attend in year three in order to assess the benefit of attending more similar events. We will probably present another workshop in collaboration with WP9 at Online Educa again as we have had good results in terms of making useful contacts with corporate users See the discussion in chapter eight below on further steps for year three.
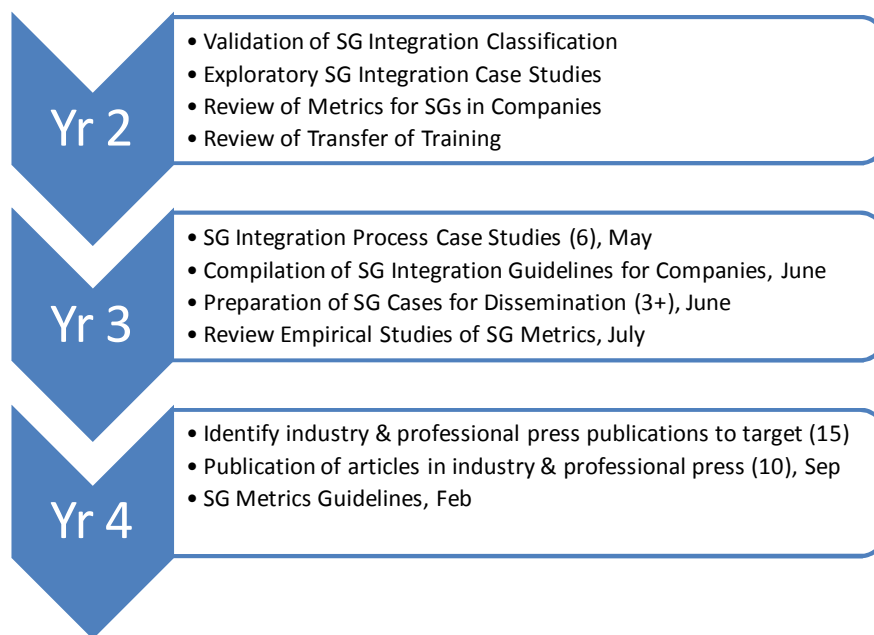
7   WP7 Metrics

The following table 9 shows the metrics defined for WP7, their targets and the achievement in each year. In the first two years the emphasis has been on literature reviews and collection of empirical data (SG Survey, integration cases), rather than on publications. Nevertheless seven conference papers have been published, including one Tier 1 article. The plan is to increase publication outputs as the needed high quality case study evidence is gathered. High quality cases studies are essential for producing articles in the industry/professional press. It is planned that a targeted campaign of articles in the professional press will culminate with 10 articles being published. In order to achieve the greatest exposure most efficiently only selected industry events (where lead users will be present) will be targeted - approximately two per year.

| | Targets | | | | | Achieved | | | | |
Metric:	Year 1	Year 2	Year 3	Year 4	Total	Year 1	Year 2	Year 3	Year 4	Total
Conference Publications	2	3	3	3	11	2	7			9
Book Chapters					0	1	1			2
Journal Publications			1	2	3					
Nr of 1st tier publications				1	1		1			
Nr of other journal publications			1	1	2					
Nr of other conference publications							6			
Integration Case Studies		5	1		6		5			5
Joint Research Activities		1	2	2	5		1			1
Industry Events		2	2	2	6	1	11			12
Articles in industry press		1	2	10	13					

Table 9: WP7 Metrics – targets and achieved

8   Plan for the Next 12 Months

This chapter presents the activities which are planned to be addressed during the next two years of the project. Figure 11 below shows the general plan – numbers and dates are given for year three and four activities.

Yr 2
- Validation of SG Integration Classification
- Exploratory SG Integration Case Studies
- Review of Metrics for SGs in Companies
- Review of Transfer of Training

Yr 3
- SG Integration Process Case Studies (6), May
- Compilation of SG Integration Guidelines for Companies, June
- Preparation of SG Cases for Dissemination (3+), June
- Review Empirical Studies of SG Metrics, July

Yr 4
- Identify industry & professional press publications to target (15)
- Publication of articles in industry & professional press (10), Sep
- SG Metrics Guidelines, Feb

Figure 11: WP7 General Plan Years 2 to 4.

Research on SG integration will continue in year three. Case studies for in-depth analysis will be selected for interviewing – the five existing one plus one or two more depending on difficulties with access and confidentiality. The focus of the case studies will be on the integration process. The interviews will attempt to answer the research questions derived from the analysis of the exploratory cases, in particular the actors involved and how each stage of the process proceeded to the next. It may be necessary to find new case studies if the companies do not want to participate in the research, or if they have confidentially issues. The recruitment of new cases will be done through GALA contacts. Once the in-depth case studies have been completed in May 2013, the guidelines for SG integration in companies will be compiled by June. These guidelines will focus on how to get buy-in for SGs, how to successfully use SGs and how to evaluate the integration. In parallel, work on preparing articles for publication in the HR and training industry and professional press will be undertaken. This will involve preparing example SG cases, based on the case studies, and identifying suitable publications. Once suitable publications have been identified the editors will be approached to determine what kind of articles they are most interested in publishing – in-depth SG examples, general overviews of contemporary SGs, effectiveness of SGs, SGs in specific application domains, etc. The selection of publications and their associated article types will be completed by September 2013. In year four, work will focus on publishing articles in the industry and professional press. Second, one or two academic journal articles based on the research work on SG integration will be prepared. These could present the good and bad practices in SG integration in companies and draw lessons for successful integration.

On Metrics, work will continue, led by Cyntelix, in devising and documenting metrics for the use of SGs in corporate settings. The plan for year three is to collect data of existing evaluation practices of games in corporations; to collect additional data on integration of games in corporations to fine tune the maturity model to the different types of games; to review empirical studies to understand how game features relate to learning outcomes; and to incorporate the results of the these steps in to the metrics design. The review of empirical studies will be completed by July. In year four we will evaluate and correct the approach and formulate the findings as a guide for corporations to adopt different types of SGs in their training

Community building is an on going process through the next 12 months. Targeted events will be kept to a minimum to reserve resources for the preparation of high quality articles in industry publications. Some appropriate outlets for publications have been identified:-

European

> European Chief Learning Officers Association (ECLF),
> European Foundation for Management Development (EFMD)
> other European associations for management, management development, human resources &
> training.

UK

The Chartered Institute of Personnel and Development (CIPD) and its publication: People Management Magazine and associated website: www.peoplemanagement.co.uk.

TrainingZone.co.uk

> "We're the UK's leading independent community of people who work in the world of learning and development. We are an enthusiastic and engaged community of professionals who use this site to learn from our peers via the Any Answers forum or read the latest opinion and discourse from a wide variety of thought leaders at the coalface of Learning & Development".

The pre-requisite to getting content into these, and other, outlets is to have high quality SG case studies which can be used as the basis for articles. Work in year three will focus on developing these high quality cases from the in-depth case studies and preparing them for publication – this will involve not only writing the cases but also getting permission from the case study companies to publish them.

9   Conclusion

The second year's activities focused on collecting SG integration case studies, SG metrics for corporate training, transfer of learning and community building. The results of the research carried out – SG Survey and SG Integration Framework: were published at the 2012 SGDA and iCALT conferences, respectively.

The work on metrics for corporate training produced a review paper (summarized in chapter 4) of the methods that companies use to evaluate training that can be applied to SGs. This review paper was published at the VS-Games 2012 conference and will be further refined into a journal article. Work on metrics for measuring the effectiveness of the integration of SGs in companies will be brought into focus in year three. A review of the transfer of training into improved job performance was conducted. This showed

that the transfer is contingent on many factors – effectiveness of training, individual, organizational and nature of the work.

The integration exploratory case studies produced some insights including issues for further investigation in the in-depth case studies. The key finding was that senior management support was critical for SG adoption in every case. Further research is required to understand the integration process – the actors involved and how the barriers were overcome.

The work on community building continued with the strategy of targeting multiple outlets: online SG groups (LinkedIn – where importantly a new group on gamification was very successful, achieving the same number of members in half the time of the SG group), organizing targeted workshops and events at premiere relevant conferences (Online Educa). Targeted events will be kept to a minimum to reserve resources for high quality articles in industry publications. In year three the potential targets for articles in the industry and professional press will be identified, so that when the case studies are at the right quality level we will be ready to publish them.

9.1   Publications

During the year a number of chapters and conference papers were prepared and published:

Book Chapters

Hansen, PK. (2012) Innovation and learning facilitated by play In: Seel, N.M. (Ed.) Encyclopaedia of the Sciences of Learning, Springer Science + Business Media B.V. ISBN 978-1-4419-1427-9.

Conference Papers

1st Tier
Azadegan, A. & Riedel, JCKH. (2012) Serious Games Integration in Companies: A Research and Application Framework, ICALT2012 - *International Conference on Advanced Learning Technologies and Technology-enhanced Learning*, IEEE Computer Society & IEEE TC on Learning Technology, Rome, 4-6 July 2012. ISBN: 978-0-7695-4702-2/12. www.scuolaiad.it/ICALT2012

2nd Tier
Azadegan, A; Riedel, JCKH. & Baalsrud Hauge, J. (2012) Serious Games adoption in corporate training, In: Ma, M; Oliveira, MF; Baalsrud Hauge, J; Duin, H; Thoben, K-D. (Eds.) *Serious Games Development and Applications: Proceedings of the 3rd International Conference* SGDA, 26-29 September 2012, Bremen, Germany. Lecture Notes in Computer Science LNCS7528, Springer, Heidelberg. ISBN 978 3 642 33686 7. DOI: 10.1007/978-3-642-33687-4, pp74-85.

Baalsrud Hauge, J. & Riedel, J.C.K.H. (2012) Evaluation of Simulation Games for Teaching Engineering and Manufacturing, In: De Gloria, A. & de Freitas, S. (2012) 4th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES'12), Elsevier Procedia Computer Science, Vol. 15, pp. 210-220. http://www.sciencedirect.com/science/journal/18770509

Yulia Bachvarova, Stefano Bocconi, Bartwin van der Pols, Maria Popescu and Ion Roceanu (2012) Measuring the effectiveness of learning with Serious Games in corporate training, VS-Games'12: 4th International Conference on Games and Virtual Worlds for Serious Applications, Genoa, Italy, 29-31 October 2012. In: De Gloria, A. & de Freitas, S. (2012) *4th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES'12)*, Elsevier Procedia Computer Science, Vol. 15, pp. 221-232. http://www.sciencedirect.com/science/journal/18770509

Domain Tiers

Paananen, H.; Smeds, R. (2012) The Systems Snapshot - A Serious Game for Increasing Understanding of Organizational Models, Leadership and Communication in Increasingly Complex Systems. In: "Innovation and Serious Games", *the IFIP WG 5.7 16th Workshop on Experimental Interactive Learning in Industrial Management, in collaboration with the EU Network of Excellence GaLA*. Bergische Universität Wuppertal, Germany, June 3-5, 2012. Workshop Publication, pp 51-59.

Azadegan, A; Riedel, JCKH. & Baalsrud Hauge, J. (2012) An Application Framework for Serious Games Integration in Companies, In: Hoeborn, G. (Ed.) *Workshop-Publication The IFIP WG 5.7 16th Workshop on Experimental Interactive Learning in Industrial Management, in collaboration with the EU Network of Excellence* GaLA Innovation and Serious Games, 4-6 June, Wuppertal, Germany. pp13-25. Edition Winterwork, Borsdorf. ISBN 978-3-86468-187-5.

Baalsrud Hauge, J; Pourabdollahian, B. & Riedel, JCKH. (2012) The Use of Serious games in the education of Engineers, In: Emmanouilidis, C., Taisch, M., and Kiritsis, D. (Eds) *Competitive Manufacturing for Innovative Products and Services: Proceedings of the APMS2012 Conference Advances in Production Management Systems*, Rhodes, Greece, 24-26 September 2012.

Keynote speeches:

Pascale Xélot, IBM, "How to use serious games to teach business process management in an Industry context", *VS-Games'12: 4th International Conference on Games and Virtual Worlds for Serious Applications*, Genoa, Italy, 29-31 October 2012.

Donald Brinkman, Microsoft, "Structured Signs and Infinite Games: Serious Play for Lifelong Learning", *VS-Games'12: 4th International Conference on Games and Virtual Worlds for Serious Applications*, Genoa, Italy, 29-31 October 2012.

Presentations

Hansen, Poul Kyvsgaard. (2012) Product Development and Serious Games, *NordDesign*, 24-26 August 2012, Aalborg, Denmark.

Other Dissemination Activities

Riita Smeds was chair of the Program committee of the IFIP WG 5.7 16th International workshop on Experimental Interactive Learning in Industrial Management, organized in collaboration with the EU Network of Excellence GaLA, in Bergische Universität Wuppertal, Germany, June 3-5, 2012.

Hansen, Poul Kyvsgaard. (2011) Workshop on Serious Games in Strategy Development, Aalto University, 9-10 November 2011.

Hansen, Poul Kyvsgaard. (2011) Serious Play Facilitation, City University, Hong Kong, China, November 28-December 4, 2011.

Hansen, Poul Kyvsgaard. (2012) Development of SG-applications to cope with complexity in product development, Stanford University, USA, 23-28 January 2012.

Hansen, Poul Kyvsgaard. (2012) Use of Serious Games to review Business Models in China, Innovation Denmark, Shanghai, 19-23 March 2012.

Hansen, Poul Kyvsgaard (2012) Workshop on Serious Games Training of Serious Games, Heriott Watt University, UK, 15-18 May 2012.

Harbour Protection Table-Top Exercise (HTP2E) based on NURC OpenSea Maritime Tactical Theatre Simulator, NURC, la Spezia, Italy - 20-23 March 2012.

Research, Technology and Tactics Workshop, based on NURC tools MSTPA (MultiStatic Tactical Planning Aid) and OpenSea Maritime Tactical Theatre Simulator, NURC, la Spezia, Italy - 26-29 June 2012.

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Bachvarova, Y; Bocconi, S; van der Pols, B; Popescu, M. and Roceanu, I. (2012) Measuring the effectiveness of learning with Serious Games in corporate training, VS-Games'12: 4th International Conference on Games and Virtual Worlds for Serious Applications, Genoa, Italy, 29-31 October 2012. In: De Gloria, A. & de Freitas, S. (2012) 4th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES'12), Elsevier Procedia Computer Science, Vol. 15, pp. 221-232. http://www.sciencedirect.com/science/journal/18770509

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Appendix A – SG Integration Questionnaire

Serious Games Adoption in Companies - Case Study Template

This template collects basic descriptive information about case studies on the adoption of Serious Games (SGs) in companies - for diverse purposes, eg. corporate training, consultancy, change/ interventions, gamification, etc.

Case study title	
Company name	
Company Details Number of employees Year of establishment Industry Sector Main business/ products	
Adoption stage of SGs Planned for future/ Pilot testing/ Limited adoption (single department)/ Wide adoption (multiple departments)/ Long term user	
Adoption attitude for SGs Early Adopter/ First follower/ Slow Adopter/ Forced Adopter	
Awareness Process How the company became aware of the use of the SGs	
Rationale The reason why they chose to use SGs	

What SGs are used for in the company Description of use of SGs in the company - corporate training/ consultancy/ intervention/ gamification	
Extended Description Extended description of use of SGs in the company; How many departments were involved in the adoption & to what extent, etc	
Barriers towards adoption of the SGs	
Benefit of using SGs	
Changes to practice The changes that you had to make to your established practice to use SGs	
How the SGs overcame previous problems	
The benefits for stakeholders (Senior Management, Decision Makers, Managers, Employees, etc.)	
Key points for effective practice The most important points in the case study for other SG practitioners – these may include risks as well as benefits	
Conclusions and recommendations A summary of how and why the SG adoption outlined here	

has been effective. Are there any elements that would be changed for the future?	
Company contact details Name and e-mail address, phone number, location (town, country)	
Potential for Case Study Ease of access, confidentiality issues/problems, potential for public dissemination	