

Utilising Gamification and Virtual Environments to present Digitally Enhanced Advanced Services (DEAS) for the Financial Sector

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Abstract. Servitization offers a fresh opportunity for manufacturing and finance companies to incorporate additional services to the main product, as part of an extended maintenance scheme or for insurance purposes. Parametric insurance products based on new technological innovations in the financial sector related to weather risk management can potentially offer preferable and greater solutions for the construction industry in contrast to traditional insurance models. Such smart contract solutions/ policies can potentially aid the customers' management of risks related to weather in a more effective manner, settle insurance claims faster and overcome some of the limitations associated with traditional insurance. However, these can be complex for customers and stakeholders to understand, limiting them to express their needs and see the true value of such DEAS offers. This paper presents a prototype Serious game application designed for the financial sector which enables the customers to experience a variety of construction scenarios and weather conditions that affect the progress and cost of the in-game building. Their choices, risks and results are presented in a two-fold gaming system that offers both a 3D Virtual Environment and the relevant information reflecting the appropriate offers. Preliminary results from a specialists' focus group of ten users are presented and their results and feedback are discussed in the paper forming a future plan of development of similar applications for additional sectors that require Digitally Enhanced Advanced Services (DEAS).

Keywords: Gamification, Serious Games, Servitization; User Experience; Virtual Environment; DEAS

1 Introduction

The servitization in the current manufacturing and building industries presents a unique opportunity to convey additional and future services to the customers. This aims to ensure a long term, positive customer/user experience whilst enhancing the provider's revenues when offering additional services as part of the initial deal [1-3]. However, the explanation of the various benefits that these services could yield for the customers poses a major issue due to their complexity and bespoke nature.

To this end, technological advances and the increased popularity of smartphones and tablets provided a new conduit to present and visualise information to the general public. In particular, the use of emerging technologies such as 3D visualisation, Virtual and Augmented Reality (VR/AR) and serious games was employed to present complex information, training and simulations, in diverse domains such as medical training, environmental sciences, defence and commercial electronics, to individuals and companies [4-7].

Transferring this know-how to services provided for the manufacturing and financial sector was achieved through a new approach namely Digitally Enhanced Advanced Services (DEAS) [8,9].

With the growing amount of organisations and businesses adopting innovative technologies to offer advanced services rather than just selling products, the financial service providers have also had to consider the utilisation of DEAS as a long-term business model [10,11].

To investigate this further, this project developed a prototype online 3D serious game in close collaboration with the EHAB group - servitization designers for the building and financial sector - focusing on enhancing the understanding and education of their servitization offers in the aforementioned domains. The project was designed with a two-fold approach; (a) to provide a complete and realistic simulation of a building construction and (b) to embed/explain seamlessly the DEAS offer of the real-life provider (EHAB). This game design mantra offered positive outcomes in previous studies [12].

During the initial stages of the project, it was observed that servitization offers were particularly convoluted and difficult for the customers to understand. One of the challenges faced by this financial servitization design team was to help end-users see the limitation imposed by the current method being used for pricing risk.

The following sections will present, the design and development process as well as the challenges of the proposed serious game. The paper will elaborate on the game design and provide the feedback of a specialists' focus group after extensive gameplay testing. The paper will conclude with a tentative plan of work for the development of an example of a building positioned in a 3D/VR segment of a real-life UK city following previous studies that employed simulated cities and gamification [13].

2 Digital Transformation through Gamification

Serious Games/ Gamification is an innovative and creative way to communicate, engage and educate users. As well as bringing awareness and providing information, a serious game can potentially communicate complex information in an enjoyable and simple method. Previous studies have presented that gamification and serious games could have positive outcomes in various other industries/ education, particularly in cases where complex information has to be conveyed [14-18].

It has yet to be determined though if the above methods could be employed to enhance the communication, education and engagement of DEAS offer for the financial service providers [12, 14].

Typical practices supporting servitization include paper-based documentation and specialised offers drafted for each customer. Current attempts at digital transformation have primarily focused on transferring the paper-based material to digital format documentation or in some cases online with a predetermined modular document structuring based on customer's choices. Yet these digital outputs have limited success as they still require extensive presentation by the provider's staff until they manage to convey the servitization offer to the customers [19,20].

The financial products are significantly more complex. In this particular case, the EHAB products are designed to customise the insurance requirements for various construction projects taking into account a complex set of data related to previous weather patterns and their effects on buildings as illustrated in Figure 1 below.



Fig. 1. Screenshot of EHAB Serious Game showing weather simulation and risks.

3 Proposed 3D Serious Game

The proposed 3D Serious Game application aims to demystify for the customers, the parametric insurance products offered by EHAB group through an interactive, 3D Serious Game that guides the user through their own choices and experiences. The offers are contrasted to typical insurance offers to highlight the benefits of the DEAS offers. Traditional construction projects tended to have a minimum umbrella covering insurance policies based on the constructor's previous experience and mainly guessing or gambling with the probability of adverse weather conditions and the potential damages /delays that could cause to the buildings. The provision of bespoke insurance plans that could be defined by machine learning (ML) was not directly acceptable or understood by the typical construction companies as deemed superfluous or unnecessary. As such it was deemed essential for the digital transformation through DEAS to explore new options such as Serious Games that could entice and explain better to the users the benefits of the aforementioned products.

3.1 Game Design and Virtual Environment

The game was designed as a simulation of construction processes and random weather conditions spanning a duration of multiple months depending on the size of the construction project. In addition, the game design focused on motivating the user through gradual reward schemes embedded in the game reflecting the user's decisions [21,22]. In particular, the game focused on the EHAB's servitization Weather Ledger Platform which was at the centre of the game and like its real-life counterpart, the offer works in-game in a similar way, providing improvements to the player and simulating the benefits.

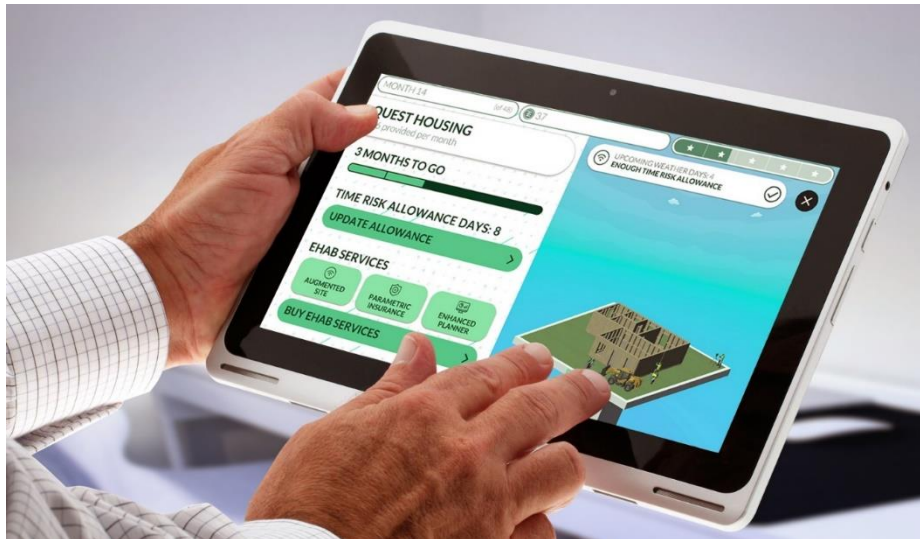


Fig. 2. Screenshot of EHAB Serious Game operated on a tablet device

The selection of different options and timelines was accommodated in half of the screen whilst the other half presented the 3D visualisation of the different construction stages and the weather conditions as presented in Figure 2.

The user, however, could change the screen size ratio and customize the panels to maintain the development of more than one building as shown in Figure 3. The customization of the operating environment, as well as the provision of multiple choices, enhance the experience for each individual user [23,24]. To further immerse the user in the process and the perks the DEAS offers, the game design introduced a key feature of the service which is the Enhanced Planner. The latter helps the user to mitigate risk and make better predictions for future weather events. The benefits of utilising the Enhanced Planner were directly mapped into the game.

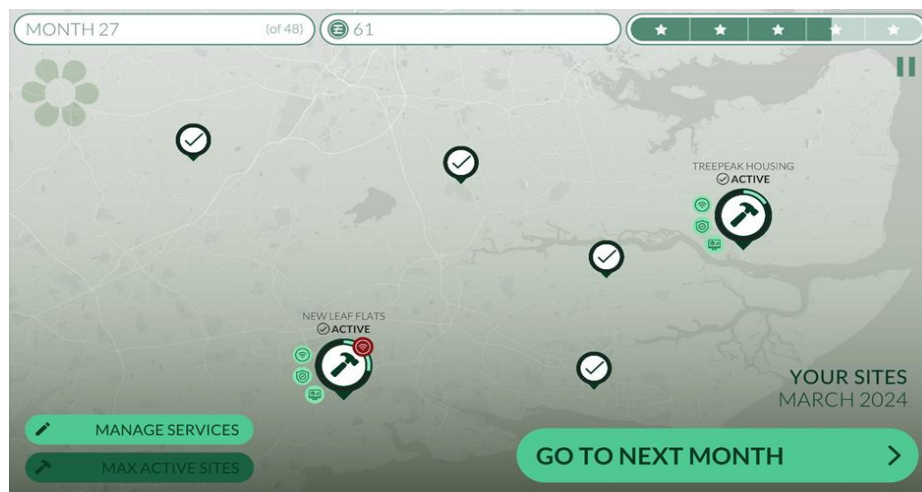


Fig. 3. The game offers the option to build and monitor more than one construction site.

3.2 User Interface (UI) Design

The game's User Interface (UI) presents all the information in a minimalistic design approach supported by colour-coded green and grey tones to avoid user distraction from the main virtual environment. However, the time-sensitive information is presented with different colour intensity or highlighted by red coloured dots and frames as seen in Figure 3.

The options and activities panels that present the simulation facts and support the decision-making process of the user are illustrated in Figure 4. The interface reveals the probability of weather days per month when the user updates the time risk allowance on the monthly calendar as presented in Figure 5. Having this feature gives flexibility to the player to change and update insurance on every round based on predicted weather events. This imitates the function of the real-world counterpart which provides a consistent and accurate approach, streamlining how the user can plan and avoid unforeseen issues.

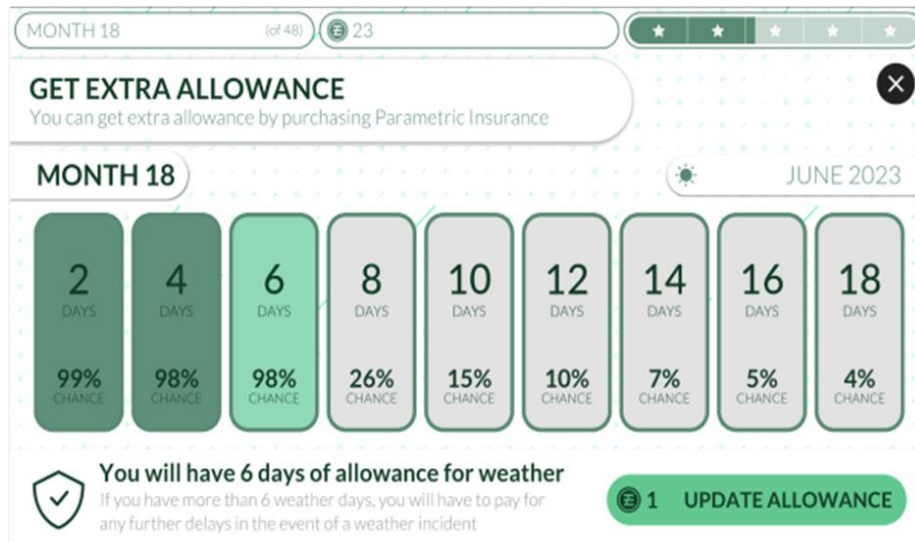


Fig. 4. The UI design presents a simple and colour-coded panel that guides the user through the different options and activities.

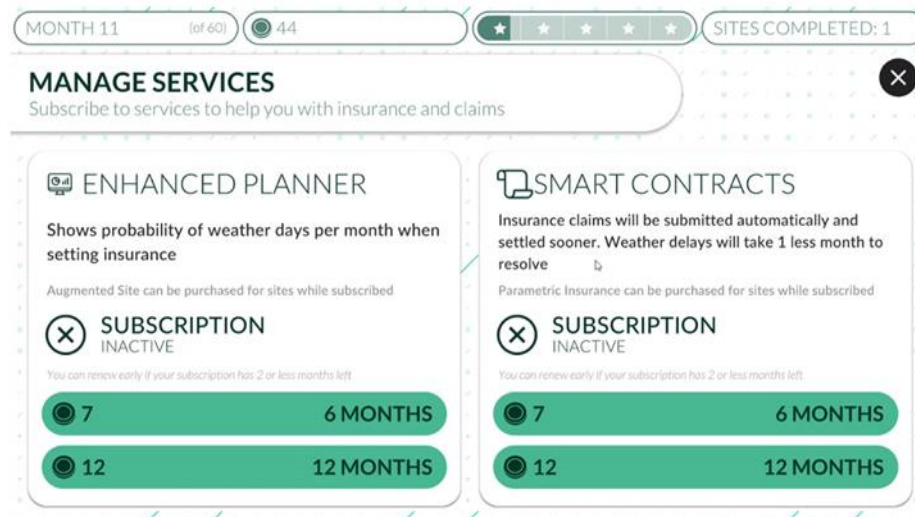


Fig. 5. User Interface (UI) design that allows the user to monitor closely the weather patterns and the risks involved in contrast to the insurance services enabled.

3.3 User Experience (UX) Design

To enhance the user experience (UX) beyond the typical scoring methods it was considered useful to replicate and simulate the more abstract notion of personal or company reputation. Users' reputation would increase based on how many sites they completed, and how efficiently.

The purpose of this was to demonstrate the impact of either a good or bad reputation of a construction company to the user. If the player does not have a reputation, would result in reduced functions and an inability to bid for the bigger and more profitable projects, even though they may have the funds. This was introduced to demonstrate to the player the direct implications of not building your reputation, the negative impact of not being prepared and mitigating weather risk appropriately.

The reputation score was defined by three reputation areas, namely: risk management, experience, and cost presented below.

- Risk Management: points awarded for insurance successes and buying site upgrades (to help insurance)
- Experience: points awarded for progressing and completing sites
- Cost: points awarded for spending funds efficiently on insurance

The player's reputation points are also mapped to an overall star system, where the player can earn points to increase the number of stars they have. This is implemented using a curve/graph which determines how many stars the player should have based on the total number of points (e.g. 1 star requires 100 points, 4 star requires 900 points, etc).

4 Focus Group Game-Play Evaluation

4.1 Evaluation Method

For the evaluation of this project, the team opted to develop a Technology Acceptance Model (TAM), based on previous projects that were evaluating prototype systems and technologies with particular groups of the public as presented in Figure 6 [25-27]. The TAM aims to identify if and how much users will accept new technologies to complement or replace existing practices [28,29].

This TAM followed a similar structure to previous studies related to the introduction of emerging technologies to diverse areas aiming to acquire users' feedback on the following user experience areas [26,30].

- Relatability to content (RC)
- Simulated Learning Experience (SLE)
- Perceived Usefulness (PU)
- Perceived Ease of Use (PEU)
- Attitude towards Usage (AU)
- Behavioural Intention to Use (BI)
- Functionality/ Controls (FC)

- Previous Gaming Experience (PGE)
- Accessibility/ Platform (AP)

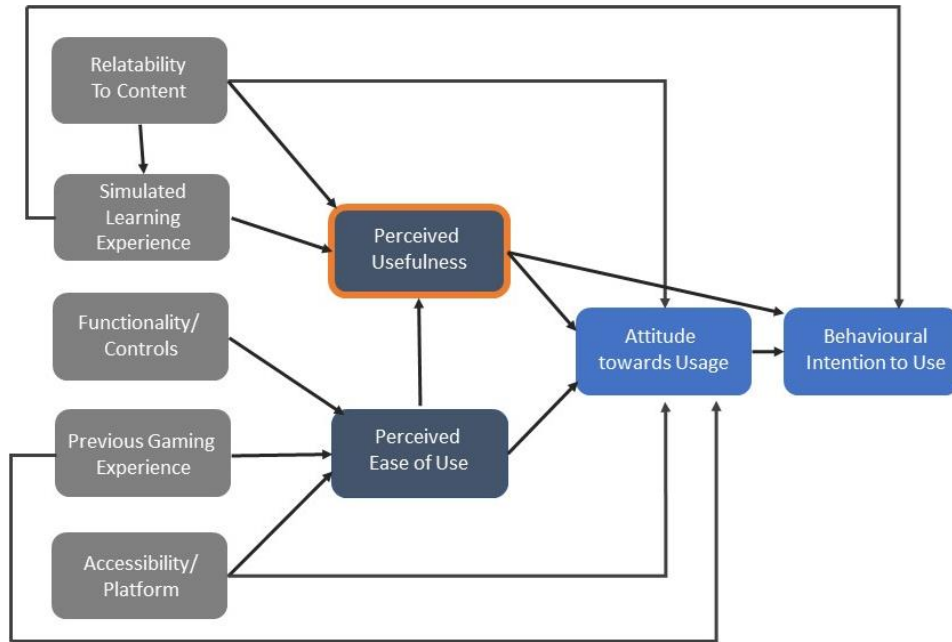


Fig. 6. Customised Technology Acceptance Model (TAM)

The users responded to a pre-questionnaire aiming to identify their demographic information and prior knowledge of gaming, DEAS and computing overall. In turn, the users played the game with the task to complete a medium-size 2-floor residential building. After the completion of their task, the users responded to several statements corresponding to the above areas of interest.

As this was the preliminary evaluation of the application one of the main points of interest was the Perceived Usefulness (PU) which will be presented in this paper as illustrated in Figure 6. To identify the users' experience with the latter, three statements were designed as presented in Table 1.

Table 1. Perceived Usefulness (PU) statements for custom TAM

Perceived Usefulness (PU)
PU1: The use of this serious game helped me understand EHAB servitisation offer
PU2: The use of this serious game simulated the servitisation offer effectively
PU3: The use of these serious games offered a better opportunity to learn about the servitization offer

4.2 Participants

The evaluation was performed by ten users (5 female, 5 male) who were specialists in the field and formed our initial focus group that game-play tested the application. The participants volunteered to test and evaluate the game.

5 Results and Discussion

One of the main challenges for this application was to address the limitations of current risk management with the customer. The game design and the educational goals needed to educate the end-user about the limitations of the current systems as well as simulate and demonstrate the benefits of the servitization offer. The responses to the pre-test questionnaire highlighted the fact that the customers/users did not always perceive the limitations imposed by the current system.

The users' feedback on the perceived use (PU) regarding their experience and understanding of the aforementioned aim offered encouraging results as illustrated in Figure 7. In particular, the users responded positively with 80% (Strongly Agree and Moderately Agree and Somewhat agree) for PU1 (The use of this serious game helped me understand EHAB servitisation offer), with 50% of the responses being on the Strongly Agree. This positive feedback was of major importance for the project as the complexity of the finance products and especially the parametric insurance offers were particularly challenging for the users.

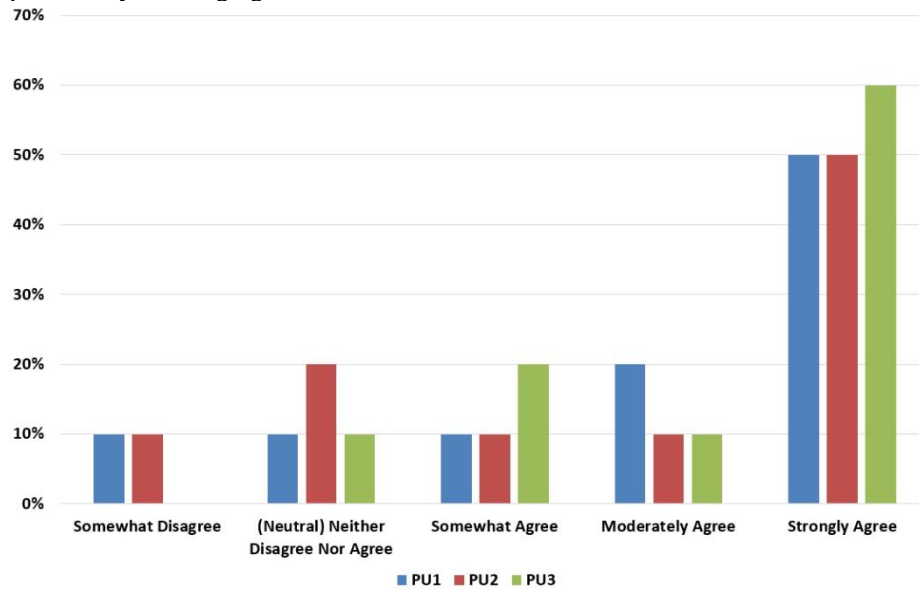


Fig. 7. Participants' feedback on the statements related to Perceived Use (PU) of the game.

The second statement PU2, (The use of this serious game simulated the servitisation offer effectively) received similar feedback scoring also 70%. 20% of users responded neutrally to this statement and 10% provided a negative response. Post questionnaire

discussions with the users highlighted that the simulation although presented correctly the construction process should have taken into consideration additional factors that might affect the delivery time of a building. This was an interesting suggestion and the game could be enriched with additional construction issues in the following versions. However, this specific work was concerned with the adverse weather conditions that could damage and delay the construction of the building, presenting mainly the Weather Ledger Platform.

On the third statement, the users responded positively with 90% (Strongly Agree and Moderately Agree and Somewhat agree) for PU3 (The use of these serious games offered a better opportunity to learn about the servitization offer) with only 10% being neutral and no negative responses. Notably, there were no Strongly Disagree responses from the participants.

The above results highlight an initial appreciation of the potential users' tendency to utilise these technologies and methods (i.e. 3D visualisation and gamification) in the particular field. The different hypotheses that link the nine TAM constructs as illustrated in Figure 6 are not analysed in this paper, as the limited number of participants offered mainly indicative results that could not support a full TAM analysis [27-29].

However, the users' responses related to the Perceived Usefulness (PU) of the proposed system are on par with other studies that utilised gamification to support the servitization of various products and industries or investigated the impact of gamification on clients [12, 16, 31-34]. This confirms the initial hypothesis that the gamification approach for the servitization of financial products will have comparable outcomes to other studies that focus primarily on manufacturing servitization [12, 35-36].

As this study investigates an uncommon area of servitization which is not directly linked to the manufacturing domain but employs gamification to present financial servitization offers, no other similar studies that use the same methods and metrics were found. Remote similarities could be found in only one study that customised an existing board game, namely: snake and ladders, to convey different servitization offers [16].

In addition, the customised TAM, based on previous projects which aimed to investigate the impact of emerging technologies on customers' uptake of new products, has also presented similar responses to the current study's results [27, 29]. The project's design which was supported by industry collaboration and continuous feedback throughout the development was reflected in the users' responses to the PU questions. This established a baseline of areas of interest that need to be covered in such applications and suggested a selection of UI structures and actions that convey successfully the complex financial products to the customers.

At this stage of the project, this output was deemed essential for the continuation of the development and expansion of the particular system. In addition, the above results and analysis of this preliminary evaluation highlight the potential use of these structures and methods for the development of other similar systems that employ gamification and 3D visualisation for enhancing the presentation of information and user engagement with other servitization offers.

7 Conclusions

This paper presented the design consideration and challenges of a novel 3D serious game developed to support the customers' understanding of financial and insurance choices in the construction sector. Both the virtual environment and the game design focused on the simplification of information provided to the user/customer whilst offering a holistic overview and real-time visualisation of construction projects.

The game was based on the EHAB insurance servitization offers and their Weather Ledger Platform that support the decision making process of various construction projects in the UK.

The application was evaluated by ten volunteers that responded to pre and post-test questionnaires designed to inform a custom TAM. The results of this part of the TAM were overall positive yet are indicative and additional user-trials with larger cohorts are required to define the exact level of learning outcomes achieved through this serious game application.

A future plan for further enriching this serious game with additional variables and construction drawbacks will be formed in the next stage. To identify further the impact on the particular industry a larger cohort evaluation will be essential.

Long term impact could highlight the potential of video games outside entertainment; this could encourage other businesses to collaborate with game developers and/ or other innovative technology practitioners to create solutions for their management and marketing issues related to DEAS.

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