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# Can Gamification Improve User Experience (UX) of Servitization in the Financial and Construction Sector?

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**Abstract.** The monetisation of the provision of consumer services rather than products is advantageous and leads to higher profit margins for the providing companies in comparison to the sole manufacturing of consumer products. This business model has gradually propagated in other areas that could offer customized services to their customers such as consumer electronics and fintech. However, the complexity of these offers could deter the potential customers as it could be difficult to understand and evaluate their benefits. Gamification of these offers is a newly adopted method with limited examples primarily in the manufacturing sector. This work presents the development of a serious game for the explanation of fintech servitization offers for the building construction industry. This work aims to identify the efficiency for improvement of user experience (UX) and behavioural intention of customers towards these offers. The project has been evaluated by ten users representing existing customers. The paper presents the evaluation results and concludes with suggestions for future applications and a tentative plan of work for enhancing the application.

**Keywords:** Servitization, Gamification, User Experience, Fintech, Construction Industry, 3D, Virtual Reality, Simulation

## 1 Introduction

Servitization is a business model that is benefiting significantly the manufacturing sector as it provides services instead of manufactured products [1, 2]. This approach reduces significantly the development and manufacturing costs whilst the provision of services could utilise the existing products for multiple functions and/or clients, improving the profitability of the manufacturing company. This is achieved in a twofold method; primarily via a reduction in manufacturing and subsequently in energy and raw materials as well as via the acquisition of additional revenue.

A closely aligned sector offering similar servitization services is the financial sector. The overlapping area where the manufacturing and financial sectors interlink is a greatly unexplored domain of development.

A major obstacle, however, to the expansion of this, lies in the complexity of the service offers. Such complexity potentially demotivates and reduces customer interest and final service offer uptake [3]. Communicating these service offers to the customer in an easy-to-comprehend and evaluate manner tends to be a challenging task for the staff of the provider company. Technological advancements have been employed to simplify and explain the offers to the customers. Digitally Enhanced Advanced Services (DEAS) have been utilised to clarify the process and include combinations of services offered to the final product [4,5]. The above methods, however, are not ideal for optimising customer/user experience (UX), an area that suffers due to the aforementioned complexity issues.

The provision of DEAS from the finance sector in the manufacturing domain can further confound the potential customers. The adoption of new digital methods such as 3D Gamification was deemed an unorthodox, yet potentially useful method to convey such offers [6-8]. This paper presents the development of a 3D serious game that was designed in consultation with an industrial partner (EHAB) for the provision of parametric insurance for the buildings' construction customers. During the building process, the application suggests different insurance services that could prevent major financial issues under adverse weather conditions. The 3D game simulates different weather patterns based on a proprietary weather risk management system in a random pattern following the potential weather phenomena of the region and the month of the construction. The users are enabled to make their own decision regarding the insurance offers that they will use. When and if the building is completed a clear mapping of the different choices, costs and reputation performance is presented through analytical charts.

Firstly, the paper will present the current overlapping domain of financial services and construction. In turn, the paper will discuss the development of the 3D Serious Game and the evaluation results from 10 users aiming to identify their simulated learning experience (SLE). The results and their subjective feedback will be discussed in detail to form an initial appraisal of the suitability of using 3D gamification methods for explaining complex information such as DEAS. The paper will conclude with a tentative plan of future work which will entail the system evaluation with larger cohorts.

## 2 Construction Industry and Financial Products Servitization

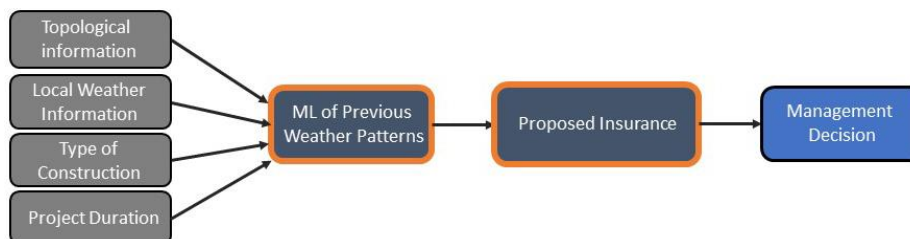
Servitization provides the most fertile ground for the transformation of the manufacturing industry towards the provision of product services. The benefits of servitization have been highlighted in previous studies.

Yet the blend of financial technology and servitization with the construction industry can produce complex combinations of offers which include multiple variables per case for risk analysis. Consequently, these offers are challenging to explain to the potential customers irrelevantly to the significant benefits that they could yield if adopted.

Any type of construction has several risks involved, depending on the area and the topological conditions, which could further dictate logistical and localized weather issues. New services stemming from the use of emerging technologies such as Machine Learning (ML) could provide future insight on numerous risks related to the construction of buildings [9,10]. These risks could be calculated by the analysis of historic and current data related to several factors such as environment temperature, types of ground and weather among others. The analysis of weather patterns could define potential issues and highlight risks and in response adapt to the projected financial risks and present the most appropriate insurance package that could alleviate the above issues.

This work was developed in collaboration with a fintech servitization company that is specialised in the provision of insurance deals for construction projects. To define better the provided offers the fintech company produced a Weather Ledger Platform (WLP) that combines Internet-of-Things (IoT) devices, distributed ledger technology (DLT), smart contracts, desktop tools and applications to reduce foreseen and unforeseen weather risks in the construction industry [11].

By using historic weather data in the pre-planning stages, construction managers can identify unknown risks. It further supports construction site teams to manage day-to-day weather risks. In situations where weather-related Compensation Events take place, it automates the overall claims and compensation processes. All these tools and services are designed with improving foresight, lowering the risk of impact, and facilitating better decisions in relation to risk management. The traditional way to predict the weather and potential construction issues was based on individual constructors' knowledge of the area without this being supported by any scientific methods. As such, detailed risk analysis and mitigation actions were not available and resulted in numerous damages and increased construction costs annually.



**Fig. 1.** Diagrammatic representation of the main process followed for a real-time proposed insurance package based on the main elements calculated by the ML.

### 3 Gamification of Fintech

#### 3.1 Gamification in Various Domains

Serious Games/ Gamification offers an innovative and creative way to communicate, engage and educate people. As well as bringing awareness and providing information, a serious game can potentially communicate complex information in a fun and simple manner. Notably, the vast majority of computer games are produced for entertainment purposes with a very small number of games targeting educational and training subjects for various domains and difficult subjects that require a different learning and understanding approach [12-17].

Although serious games have seen success in various other industries/ education, only limited work has been carried out with DEAS [6, 14]. It was yet to be determined if such methods could be employed to enhance the communication, education and engagement of DEAS offers for the financial service providers.

To this end, this work was developed in conjunction with a fintech servitization company (EHAB) to design and produce a serious game focused on enhancing the understanding and education of their servitization offers.

#### 3.2 Project Gamification Process

The proposed Serious Game was developed under the consultation of the fintech company to comply with all the relevant offers, and regulations and reflect the construction industry requirements and processes. As such the development team went through a training process to familiarise themselves with the services offered by EHAB, and to design an optimal solution for their challenges.

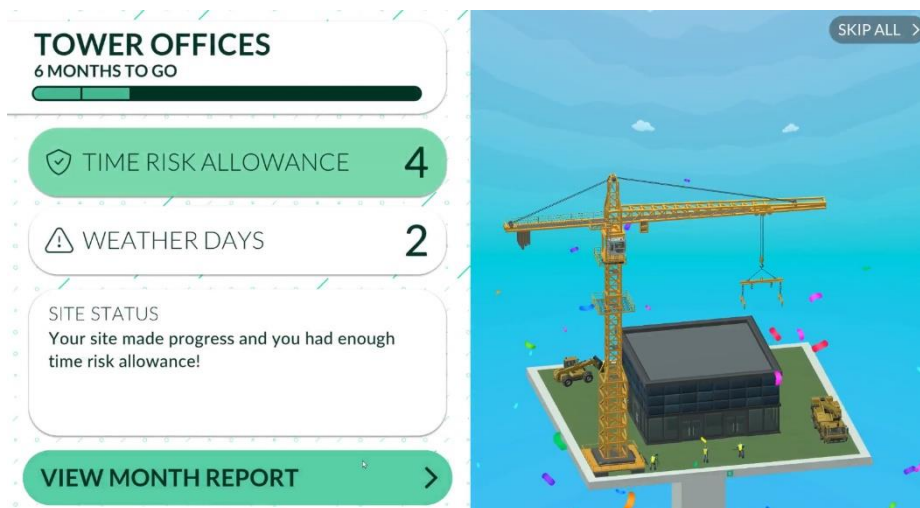


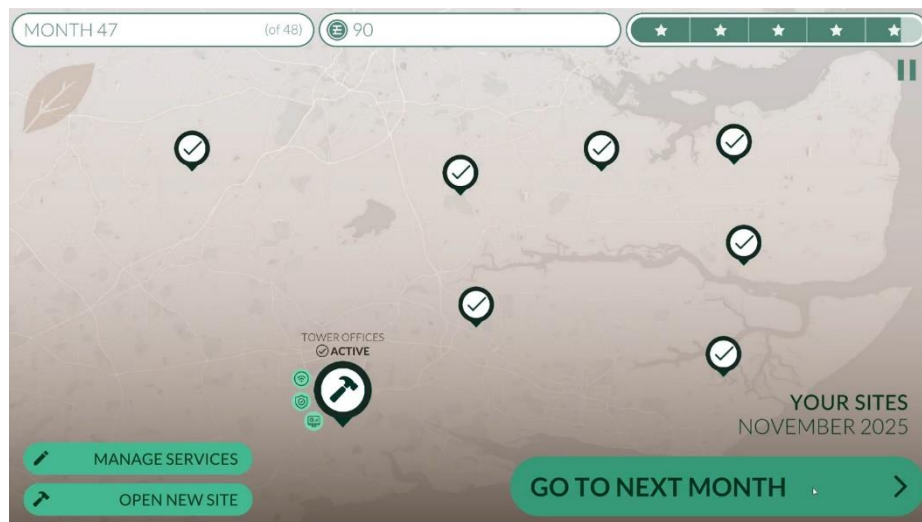
Fig. 2. Game Screenshot of 3D construction model progress and management menus.

The gamification of highly complicated and technical tools and services, supported by ML and designed as risk mitigation financial offers entailed several challenges and development issues.

During the training process, the fintech company highlighted the potential issue of the UI and visual cues of the game, which should follow a style acceptable to a simulation level rather than a game. If the UI appeared too imaginative or unconventional it might be rejected and not taken seriously by the end-users.

Furthermore, the construction simulation of any building should follow a specific development process and timelines reflecting the real-life scenarios. All the above should be transferred in the serious game whilst a 3D model of the actual building should be presented in one of the menus as illustrated in Figure 2.

In addition, different types of buildings should be available for construction in the 3D environment, matching specific topographical information in different UK regions and the expected weather conditions and patterns of these areas as presented in Figure 3 below.



**Fig. 3.** Data visualisation of the construction sites and weather predictions for each season and month with supplementary information about services management, performance and cost

### 3.3 User Interface (UI)

As stated above, the game had to be presented visually more closely to a simulation tool rather than an entertaining game. As such the aesthetics and User Interface (UI) were designed in a similar manner to previous simulation systems [13, 18-20]. As the end-users were not familiar with playing games, it was essential that all the visual elements were clearly described and not abstracted to oversimplified or unknown icons. Any icons that were used followed a direct manipulation design concept in which any displayed objects of interest can be physically and incrementally manipulated by the users whilst they can reverse any of these actions and the effects of their actions can be directly noticeable on the screen [21-23]. As such the UI was designed in a minimalistic approach wherever possible, whilst descriptive menus have been maintained in visible positions to support the management of the site and investigate different insurance offers as shown in Figures 2 and 3.

To entice the users to play the game and continue until their building is completed, it was deemed essential to add a scoring system as shown in Figure 4 below.



**Fig. 4.** The scoring system presents a leaderboard that could be used for the comparison of different practices and decisions that affected the performance of a user.

This scoring system utilised proven game methods which entice the users to compete and learn from the best players on the leaderboard. In this leaderboard, the users could see analytical charts of their overall performance and contrast them with higher-scoring users. In this way, they could compare the different decisions and insurance choices that improved the completion rate of different constructions, and the cost-saving approaches. The overall profit and site completion number were counted towards the leaderboard place.

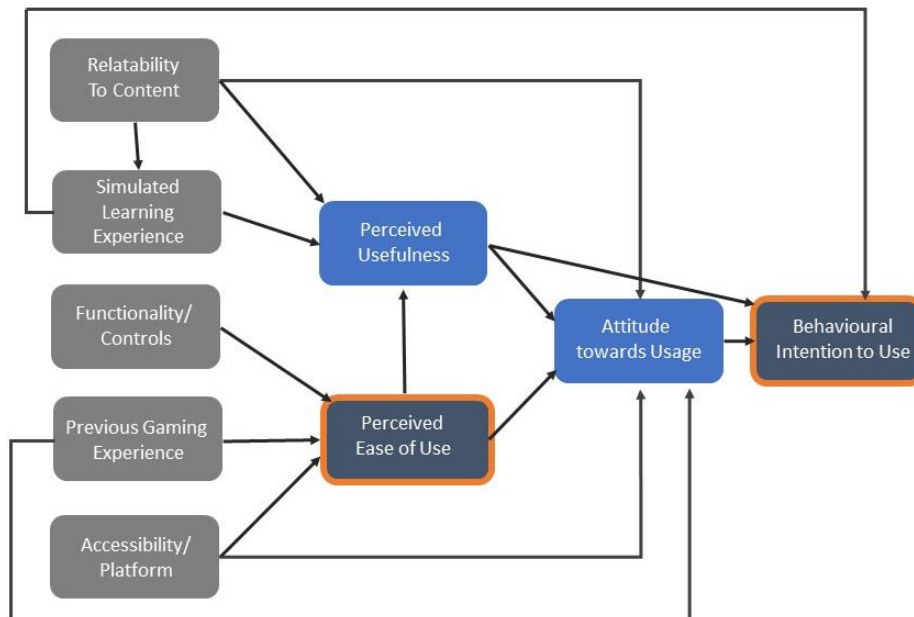
## 4 Evaluation

### 4.1 Evaluation Method

The evaluation of the serious game was performed by ten users specialising in the field and reflected the views of potential customers of the construction industry. The game application was evaluated to determine its effectiveness to support the dissemination of the fintech company information related to their offers. Secondly, as this type of system poses several issues for the evaluation and extrapolation of results in the larger population, this study employed a customized Technology Acceptance Model (TAM) that could offer valuable information regarding user acceptance and create a tool framework for future studies in the field of servitization and the use of serious games [25-27].

While the primary focus of the original project (Development of a Serious Game prototype to aid the education of smart contract policies) was to design, develop, and implement the serious game, this work aimed to explore and analyse the potential use of the game from a user experience (UX) point of view through a larger cohort.

This preliminary evaluation utilised a 7-point Likert Scale Questions (strongly disagree, disagree, somewhat disagree, neutral – neither agree nor disagree, somewhat agree, agree, strongly agree) referring to the custom TAM structure illustrated in Figure 5 below.



**Fig. 5** Custom TAM structure for fintech servitization offers for the construction industry.



The ten users responded initially to a prequestionnaire which concerned with their demographic information and their computer literacy that could affect the outcome of this study.

In turn, the users played the serious game application and followed a typical construction process of a building for multiple months until completion. During the process, they could monitor their risk assessments, the predicted weather issues and their proposed insurance packages that could be implemented depending on the construction stage, development costs and overall performance.

After the game, the users completed a post-questionnaire following the custom TAM. This second questionnaire was designed to identify the user experience (UX), and the users' behavioural intention toward purchasing the fintech servitization offers.

This paper presents two of the most interesting sets of questions/statements that aim to reveal the users' Perceived Ease of Use (PEU) and their Behavioural Intention (BI) as presented in Table 1 [28-30].

**Table 1.** Perceived Ease of Use (PEU) and Behavioural Intention (BI) statements

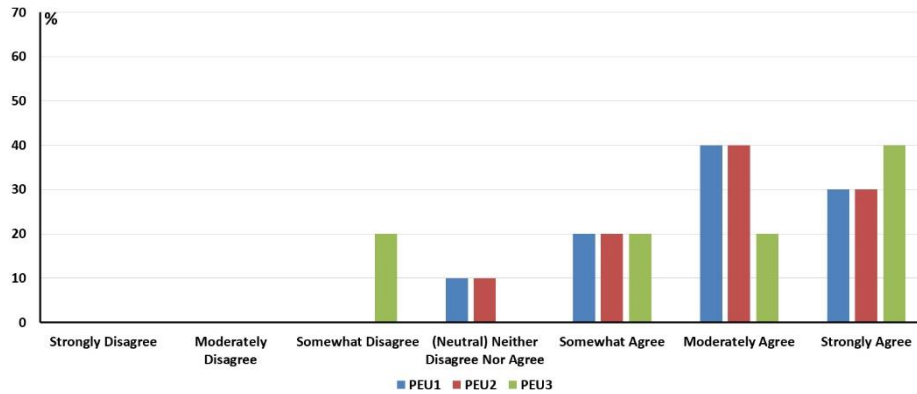
PEU_1	I found the serious game easy to pick up and play.
PEU_2	Learning to play this game was fairly simple.
PEU_3	Interacting with the serious game did not require a lot of mental effort.
BI_1	I would support the use of serious games to communicate complex servitisation offers.
BI_2	If I had the opportunity I would participate in other simulation-based serious games.
BI_3	I would like to see more of such serious games being utilised by manufacturing/ engineering companies to aid communication of their servitisation offers

## 5 Results and Discussion

The analysis of the TAM questionnaire provided some insight into the users' behaviour and their overall user experience. The three statements for the Perceived Ease of Use received positive responses from the users as illustrated in Figure 6.

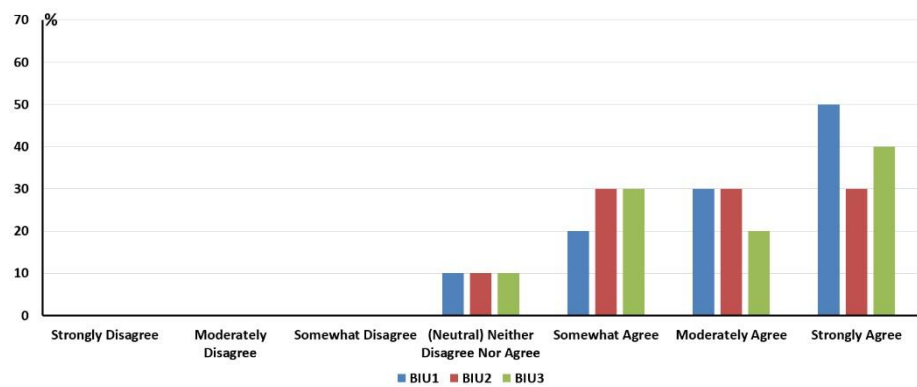
In particular, PEU1 scored 90% on the combined score of positive answers with only 10% neutral. This result was within the expected margins, yet additional changes on future versions will attempt to reduce this 10% further.

The PEU2 presented similar results showing that the users managed to learn to play this serious game fairly easily and quickly. This was identified during the development as a potential issue, as the majority of the target users don't play games. This concern was tackled by simplifying the game design and UI without losing through the detailed provision of servitization offers.



**Fig. 6.** Responses of 10 users in 3 statements describing their Perceived Ease of Use (PEU).

The PEU3 statement presented a slightly different output. Although 80% of the users appeared to be comfortable with the overall UI and the visual information as well as the menus and descriptions provided in the game design, 20% found it somewhat difficult and disagreed with the PEU3 statement (Table 1). This was a major concern that the fintech company highlighted during the consultation period at the early stages of the UI and the game development. However the concern was expressed as a potential complete refusal of the users to operate the game, so the 20% that found the interaction somewhat difficult was encouraging. To reduce this percentage this work will develop and experiment with new interface designs following the users' feedback and suggestions.



**Fig. 7.** Responses of 10 users in 3 statements describing their Behavioural Intention (BI).

The other three statements aimed to identify the users' behavioural intention (BI) towards the received overall positive results with only 10% responding neutrally. The users displayed comparable positive approaches and stated that they would be happy to use similar types of serious games to communicate and understand complex servitisation offers. They also responded that they would be keen to participate in other

simulation-based serious games and would be interested to see more of such applications employed by companies to aid the communication between providers and clients, especially for the communication of complex servitisation offers.

## 6 Conclusions

This work presented the servitization business model and its applications in various industries with a particular interest in the fintech domain. The latter can provide major benefits through bespoke servitization offers to potential customers. Yet, these offers can be overcomplicated and deter the clients. To circumvent this issue, gamification is tentatively adopted to convey this complex information in an enjoyable manner.

The paper elaborated on the development requirements and process that resulted in a complete, functional serious game with simplified UI and a complete suite of servitization offers presented through the gameplay.

The final serious game was preliminarily evaluated by ten users, that are specialised in the construction and servitization field. A custom TAM was developed to gauge users' acceptance of this type of technology. The paper presented the results of PEU and BI which were encouraging and supportive of the current serious game. The evaluation results emphasized the users' ability to understand and experience in a simulated 3D environment the benefits and drawbacks of the proposed insurance and other financial offers during the construction of a building. Furthermore, this initial testing highlighted the suitability of the gamification process to convey complex information for financial products.

Based on the users' feedback, additional UI elements and development will be required to improve the playability and acceptability for future similar 3D serious games and applications. In addition, a future plan will entail the evaluation of such game applications with larger and more diverse cohorts.

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