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Supply chains are playing games: A review literature on Gamification in supply chain

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A B S T R A C T

Supply chains are changing due to changes in the global environment and to make the strategies effective most of the companies are striving towards the trends in the supply chain. Among the trends gamification is one of those that are creating an impact in the workspace with the techniques that are associated with it. Gamification in the supply chain had the least application and this study gave a road map for the decision makers like supply chain managers with the help of reviewing papers from the databases that are available. Findings say that giants like Amazon and Starbucks are applying gamification techniques to bring more transparency and visibility to reduce errors and to mitigate errors. This paper is providing evidence from the different activities like order management, warehousing activities with case applications are discussed. We conducted systematic literature review with 118 papers on gamification and 22 found relevant to the supply chain and its activities.

1. Introduction

Gamification is not a buzzword which has a boundless potential in the workplace if it is going to be executed properly. To gain a better understanding of the process, it is important to study how psychology works and in which ways workers can be motivated and apply the techniques. Most of the gamification experts mention game experiences where players feel imperceptible thinking out of the box and show better determination to excel and people who work under gamification as they team up with others, work together towards a firm goal and the goal of gamification is to participate the game experience to actual world contexts and problems (Bright & Ponis, 2021; Behl & Dutta, 2020). The general thought of gamification, whether it accomplishes the envisioned results and how it is still existing as evidently as it is lower than the development. Significant research is required to develop a solid mechanism of theoretical as well as methodological base on which knowledge is gathered (Hamari, Koivisto, & Sarsa, 2014; Seaborn & Fels, 2015). Gamification though from time to time has been observed as coercive, suppressive, and a way to disconnect workers from their fundamental motivation (Bogost, 2015; Morschheuser et al., 2017; Bahr et al., 2022; Settanni & Srai, 2022). These understandings seem to stem from a very specific understanding of gamification and they should be recognized and investigated. It is significant to discover how gamification is essentially used, whether it is to support workers motivation and increase the knowledge of gamification which impact the logistics and supply chain operations (Koivisto & Hamari, 2014). This study provides a map to review the literature on gamification, taking standpoints on supply chain and related to the state of the art and recognizing gaps with a view of prominent aspects of future research potentials. To develop and promote future trends in the supply chain in the organizational or industrial context this paper reviews which are already available in the literature of gamification and supply chain. The sudden Buzz in the industry on gamification and extensive articles in the future of gamification with the titles like "***Amazon expands gamification program" and "Amazon gamifies warehouse worker"*** *from Forbes (03/21/2022)* in the last six months made us do research in this area. The objective is to understand the application of gamification in different activities in the supply chain like warehousing, order picking etc. This study provides a way to future research to apply gamification techniques in logistics and supply chain. In keeping with the research aim the paper highlights the important question:

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RQ1: How extent is the use of gamification in supply chain practices?

2. Literature Review

2.1 Gamification

Gamification can be defined as "the presence or addition of game-like characteristics in anything that has not been traditionally considered a game" (Harris & O'Gorman, 2014). The gamification design frequently comprises of the different aspects that construct on game design and communications which are frequent and the most common in games which are designated to considered parameters and properties of the system either seeming or the definite that determine how person may use the given system, methods that are in use and the employee cannot compel to act upon the properties (Norman, 2013). Gamification is regularly positioned in a certain setting and efforts to elicit behavior related to background where the domain application comes to front. Liu et al. (2011) suggest that the target area of gamification is to incentivize a non-game system access user to have the so-called game like behavior focus on the task on one hand, multitasking under pressure, work overtime without any discontented attitude, keeping always in retrying when it fails etc. One of the most commonly leveraged frameworks of gamification designs are referred to as MDA which means Mechanics, Dynamics, and Aesthetics. The MDA framework is the postmortem analysis of the elements of a game. It helps us understand how systems are thinking and how to use the interplay of games and the elements which can be applied in the domain. Typical elements of a gamified activity include (Dale, 2014; Korn & Schmidt, 2015; Kapp, 2012; Zichermann & Cunningham, 2011; Cardador et al., 2017):

Table 1
Gaming classifications

Points	Distributed to players for high value achievements and behavior
Achievements	Provide satisfaction for high value user behavior
Levels	Highlight the level of engagement of each player and reinforce them for new challenges
Missions	are set of behaviors which enable players to get specific rewards
Contests	Specific rewards for players who finish effectively and quickly
Leader board	Increase Competition by posting rankings
Notifications	Encourage players towards the desired goals and actions

Gamification of business activities has a significant positive impact on employees by improved engagement, more increased morale, adaptive faster learning, increased productivity, competition and excellent performance (Narayanan, 2014; Dale, 2014; Marczewski, 2013; Burke, 2014; Marcão et al., 2020). Warehouse consultants like Manhattan Associates state that "we are still in the early stage of gamification elements embedded in labor management systems, but it holds great promise as a tool to revolutionize the warehouse workforce" (Schnorbach, 2015; Webb, 2013). This indicates the gap within the core area of logistics and supply chain in which this paper or work aims to fulfil at least partial directions to industry.

2.2 Supply chain Management

According to Lee and Billington (1995), supply chain management is a network of facilities that produce raw materials, transform them into intermediate goods, and then to finished products, deliver the products through a distribution channel or system. It includes procurement, manufacturing, and distribution, the basic objective of the supply chain management is to optimize the performance of the supply chain as much as possible with the least cost, in other terms it aims to link all the entities along the firm to cooperate and maximize the productivity in the supply chain to deliver the benefits to all the partners or entities (Lietke, 2006; Mohaddesi & Harteveld, 2020; Neto et al., 2014; Rodrigues et al., 2021).

2.3 How Gamification works?

Gamification broadly refers to designs that attempt to transform various systems, services, activities and organizations into more game-like (Vesa et al., 2017; Huotari et al., 2017). Gamification therefore in general contains the use of game design as means to invoke comparable experiences as games do and further affect people behavior. Gamification can further divide in three primary elements: gamification design, psychological mediators/outcomes or behavioral outcomes (Huotari & Hamari, 2012; AlSaad & Durugbo, 2021).

Gamification design commonly consists of affordances that build on game design and exchanges the interactions that happen in common games. With different sets of designed properties of a system either perceived or actual that determine how a person may use the given system (Norman, 2013). A user of a system is not compelled to act upon these properties instead of what they call as "enable" that affordances most often refer to various design elements in games.

The Psychological mediators/outcomes refer to any psychological effects and experiences that the gamification implementation is seeking to support the user. The experiences and effects that are mostly commonly used by users in games. For Example, senses of mastery and capability and sense of community, creativity and playfulness, enjoyment, and flow. All

these different sets of aspects that are commonly connected to the intrinsic behavior and motivations to the patterns of gameful experiences (Deterding et al., 2011; McGonigal, 2011; Ryan & Deci, 2000; Behl et al., 2020).

Behavioral outcomes refer to any activities or behaviors that the gamification seeks support.

3. Gamification Framework

Table 2 provides which type of activity or task that needs to implement through gamification and the components and mechanics that firms could follow based on their target behaviors.

Table 2
Gamification Framework

Target behavior	Task of the Gamification Application	Components	Mechanics	Self-determination theory influence
Self-Control & personal decision for adjustments	Show the number of finished work tasks	Points	Feedback	Competence
	Show a comparison of current and specified status	Points, Achievements	Feedback	Competence
	Comparison with previous Performance	Points, Quests	Feedback	Competence
	Comparison with other group of employees	Points, Badges, Leader board, Teams	Competition, Cooperation	Competence & Relatedness
Focus on quality and correctly conducted work tasks	Number of correctly produced parts	Points, Badges, Leader board, Teams	Competition, Cooperation	Competence
Recognition of personal progress	Number of successfully completed tasks	Points, Badges, Levels, Skills	Feedback & Rewards	Competence
Employee-Specific assistance level	Provision of person specific level of information during work	Skills	Feedback	Competence & Autonomy
Storage and transfer of expert knowledge	Generation and expansion of knowledge database	Teams	Feedback & Rewards	Competence
Team Support	Transfer of Expert Knowledge	Points, Badges, Levels, Skills	Feedback & Cooperation	Relatedness & Autonomy
Regular usage	Use of the training platform	Points, Badges, Levels, Skills	Rewards	Relatedness & Autonomy
Publishing of ideas	Collection of enhancements	Points, Badges, Levels	Rewards	Autonomy & Competence
Interaction and Discussion	Evaluation of enhancements	Points, Badges, Leader board, Teams	Competition, Cooperation, Feedback	Relatedness & Autonomy

4. Methodology

This paper adopts a systematic review methodology which enhances the identification, evaluation, and interpretation of existing available research material and the database sources related to a specific area of interest, topic, or phenomenon. This paper adopts this approach to remove the chance of causing biasness and to enhance the scientific contributions to the field. Studies that give added value to the systematic review is a form of secondary studies. This type of study requires more effort and a wide range of papers or information to make systematic reviews are advantageous (Kitchenham, 2004; Kitchenham & Charters, 2007). There is evidence that the results from systematic reviews help to cover vast and transferrable to review and study different sources that cause difference. This paper captures systematic review methodology, and the review method steps (Fig. 1) suggested by Kitchenham (2004) and Torres-Carrion et al. (2018).

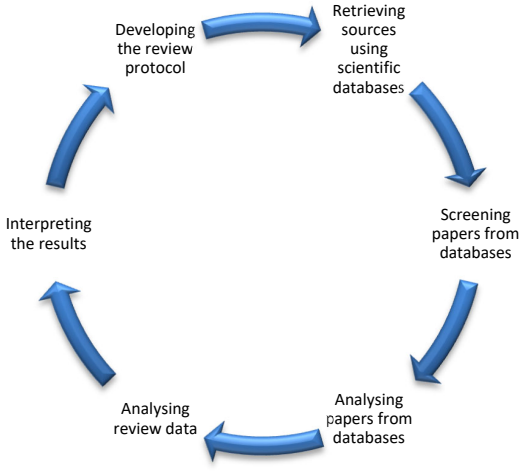

Fig. 1. Systematic Review Methodology

Table 3 provides the information and the review used from the databases which have their own scientific databases such as Scopus and Web of science. Scopus, owned by Elsevier a Dutch publishing company, is an abstract and indexing database with the full text links. Web of science is also a platform which is globally renowned, accepted and widely used for scientific research owned by Clarivate Analytics an American technology company and the main strength of the database used as a dataset for large scale data intensive studies. The availability of these databases to access journal articles together with reference makes it suitable for conducting research in backward mode of search. Backward referencing involves categorizing and identifying the references or works cited in the article which is also known as chain searching (Burnham, 2006; Khan et al., 2003; Wood & Reiners, 2012; Vesa et al., 2017,). Table 2 summaries the review protocol suggested by Durugbo (2020).

Table 3
Systematic Review Literature review protocol

Review Element	Description	Focus on the review
Purpose	Aim of the literature Review	The purpose of the literature review is to capture perspectives of gamification in supply chain activities to summarize activities related to it.
Search Strategy	Course of Action or plan to inform the search process for the review	The search strategy for the review involves using keywords to search specified databases informed by screening and exclusion criteria
Search Strings	Combination of key words used to conduct the search for literature	The search strings for the review are "Gamification" and "Supply chain" as key words to be searched within the database article title, abstract, keywords field.
Databases	Independent online database with citation data and index of scholarly writings	The database used in the review is Scopus, Google Scholar, Web of Science
Screening and Inclusion Criteria	Conditions for selecting and including review sources	The Screening Criteria for the review involves database search and inclusion of centers of relevance and Publication type (Journal article)
Exclusion criteria	Conditions for omitting publications during the review process	The Exclusion criteria for the review are duplicates, non-English studies, and unrelated title and contents; Master theses, doctoral dissertations, textbooks, and unpublished working papers.

The following search string was used in Scopus database and other databases TITLE-ABS-KEY (gamification)/logistics/supply chain/production/operations. The search entries were limited to open access and using of only one database as primary search i.e. Scopus was well used and acted as a desirable systematics method to improve the clarity and replicability of literature search methods and processes (Pare, 2015). The literature search resulted in 118 papers which were further verified and studied for inclusion or exclusion with the subsequent conditions suggested by (Waremelink.H,2018) 1) the entry was a research paper and not a summary, conference review, book etc. 2) the research paper was written in English, 3) the paper was related to supply chain, logistics, production 4) the paper was not focused on gamification in education. After identifying the relevance of papers and conducting a backward-forward search 22 papers were reviewed which followed the above criteria in gamification in supply chain.

5. Application of Gamification

Order Picking: Order picking is one of the most challenging, critical and costly warehouse processes and there are many tools to enhance the support activities to increase quality and productivity. It is also accountable for most of the total warehousing costs which are labor intensive and repetitive work could take place. It is important to implement the digitization methods which are primarily based on artificial intelligence, augmented reality etc. Gamification methods help to transform the various levels of expertise to provide real time data that are available about the inventory and necessary information of picking goods which enables reduction of errors across the process that firms follow, and execution times and information is key which has facilitated the enhanced performance of workers.

Production Control: It is surprising that gamification has not widely used and not even more spread into industrial production many processes in this domain have physical outcomes and these outcomes are measured and transferred to business intelligence systems like enterprise resource planning, so that the gaming elements like process visualization, systems assistant and the different set of modern interaction techniques with variety which needs to be implemented. The addition of gamification techniques in production control has an important impact on the workers and their task which is replicated to the supply chain planning and control. The gamification allows plant managers or workers to boost the goals in the weekly or monthly production schedules that keep them effective in the plants. Another important element is to complete the assigned tasks of an individual's team to complete the different set of goals which are framed in production schedules. The possibility of reducing supply chain risks through the visual gamification methods that deploy seeks the improvement of supply chain strategies along with the improvement of productivity.

Warehousing: Majority of the warehouse's activities are surrounded to fulfill an order out of which the cost and the activities that warehouse includes the highest of the total logistics cost. Gamification potentially helps to achieve a business environment which includes the employee morale and productivity, increased engagement, and the competitive environment, tracking of material etc. The creation of gamification in warehouses could help the healthy environment among the employees with fun to achieve benefits and easier performance.

Sustainable Manufacturing: Gamification helps to bring sustainable manufacturing practices that are enabled in Industry 4.0. The identification of sustainable manufacturing develops with the different set of manufacturing processes that are done in different industries which is more focusing on designing of production systems, which helps the whole supply chains be accountable in the complete product life cycle. The gamification approaches which involve sustainable manufacturing have four key areas are business models and process, asset and product lifecycle management, resources and energy management and the enabling technologies. The impact of mechanisms that industries follow from regular to sustainable manufacturing needs some inclusion of gamification techniques to bring more scope towards the manufacturing practices and supply chains that have a significant positive impact.

E-commerce: Gamification is the most useful strategy in e-commerce websites to motivate the customers and to keep the customers to revisit their websites and grow the business financially. Socialness, ease of use, usefulness, enjoyment, intention to use, also create a positive environment that gamified elements help in bringing creativity, loyalty and maintenance among the users. Gamified elements which implement in e-commerce websites have a confidence in the potential user and seller as well. Gamification can produce different sets of engaging customer experiences by improving the way customers are intact in the website and how this engagement in the online shopping process can be improved if we have a successful digital strategy. Gamification and integration of game design principles and characteristic game mechanics to e-commerce can increase the engagement of businesses. Industry needs the more understanding of the customer needs and must try implement game elements as successfully as possible.

6. Industries that apply Gamification

Starbucks is an example of successful application of gamification in the supply chain environment. They improved their profit margins and delivery efficiency for the distribution of disposable items such as coffee cups, napkins, etc. to their stores through these applications. The problem that arose from suppliers not making shipments ready of these items on time, since the stores made frequent last-minute orders, without planning, this has increased the cost of logistics forcing them to use air transport due to the urgency. This problem has been solved using gamification techniques like the member of the chain could see the performance of each one and if the member made late deliveries it would remain as bad reputation points. Another way is that the data was shared among the members of the supply chain in real time and began to collaborate. The system based on transparency allowed the reduction of emergencies, increase in the use of land shipments compared to air transport and improved margins of company along with the business strategy was achieved by reducing costs through gamification.

7. Guidelines for successful gamification implementation

Keep Information transparent: Gamification should not result in the masking of relevant information for a particular task.

Provide real time feedback: users need to know if they are on track or understand why they failed.

Setup rules and goals: users need to understand what is expected and how they can achieve it.

Freedom: there will be no increase in motivation if decisions are made for the users and they cannot do it in their own way.

Rewards: Rewards remain continuous for the real achievements in the processes.

8. Limitations & Future work

The improvements to the study further can be done through the interview methods with the industry experts and in-depth discussions with the practitioners to reflect their application of gamifications in their firms. The sample to review is low and the possibility is there to check with the different industry wise and its use of different gaming techniques to improve quality of work, mechanisms, process designs etc. using of survey methods with warehouse and supply chain managers of different countries may bring a scope to identify the potential of gaming in supply chains could reach in more effective way and by incorporating focus groups, case studies, action research, systematic review literature, appropriate elements to overall research design along with mixed method of research. The limitation of reviewing maximum papers from SCOPUS is a limitation of the study and future research broadly recognizes the other databases which would be beneficial for literature reviews.

9. Conclusion

A buzz in the supply chain forums or industries create a tremendous change across the industries out of which one of them is gamification, which was least observed area and used area in the logistics activities like order picking, warehousing etc., To understand the extent of how industries are using and the potential of research in the area was less and to make the way for the industries this study is one of the impactful to the supply chain managers how gamification helps to improve their business. Literature review was used from the previous studies on gamification in supply chain which is relevant to the study. An increase in the motivation to apply gamification techniques help to increase in the performance or in the efficiency

of the different levels of processes and the improvement in the quality of resources and procedures that are involved in the production, transportation areas. It was found that different game elements were liked differently depending upon the level of use and experience of activity and the research should address the long-term effect of gamification in the supply chain and combination of different game elements which could affect the impact in the long run.

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