Logistics Simulation Game Proposal – a Tool for Employees' Induction

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ABSTRACT

Purpose: The main purpose of this paper is to propose the development of a simulation game and to explain the use of the proposed logistics simulation game in the induction programme of new employees in real company settings.

Methodology/Approach: The proposed logistics simulation game is based on a conceptual modelling framework – mostly a specification of the parameters and variables, and the relationships between them, as well as the adjustment of the game to the real conditions and company's requirements.

Findings: The proposed simulation game enables new employees to learn to manage internal transportation in a way that would achieve the lowest level of connected logistics costs together with the maximum use of production lines capacity per single shift.

Research Limitation/Implication: The logic of creating a simulation game is universal. An applicable simulation game has to be tailored to a particular company and the requirements of an induction programme to a specific job. The proposed simulation game was tested in a specific company; its application in different types of companies would be needed in future.

Originality/Value of Paper: The induction programme has rarely been the subject of theory and research, in comparison to other functions of human resource management. Thus, the paper contributes to theory and practice by presenting the partial results of research focused on an innovative approach in the induction training of new employees in a logistics department.

Category: General review

Keywords: employees' induction; simulation game construction; logistics

1 INTRODUCTION

The formal induction of new employees to a company is a planned and organised process that can increase efficiency and shorten the period of integration of new employees to the company, and working and social environment, as well as the familiarisation with job tasks and working conditions. The purpose of the induction is to ensure that employees understand their job tasks and achieve the required job performance as soon as possible. The importance of the adaptation of new employees is increased by the fact that "employees are entering and exiting jobs more frequently than 50 years ago" (Simosi, 2010), however, it is still under-rated in both theory and company practice, in comparison to other fields of human resource management (e.g. Wanous and Reichers, 2000; Armstrong, 2009). This paper is the result of partial research focused on an innovative approach in human resource management in the field of the induction of new employees. It is applied to new employees in the logistics department. The objective of the paper is to present the logic of the development of a simulation game and to explicate the use of a specific logistics simulation game in the induction programme of new employees in the real setting of a selected company. Employees passing the logistic game can verify their understanding of their responsibilities, clarify the activities that will be in their job description and understand the interconnections before their actual performance of the tasks and assuming responsibility for these tasks. Employees are monitored during the specific induction programme that helps to prevent potential problems and to eliminate costs due to errors or the incompetence of employees.

2 THEORETICAL BACKGROUND

This section describes the definition of a simulation including its value in a real work setting. The basics of the induction, its effects and training as a part of the induction are also presented.

2.1 Definition of simulation and its use

The term simulation can be defined in various ways concerning the level of universality. Klabbers (2009) lists the terms that are related to the game, referring to their common use, and he describes simulation as "the process of simulating something, that is, reproducing a set of conditions, or the result of simulating it", and as "an attempt to solve a problem or to work out the consequences of doing something by representing the problem or possible course of events mathematically, often using a computer". Taking into account the focus of this paper, more specific definitions of simulation are described. To acquire information through experiment is defined as: "Simulation is a technique which replaces the dynamic system by a model with the aim of getting information about the system through experiments with the model" (Dahl, 1967). For a better focus on the system under examination, a specification of the system is aimed as:

"the process of the real system model, the execution of the experiments by this model to achieve a better understanding of the studied system behaviour or to assess different alternatives of the activity" (Shannon, 1975). We understand the simulation in this paper as an experimental method in which we replace the real system by the model.

Logistics is a very suitable area for using simulation games as stated by several authors (Debnár, Košturiak and Kuric, 2000). It is possible to simulate quite a lot of activities and to gain experience in different logistics functions in a safe environment.

Simulation is usually used to achieve one of the following goals (they are partially simultaneous):

- To understand a real (model) system,
- For the parametric study of a real system (finding the influence of changing parameters on the system's functioning),
- As an alternative to experiments on the real system – if the real systems are expensive, long or dangerous (Hušek and Lauber, 1987).

2.2 The induction of new employees

Generally, induction can be explained as "a formal introduction to a new job" (Dorling Kindersley, 1999). It is also known as orientation, introduction or socialisation, less formally as "onboarding" (e.g. Wanous and Reichers, 2000; Grobler, et al., 2006; Lawson, 2006; Armstrong, 2009; Bradt, 2014). More precisely, induction is "the process of receiving and welcoming employees when they first join a company and giving them the basic information they need to settle down quickly and happily and start work" (Armstrong, 2009, p.603). Grobler and colleagues (2006) define induction as "the process of integrating the new employee into the organisation and acquainting him or her with the details and requirement of the job…It not only involves the job training of new employees but also the whole process of integrating employees into the organisation." Although work induction interrelates with social induction (Bedrnová, et al., 2002; Bláha, Mateiciuc and Kaňáková, 2005; Antonacopoulou and Güttel, 2010), we focus on work induction in the paper – the induction to the department and the induction to the specific job position that is realised by the training of new employees. Anderson, Cunningham-Snell and Haigh (1996) present the results of a survey among a British organisation, which indicates that "over 90% of organizations conduct formalised induction programmes in the early stage of newcomer socialization".

Induction is important to prevent new employees' resignation due to inconvenience, stress and problems immediately after joining the organisation. The aims of induction include smoothing the preliminary stages for new employees, quickly establishing a favourable attitude to the organisation in the mind of new employees so that they are more likely to stay, obtaining effective output from the new employee in the shortest possible time and reducing the likelihood of the employee leaving early (Armstrong, 2009). Similarly, Acevedo and Yancey (2011) include among the benefits of a proper induction programme "improving the person-job fit, reducing turnover and absenteeism, and increasing employee commitment and job satisfaction".

From an economic point of view, induction reduces the costs associated with repeated recruitment and the other costs of employee turnover, such as training, lost production and the costs arising in the period when the job position is not staffed (Armstrong, 2009; Dvořáková, et al., 2012). According to Armstrong (2009) these costs "for a professional employee could be 75 per cent of annual salary. For a support worker the cost could easily reach 50 per cent of pay". Dahl (2013) states that "the cost to bring on a new employee can range as high as 150 per cent of that person's salary". Without a consideration of the actual amount of the costs, the importance of formal induction is evident for any company from a cost perspective.

2.3 Simulation training as part of an induction programme

Orientation programmes are sometimes distinguished from training. Wanous and Reichers (2000) present the differences between orientation and training. These include the focus of orientation on the performance context and of training on task performance, and the timing difference between them including the level of stress associated with the entry. Still, there are several similarities (Wanous and Reichers, 2000) – "both are primarily concerned with organizational influence on employees, rather than the reverse", "both are programs rather than processes" and also, "it is often difficult to evaluate the effectiveness of the various individual components of the program". We consider the entry training programme as part of the orientation programme in this paper, as we narrow the focus of our application to departmental induction and specific job induction.

Bradt (2014) presents the results of an onboarding survey conducted by BambooHR's founder and COO Ryan Sanders, released on 19 March 2014. The survey highlights that a combination of three components has an impact on the effectiveness of the onboarding programme, such as the impact of the manager, on-the-job training and the extended timeframe of the induction. According to the results "76% of respondents agree that on-the-job training is the most important thing a new employee needs to get up to speed and begin contributing quickly" (Bradt, 2014).

Kirkpatrick's Four-Level model evaluating training programmes, originally introduced by the author in 1959 and revised in 1996 (Kirkpatrick, 1996) can be used to evaluate an induction training programme at four levels: reaction of participants, learning, behaviour and results. The effects of the induction training can only be estimated, as the results are difficult to quantify and the contribution of the induction training to improved results is not always unambiguous due to the impact of other factors. The results of orientation training that can be measured "could include any of the following factors (Lawson, 2006): safety record, turnover rate, absenteeism, employee grievances, and employee satisfaction".

In the learning process, simulation techniques provide the opportunity to deal with virtual situations which bear resemblance to those that are to be solved in real life (Cano and Sáenz, 1999). The experience gained in using one of the simulation models ("Beer Game") in training sessions is given, for example, by Hieber and Hartel (2003).

Simulations used in on-the-job induction training offer many benefits both to the newly hired and to the company. The simulated environment takes on all the characteristics and variables faced in the employment, but the new employees gain new knowledge and experience without the risk of making costly mistakes for the company. "In light of the comparable cost to conventional training, the additional benefits of decreased delivery time and improved performance over a shorter duration make simulated learning an effective tool for both cost and efficacy" (Hritz, 2013). Similar conclusions have been reached by Zgodavova, Kisela and Sutoova (2016) from the experience in applying the role-play simulation in the learning, e.g. reduction of costs, process improvement, but also positive attitude of the players and managers to the simulation.

3 METHODOLOGY

The main purpose of this paper is to propose a simulation game construction and to explain the use of the proposed logistic simulation game in the induction programme of new employees in a real company setting.

The construction of the logistics simulation game is based on a conceptual modelling framework for simulation-based serious gaming (Zee, Holkenborg, and Robinson, 2012). Shannon's (1975) approach to conceptual modelling is used as the basis of the paper, in which he distinguishes four steps in conceptual modelling:

- specification of the model's purpose;
- specification of the model's components;
- specification of the parameters and variables associated with the components;
- specification of the relationships between the components, parameters and variables.

The process of constructing the logistic simulation game is based on two main ideas:

1) Using the parameters and variables which other simulation games use, and the goal of the games: For the specification of the parameters which can occur in the particular games and the specification, which participants in the games work with, the parameter, variables and the goal of the game used in other logistic simulation games were compared and described. Six logistic simulation games were chosen, that are commonly known and used in logistics applications (Lane, 1995; Forssén-Nyberg and Hakamäki, 1998; Cano and Sáenz, 1999; Hieber and Hartel, 2003; Harrison and Hoek, 2008; Brotherton, Montreuil, and Naccache, 2012; Riemer, 2007, 2012; Thompson and Badizadegan, 2015):
    - Beer game (BG),
    - Mit Beer game (MBG),
    - The International Logistics Management Game (ILMG),
    - Cornell University students game (CU)
    - Global player (GP),
    - JISEL, created by the Groupe ESC in Bordeaux.

2) The adjustment of the game to real conditions and the company's demands, so the proposed game can be used as a tool for the employees' adaptation to real working conditions. The purpose of the induction training of employees is to acquire applicable knowledge on the daily work. To adjust the logistics simulation game to the real conditions in a company, the company's requirements in the logistics simulation game were examined.

The comparison of parameters, variables and the goals of the game is mentioned in subsection 4.1. The proposed logistics simulation game in a real company setting is presented in subsection 4.2. The subject of the case study was a manufacturer of electric motors for home appliances, operating in Slovakia since 1993. The process of the construction of the logistics simulation game consisted of selecting parameters, variables and the goal of the game and their descriptions, as well. The problem was formally written down including the definitions of the relations. Then, the main results of the test of the game are presented. In subsection 4.3, four steps for the realisation of the proposed logistics simulation game were set and an evaluation of the application of the logistics simulation game for the employees' induction was suggested.

4 RESULTS

4.1 Comparison of parameters, variables and the goals of the games

Different parameters and variables are used in the games. They come from their range, complexity orientation, the goal of the game and the target group for which the games have been aimed.

To clearly describe the use of the parameters and variables in each game, a comparison of them is presented in Table 1.

Table 1 – Parameters, variables and the goal of the game in the selected simulation games

Game						
Parameter	**BG**	**MBG**	**ILMG**	**CU**	**GP**	**JISEL**
Means of transportation	Y	Y	Y	Y	Y	Y
Suppliers/producers		Y	Y	Y	Y	Y
Distributors/carriers		Y	Y	Y	Y	Y
Purchasers			Y	Y	Y	Y
Distance			Y	Y	Y	Y
Wholesale	Y	Y	Y			Y
Retail business	Y	Y	Y			Y
Storage houses			Y	Y		Y
Markets			Y			Y
Variable						
The amount of the realisation	Y	Y	Y	Y		Y
The direction of the carrier					Y	
The goal of the game						
The management of the carriage	Y	Y	Y	Y	Y	Y
The management of the storage			Y	Y		Y

Source: the authors

In Table 1, the following analysed games are compared: Beer game (BG – three parameters, one variable, the goal of the game is to manage the carriage), Mit Beer game (MBG, five parameters, one variable, the goal of the game is to manage the carriage), The International Logistics Management Game (ILMG – nine parameters, one variable, the goal of the game is to manage the carriage and to manage the storage), Cornell University students game (CU: six parameters, one variable, the goal of the game is to manage the carriage and to manage the storage), Global player (GP: five parameters, one variable, the goal of the game is to manage the carriage) and JISEL created by the Groupe ESC in Bordeaux (nine parameters, one variable and two goals of the game).

To compare single games it was necessary to set up certain common definitions of the parameters and variables. That is the reason for giving an explanation of the information in Table 1 by giving the characteristics of each parameter and variable.

The characteristics of parameters used:

- The means of transportation are taken as the carriage capacity, the speed, the number of vehicles and the distribution of the vehicles,
- Suppliers/producers are the number, the distribution, the supplier/production capacity and the number of request,
- Distributors/carriers are understood primary from the point of view of the transportation capacity and limits,
- Purchasers are understood as purchaser density, production (supplier) capacity and prices,
- Distances are understood as physical or time constant influencing transportation costs and the capacity,
- Wholesalers and retail businesses are taken primary from the point of view of the capacity, distribution and orders,
- Storage houses are the capacities, distributions and the amount of the fixed costs (lodgings),
- Markets are understood as the market capacity, turnover and branch.

The characteristics of the variables used:

- The amount of realisation is understood as a result of the financial management or the profit, while the revenues come from the retail activities of buying or selling, and the depth of the costs structure is very variable and usually made up of the transportation costs and the fixed costs (in a varied structure),
- The direction of the carrier means the management of the material flows from a time and cost point of view.

The most frequent parameters used in simulation games are: the means of transportation, then the suppliers and the distributors. The most common variable used in logistic simulation games is the amount of the realisation in different aspects. This points at the most common problems which are in the area of company's logistics and which the managers have to solve.

The general goal of the game is to manage the carriage. From the wider point of view, the management of the storage is used as the other goal of the game.

4.2 Proposed logistics simulation game – case study

The logistics simulation game was proposed for a large company producing electric motors for home appliances. The logistics problems cover the logistics activities in the factory, among the storage places and the production lines.

The real conditions and company's requirements for the goals, the variables and the parameters of the game were examined and are shown in Table 2.

Table 2 – The company's requirements in the logistics simulation game

The requirements to adjust in the game	***The alternatives***
The existing means of transportation	3 (the milk run vehicle, the trailer, the high lift)
The existing production lines	6 (the different lines with different maximum norms)
The existing types of covers	4 (the Gitterbox, the euro pallet, the euro pallet EWP - not refundable, one direction and the box)
The existing input material and the norms of the consumption of the input materials	As the directions of the game
The priorities in the goals	1. The maximum use of all lines' capacities 2. Cost minimisation

Source: the authors

Stemming from the logic of the logistics simulation game, the parameters and the variables used in analysed games (Table 1) and the company's requirements (Table 2) have been taken into consideration. The proposal of the specific logistics simulation game can be introduced (Table 3).

Table 3 – The parameters, the variables and the goal of the game in the proposed logistics simulation game

Parameter	**Description**
Means of transportation	The vehicle's capacity, the way of putting materials in the vehicle
Purchasers	The production line capacity per single shift in physical units
Suppliers/producers	The input and output per specific production line
Distributors/carriers	The types of vehicles, the capacity of the vehicles, the way of using the vehicles for inputs and outputs

Parameter	**Description**
Covers	The type of cover, the type of cover unit with the specification of maximum carriage
Material	The norms of consumptions of input materials per single unit of output, the list of materials with the physical parameters, the specification of input materials with the relevant characteristics
Variable	
The amount of the realisation	The use of the production line, the energy consumption and fuels used by the vehicles, the frequency and the vehicles routes
The goal of the game	
The management of the transportation	Logistics costs, the use of the production lines 'capacity

Source: the authors

The goal of the game is to manage the transportation in a way which would bring the lowest level of related logistics costs together with the maximum use of the production lines' capacity per single shift.

During the simulation game, the worker makes decisions in which s/he proposes the values of the variables in the logistics activities to achieve the goal of the game. The aim is to verify if the worker understands his obligations, to clarify the activities which s/he has to do and for which s/he will be responsible and make sure s/he understands the mutual connections. The game evaluation is based on a comparison of the results obtained by the worker with the optimal task solution and with his or her previous results.

Formally, the problem can be written down as

$$f(\overline{X},\overline{Y},\overline{x}) = \sum_{i=1}^{4} X_i \,.\, No_i + \sum_{j=1}^{3} Y_j \,.\, Np_j + \sum_{k=1}^{N} x_k \,.\, Nm_k \rightarrow \text{opt (min)} \quad (1)$$

$$\sum_{k=1}^{N} x_k \,.\, g_k \leq X_i^H \qquad \text{for } i = 1, 2, 3, 4 \quad (2)$$

$$\sum_{i=1}^{4} X_i \,.\, \sum_{k=1}^{N} x_k \,.\, g_k \leq Y_j^H \qquad \text{for } j = 1, 2, 3 \quad (3)$$

$$\sum_{j=1}^{3} b_j \,.\, Y_j \leq b^H \quad (4)$$

$$X_i \geq 0,\ Y_j \geq 0,\ b_j \geq 0,\ x_k \geq 0 \quad (5)$$

Where:

$\overline{X}$ is the decision about the number of different types of covers needed in one shift; in our case it was possible to use four different types of covers,

$\overline{Y}$ is the decision about the number of different forms of internal transportation used during one shift; in our case we could use three different types of vehicles,

$\overline{x}$ is the decision about the amount of materials used during one shift, in our case we could use thirty different materials,

N is the number of material types,

X_i is the number of *i* used covers during one shift,

Y_j is the number of carriages in *j* form of internal transportation during one shift,

x_k is the number of units of *k* material,

g_k is the weight of the *k* material unit,

b_j is the elaborateness connected with one use of *j* mean of transportation,

No_i costs connected with the use of *i* cover type,

Np_j costs connected with the use of *j* type of mean of transportation,

Nm_k costs connected with the manipulation with the unit of k material,

X_i^H is the bearing capacity of *i* cover type,

Y_j^H the capacity of *j* type of mean of transportation,

b^H is the available labour time fund of the warehouseman.

The relations (2), (3) and (4) represent the maximum level for the task solution. The relations (5) represent the standard low level for the task solution.

The proposed logistics simulation game was tested by new workers in the logistics department of the manufacturer. The results achieved by a worker with no work experience of planning the transportation of material among production lines are presented. It should be noted that the worker had some knowledge of similar partial logistics operations from previous employment (e.g. storage or working with trailers and high lifts). Also, it was the first experience of the worker with a simulation game.

The worker played two rounds of the simulation game. The first round was primarily aimed at the understanding of game philosophy. The comparison of the results of the second round is presented in Table 4.

Table 4 – The results of the proposed simulation game (2nd round)

Solution	**Total costs – relative value**
Optimal	100,0%
Player	108,5%

Source: the authors

The relative value of the total costs of the worker playing the game (108,5%) is above the optimal level. On the other hand, the result is considered as relatively sufficient and it shows the understanding of the philosophy of problem solving.

The partial results related to the use of the types of vehicles were the most interesting. The results proved the tendency to use the same types of vehicles the worker had experienced before (Table 5).

Table 5 – The number of the use of the types of vehicles (2nd round)

Solution	**Type of vehicles**			**Total**
	the milk run vehicle	**the trailer**	**the high lift**	
Optimal	112	13	13	138
Player	100	30	26	156

Source: the authors

The results in next rounds should be compared not only to the optimal solution, but also to the outcomes from previous rounds to verify the progress of the worker as it is possible to play the game repeatedly.

The proposed logistics simulation game is suitable for the use with required adjustments in all manufacturing companies that have similar restrictions. Before, it is necessary to interface with business strategy and objectives, similarly to the models in project management (see Majtán, Mizla and Mizla, 2014).

4.3 The proposed logistics simulation game as part of induction training

After a general induction programme that is usually focused on the company's standard information, practices and policies, the specific training of newly hired staff follows in the logistics department (e. g. Daly, et al., 2009). The logistics simulation game is realised cyclically through four steps:

Step 1 – Initiation: The employees get acquainted with the scenario of the game, with new data and information, or with the results of the previous cycle.

Step 2 – Planning: The processing of available information, its analysis with subsequent decisions to solve problems are included in this step.

Step 3 – Action: During the action stage, the activities leading to the established goals are performed, on the basis of the decisions made according to the results of the previous step.

Step 4 – Evaluation: The results of the cycle are under discussion. Consequently, the simulation ends, or the worker returns to the first step.

Planning of the application of the simulation game also includes a decision on the required outcome of the game, which the employee has to achieve and the decision on a further process of the induction programme in the case where the worker fails repeatedly.

The successful application of the logistics simulation game can be evaluated in the company by comparison of the results before and after the use of the simulation game. Evaluation includes:

- verifying the professional competence of the new employee by using pre-test and post-test;
- estimating the costs that might occur in the case of a failure in the real fulfilment of working tasks,
- the period of induction, when the required work performance is not completely achieved by the worker.

Simultaneously, a well-planned induction brings other benefits, as it is a helpful tool for the stabilisation of new employees by reducing the stress and inconvenience of being responsible for real tasks.

5 CONCLUSION

The purpose of the paper was to propose a logistics simulation game with a specific use as part of the induction training of new employees in the logistics departments. The paper contributes to the theory focused on the induction programme, as this topic has rarely been discussed.

The proposed simulation game emerged from a comparison of other simulation games used in logistics. The aim of the game is to manage internal transportation and to achieve the required logistics costs and use of the production line capacity per single shift. The simulation game is universal and feasible in logistics companies and manufacturing companies with logistics departments, willing to use new training methods in the induction training of new employees. Before the application, the simulation game has to be adjusted to the real conditions and company’s requirements, and then experimented. The proposed simulation game was applied in a particular company, and its application in other types of companies would be needed to verify its general applicability. Future research aimed at the specific problems with the use of the simulation game in different companies and the impact of simulation training on the induction of new employees is desirable. For instance, it would be worthwhile to examine the cost savings and length of period of induction with using the logistic simulation game in the induction process.

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