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SIMULATION-BASED FRAMEWORK FOR TEACHING METHODS IN LOGISITC AND PRODUCTION PLANNING

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ABSTRACT

Uncertainty in planning tasks such as processing times, set up times, customer required lead times, due dates, time to failure, time to repair and the complexity in terms of product variety, outsourcing, short lead times, low inventory levels, low costs, high utilization are major hurdles for planning logistic and production processes.

This poster introduces a business game for methods in logistics, production planning, procurement, production, distribution and sales tasks. Basic methods such as MRP, CONWIP, Kanban, reorder policies, dispatching rules, basic demand forecasting methods, MPS are implemented in the game. Due to the generic environment additional methods can be implemented efficiently. Attention has also been paid to a didactic learning concept. A web based platform has been developed where presentation and videos will support the learning effort of the gamers. Online pre-test are included to examine the current skills.

1 INTRODUCTION

Based on a generic framework presented in (Hübl et al., 2011) a simulation framework for teaching planning methods in logistics and production planning for educational purpose has been designed. Master data (e.g. bill of material (BOM), routings, planning methods and their parameters) and transaction data (distributions and their parameters for processing times, set up times, replacement times, customer required lead times, time to repair, time to repair) are stored in the database. This avoids throw away solutions for each of the scenarios needed. The data from the database is imported into the simulation framework and the shop floor as well as the related planning process for purchasing, production and distribution related tasks according to the supply chain planning matrix (Meyr, 2004) are parameterized.

2 DIDATIC CONEPT

The core element of the didactic concept is a simulation-based business game in which the gamers are able to set parameters of the observed methods such as lot size and number of Kanban containers for Kanban or lot size and reorder point for a reorder policy. Hereafter, they can see how performance change by different parameters. The methods and their parameters are integrated in Java based input masks programmed in the Simulation tool Anylogic 7.3 which are integrated into a web based font-end. Complementarily the theoretical background of the specific key-performance indicator and the underlying method is presented by providing slides and video-tutorials on the web based front-end.

The business game supports traditional lectures on logistics, production planning, procurement, distribution and sales. The main surface of the business game is implemented as the front end of a customized Content Management Tool (CMS) for Massive Open Online Courses (MOOCs). The whole course is embedded into a fictional case study. If, for example, a undergraduate course on production planning methods of 30 teaching hours consist of MRP, Kanban, Conwip and DBR (Drum-Buffer-Rope), then the whole class have to solve at home individually a “Pre-Test” for the first method (MRP) in form

of a brief multiple choice questionnaire. This test is integrated in the MOOC platform and allows instant evaluations delivered to the course lecturer. The lecturer teaches the method MRP based on the results of the pretest. In the next step the students team up in groups to investigate one certain method (MRP).

Following this the business game is conducted in rounds. The first round starts with an theoretical input given by a lecturer, slides and supporting videos to understand the business game. In the situation of MRP the students have to identify which parameter can be influenced and to which value they are set. Finally, they should give predictions to the key figures WIP, FGI, lead times and utilization of the machines. After the theoretical input and analysis of the current state the simulation of the business game calculates the key figures. Parameters are not influenced by the students in this situation. The parameters of MRP (planned led time, safety stock, lot size) are configured to delivery very worse results on the key figures. This allows the groups to improve the system.

Based on input given by the moderator, slides and videos the groups have to set new parameters to improve the key figures of the system. In the case of MRP, planned lead times, safety stock and lot size for each item have to be redefined to improve WIP, FGI, lead times and utilization of the machines. Different effects and strategies can be illustrated by this business game such as . Therefore, the moderator has to steer the groups carefully not to mix up effects. In the case of MRP the business game can illustrate that just cutting the lot size in half results not in a 50% inventory reduction. Therefore also the planned lead times have to be adjusted (assuming 100% service level). Based on these settings the simulation run will create case specific numbers for each group of students. Every round ends with a set of figures representing the results of the actual round. The obvious task for every group is to reach a maximum of efficiency by using the correct method in a correct way. As an additional motivation factor the competitive situation among the groups lead to better results. This procedure is executed with all the remaining methods of the lecture. Take in mind that the business game can be also applied in courses focusing on logistics, production planning, procurement, distribution and sales.

3 SUMMARY

With the objective in mind of creating a close to reality but workable business game supporting lectures of the logistic focused bachelor and master programs at the University of Applied Sciences Upper Austria Campus Steyr and the Deggendorf Institute of Technology we decided to create a simulation based case study model. A generic database driven simulation model is embedded into a web interface, where different methods for logistics, production planning, procurement, distribution and sales can be selected. Based on a underlying didactic concept the gamers have to adjust the parameters of the methods in order to achieve better key figures. Therefore, slides and videos for each methods are available on the web based front-end.

By combining case study based lectures with approaches in gamification and simulation an innovative didactic concept of a lecture was created. We think that these setting is able to enlarge the quality of education in this field significantly.

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REFERENCES

Hübl, A., Altendorfer, K., Jodlbauer, H., Gansterer, M., Hartl, R.F., 2011. Flexible model for analyzing production. Proceedings of the 2011 Winter Simulation Conference, 1554–1565. 10.1109/WSC.2011.6147873.

Meyr, H., 2004. Supply chain planning in the German automotive industry. OR Spectrum 26 (4), 447–470. 10.1007/s00291-004-0168-4.