Visualizing Supply Chain Structures and Processes to Evolve a Better Understanding for IT-related Operations in mySAP ERP *

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Abstract: The following conceptual paper mainly addresses the understanding problem that comes up with teaching business economics and applying this to complex IT-infrastructures and integrated processes within an Enterprise Resource Planning System. Under laboratory conditions, we assume to resolve this lack of understanding during transactional exercises and to confirm pupils or students business know-how, while well-evaluated case studies are demonstrated and executed by themselves. To visualize supply chain structures and processes, the authors are presenting a framework for physical LEGO constructions and digital modelling logistic scenarios.

Key words: Visualizing supply chain; mySPA ERP; IT-related operation
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1 Motivation

For general and further academic education, the field of integrated information systems is one of the most interesting and popular topics for students, especially with emphasis on business information systems. At the University of Applied Sciences in Zwickau the number of volunteers for the lectures and practices in ERP/SAP systems indicates its relevance for economic-based studies. Present case studies of that course include customizing organizational structures, Human Resources, Accountancy and Controlling, Workflow Management or Business Information Warehouse and the continuous scenario addresses the main focus on operating logistics in a supply chain. The widely accepted course, characterized by a high quality and an ambitious methodical concept, is reflected in the ranking results at an independent internet platform as the best course of the whole university[1]. Students expect to learn about economics in practical situations at a complex information system like the widespread mySAP ERP solution. Furthermore, it is recommended to facilitate research and intensifying (pre-) universitary education in this field. So pupils from upper classes of the grammar school can be introduced in a playful manner to special selected case studies mainly focusing on logistics. The following drawing structures the main target groups for which the central ideas of the SAP LEGO laboratory are designed.

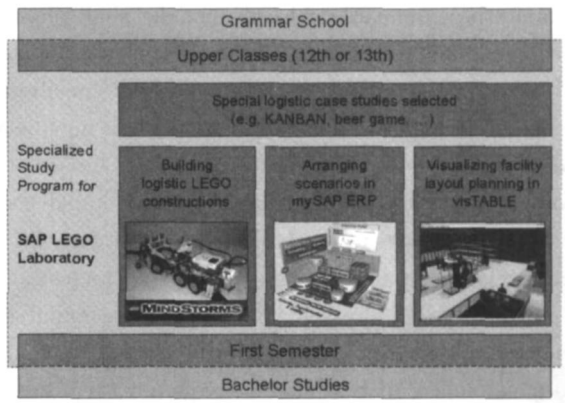

Fig. 1 Target groups of SAP LEGO Laboratory

According to named expectations and the course's reputation, it is necessary to improve the course continuously to enable all target groups to cope better with complex information systems. From this follows the main objective of this conceptual paper: Visualizing structures and processes within a supply chain to evolve a better understanding for IT-related operations in mySAP ERP.

This paper presents concrete ideas on how to set up a laboratory for continuous supply chain management (SCM) and specifies the basic physical equipment to realize its processes. By demonstrating material and information flow, pupils and students can benefit from there being an insight into operating business processes with high practical relevance.

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2 Key Aspects

Besides the central goal of this project there are several other key aspects that might be considered as well. Based on present ERP/SAP course materials, it will be created an experimental environment consisting of three companies to demonstrate their vendor relationships and basically refers to logistic and personnel management related issues. The supply chain is characterized by one 1st and 2nd tier supplier as well as a direct producer (OEM) and they are involved in a continuous scenario of manufacturing office chairs based on a division of labor.

To arrange a tangible and visible supply chain laboratory, all physical elements will be constructed using material from LEGO, especially LEGO Technic and the robotics product line LEGO Mindstorms NXT[2]. Focusing logistic and manufacturing elements, dynamic programmable LEGO models shall emulate movements and transformations. Previous studies basically combine economic problems with SAP-specific implementation and additionally students can now be introduced in a playful manner to complex processes of an information system to recognize their conceptual gaps. It is not necessary or affordable to create a real-size laboratory for illustrating these sophisticated topics.

This paper addresses three other conceptual elements. The first is to enable the integration of innovative technologies such as Radio Frequency Identification (RFID), bar codes and employee time and attendance solutions. So students and pupils can get in touch with state-of-the-art technology and its appropriate implementation as well as connection to an ERP system.

Secondly, various logistic control principles will be illustrated to compare them with each other, i.e. KANBAN and the principles of PULL and PUSH. For economic benchmarking, it is necessary to design information and material flows with different transport handling and storage techniques.

The greatest benefit of this comes from the third conceptual aspect. Of course, physically visualizing a supply chain promotes an optimal understanding of all the interrelationships in information systems, but has a clear disadvantage in application. You can not use the lab anywhere, only in a space and time independent manner. To resolve this dependency on space and time, you can set up a digital scenery. Via software for computer aided design (CAD), students can create digital models of all the LEGO constructions. Finally the models can be brought together in one scenery and

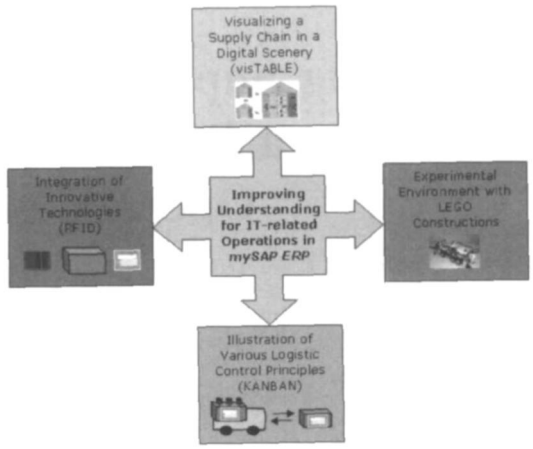

Fig. 2 Key aspects of SAP LEGO Lab

be displayed using software called visTABLE. With this digital preparation, calculations for material flow are possible from anywhere for example.

3 Core Activities and Work Packages

The following schematic overview gives an impression of processes along this supply chain. A detailed illustration of the direct producer (OEM) supports examples of the structures and main principles of a manufacturing company.

To split the project in a functional manner, four work packages are defined and occupied as the core activities: external and internal transport, loading as well as production.

For external transport activities, common means of transport like trucks and trains are used out of consumer LEGO material. Trains are arranged with conducting tracks and 9 volt motors and can be controlled by electric signals. The scenery provides a track layout where three trains can drive simultaneously, because deliveries of goods issue or goods receipt will be realized by holding tracks. Building up the tracks layout, trains and wagons defines the 1st work package and is called train transport.

Besides trains, the concept of linked transport, defined as the 2nd work package, will be used for LEGO trucks. Implemented as sensor affected trucks with programmable LEGO NXT bricks, the truck can be controlled by light or color sensors and servomotors for example. According to the functional concept of sensor affected trucks, internal transport processes shall implement cyclic supply automatism through an automated guided vehicle system (AGV). Its task is to accommodate demands for material from the production department as requested in the PULL principle for example.

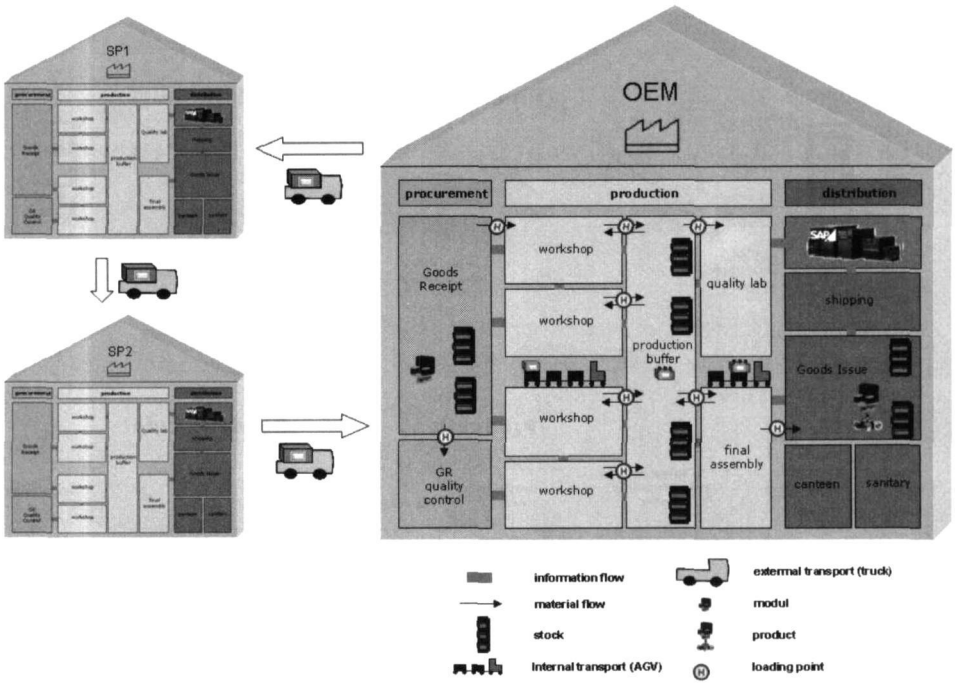

Fig. 3　Schematic overview of supply chain laboratory

Most difficult is the 3rd working package called loading, dealing with RFID processes in goods receipt and goods issue as well as setting up a high bay warehouse[3]. To load or unload trains or trucks, a tower crane has to be assembled. It takes the container to a well-defined supply area and enables reading RFID tags to post goods issue or receipt. The next image presents the RFID scenario for loading.

For storage in the warehouse, an automatic storage and retrieval robotic handling system is required, similar to a cranes functionality. So a typical high bay warehouse with an operating device.

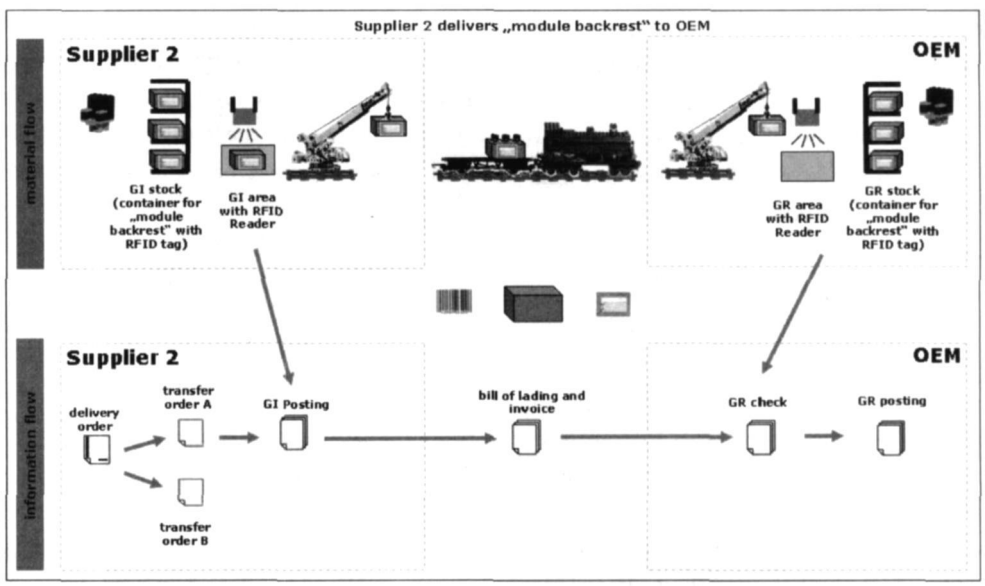

Fig. 4　Scenario for loading

The 4th working package named production includes constructions and programming for the physical handling unit management[4]. Robotic technology is used for assembling machines or the replacement of boxes. Simple container transport will be realized by apparatus such as conveyor belts or flow racks, assembled by LEGO Technic product line. The next picture shows the production scenario with conveyor belt transport and barcode reading. Via automated completion confirmation, the stocks, elapsed time and costs can be passed on.

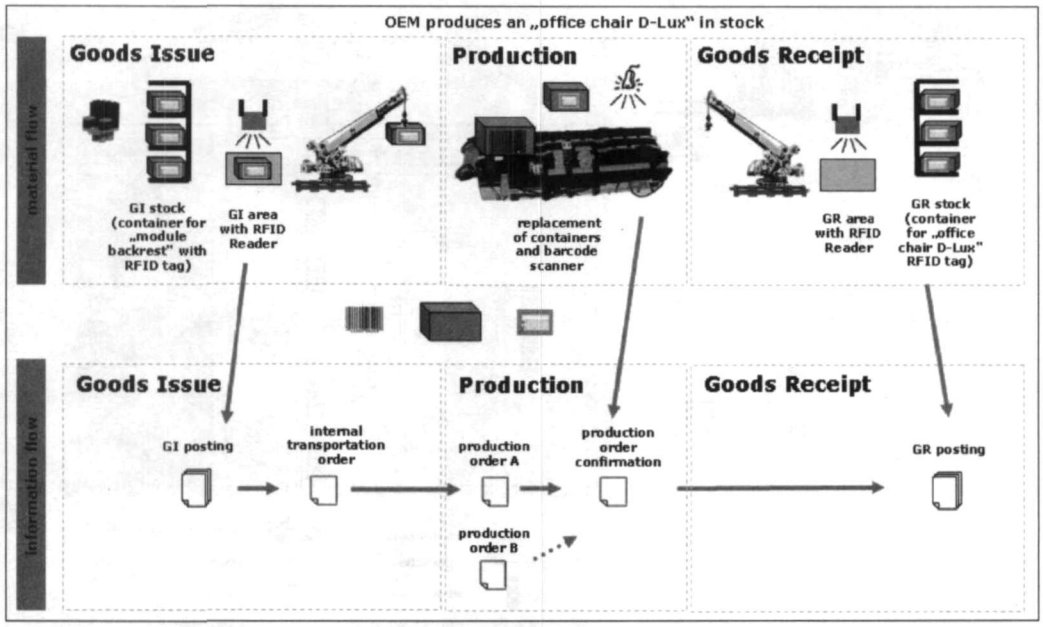

Fig. 6 Scenario for production

4 Summary and Benefits

The paper addresses a couple of highly interesting issues in the range of business economics and business information technology. Regarding combined theory and practice at the University of Applied Sciences in Zwickau a laboratory (SAP LEGO LAB) is administrated to cover research, educational and experimental purposes in one continuous manufacturing scenario. It is based on well-evaluated economic ERP/SAP case studies that emulate a supply chain consisting of two suppliers and one OEM producer. By implicating innovative technologies such as Radio Frequency Identification (RFID) and by visualizing digital LEGO constructions, various information and material flow-based processes will be made "visible, tangible and experiencable". The described concept can be understood as an instrument or model exactly conveying the specific knowledge and skills to students or pupils that are relevant and state-of-the-art for an industrial environment and its applications.

So pupils and students benefit from such a project implementation by (im-) proving their knowledge practically and, according to their career entry, they will sustainably get ahead from other job applicants. As a result too, raising the anticipated reputation for our university is the consequence and has an impact on cooperated academic or business partners. For example, Industrial partnerships may also benefit from such a laboratory project, because they can practically realize their logistic concepts continuously in an integrated IT environment and investigate occurring effects. Henceforth, the goal of improving and ensuring the quality of (pre-) academic education can be put into practice by such projects, as the case may be in cooperation with business companies or establishments.

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