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FLEXIBLE LOGISTIC CONCEPTS FOR ASSEMBLY SYSTEMS

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ABSTRACT. Logistics is a crucial issue for small and medium sized enterprises (SME). This paper deals with logistical concepts for assembly systems. The IPH is currently conducting a project with the aim of developing a method to combine allocation and delivery concepts for assembly systems to increase the logistical efficiency of SME. Via this method SME are able to adapt quickly to changing market environments.

Key words: logistical concept, allocation concept, delivery process model, assembly system.

More than just being flexible, in the last decade small and medium sized enterprises (SME) have made progress in becoming versatile towards the produced number of units in a period of time as well as in the number of product variants. An enabler for fulfilling these customer requirements can be found in production where progress is made to maximise the assembly systems' versatility. However, in many cases the supplying, delivering and allocating logistics remain unaccounted in qualifying for versatility. The target of the "Lowamos" (Logistische Wandlungsfähigkeit von Montagesystemen) research project is the development of practicable logistic concepts for SME.

INTRODUCTION AND TASK

Due to their technically versatile assembly systems, many SME are already in a position of quickly adapting to short-term changes in market situations. However, measurements of performance in logistics, i. e. adherence to delivery dates and time of delivery are often disregarded. SMEs tend to strictly pursuing their implemented logistic concepts without questioning them, for the logistics not belonging to the core competences. Logistic concepts are combinations of allocation and delivery process models. Allocation concepts define how materials or raw parts are supplied to assembly systems (e. g. just in time delivery). Delivery process models describe the flow of materials or raw parts between the companies involved (e. g. reserve stock procurement). At present, technical and organisational changes of assembly systems based on product changes or fluctuations in demand are exceedingly rare and there is no reconfiguration method following changing requirements in view of an enhanced logistic efficiency.

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A STEP-BY-STEP GUIDE TO CONCEPT DEVELOPMENT

The IPH has developed a tutorial for gradually adapting logistic concepts according to the needs of versatile assembly systems. The tutorial provides companies with decision support for the adaption stage and enables them to react flexible and swift to the requirements of the market. Assembly lot sizes can be scaled, product variants can be adjusted and product changes can be realised. Depending on the available assembly system and the product to be mounted, the tutorial offers palpable recommendations regarding the adaption of the logistic concept. Costs for the realisation of the logistic concept are thereby considered as well as future expenses or savings for storage, processes and deficiencies.

3-PHASE MODEL FOR ALLOCATION- AND DELIVERY-CONCEPTS

For an easy and practicable application of said concepts a 3-phase model for implementing adaptable logistic concepts has been developed. After consideration and analysis of the company's assembly departments, practice-oriented combinations of assembly systems with allocation- and delivery-concepts were identified and specified within the scope of this research-project. By consolidating these combinations, further combinations of assembly systems (e.g. shop assembly, continuous line assembly), allocation-concepts (e.g. periodic provision) and delivery-concepts (e.g. stock procurement) become possible.

As a result of an empirical survey with SMEs it can be said that mainly multiple logistic concepts are in use for feeding assembly systems. Today's choices on logistic concepts are based not only on the type of assembly systems but also on the characteristics of the respective range of parts. A range of parts or rather a range of part types is defined as an expedient aggregation of different part types. It is generated via ABC analysis. In the process, the parts are sorted into three categories according to their respective portion of the overall consumption. On a value basis, A-parts constitute the largest, B-parts a medium and C-parts only a marginal share of total consumption.

Despite the fact that two different part types are mounted at the same type of assembly systems, the supply of i. e. small C-parts requires a delivery-concept which varies from a delivery-concept for acquisition of small A-parts.

The concept combinations developed and suggested for a certain type of assembly systems (phase 1) have to be adapted to the respective range of part types (phase 2). This process requires the exclusion of logistic concepts inapplicable for the range of part types concerned. Based on the value-benefit analysis, the allocation concepts were evaluated in view of their respective efficiency. Every criterion was individually weighted, according to the assembly systems type. The result is a selection of allocation concepts depending on the type of assembly systems. The value benefit analysis is complemented by a description of the adequacy regarding the part value (A, B or C). Subsequently, catalogues of requirements and performance catalogues for the logistics concepts and the various types of assembly systems were developed. With these catalogues, expedient combinations of stand by and delivery process models, depicted in figure 1, were identified.

The choice of concept combinations is further restricted by external and intra-corporate conditions (e. g. provided space in the buildings) as well as specific conceptions of the management (phase 3). For example, little buying power combined with high market attractiveness complicates the realisation of synchronized production processes. Criteria like the type of assembly systems, the range of parts to be acquired and provisioned as well as intra-corporate restrictions and market related conditions are decisive in the choice of a logistic concept. A 3-phased-decision-model was developed for filtering inapt logistic concepts, based on the aforementioned criteria. The model is depicted in figure 2.

Stand-by-concepts		Delivery process models					
Combination: Stand-by-concept and Delivery-concept		Reserve stock procurement	Single item procurement	Synchronised production processes	Standard part management	Consignment-warehouse concept	Shared-user-warehouse
A:	Consolidated Provisioning of order	●	○		●	●	●
B:	Provisioning of complete order provisioning	●	●		●	●	●
C:	Provisioning of partial order	○	●	●	○	●	●
D:	Provisioning of individual items	○	●		○	○	●
E:	Target monitoring Just-in-Time		●	●		●	●
F:	Periodic provisioning	●			●	●	○
G:	Kanban			●		●	●
H:	Multi-wells	●			●	●	○
I:	Free stock	●			●		
J:	Milkrun	●			●	●	○

caption

●	correlated
○	conditionally correlated
	not correlated

Fig. 1. Combination of Delivery- and allocation-concepts for assembly systems
Rys. 1. Kombinacja koncepcji dostaw i alokacji w systemach montażowych

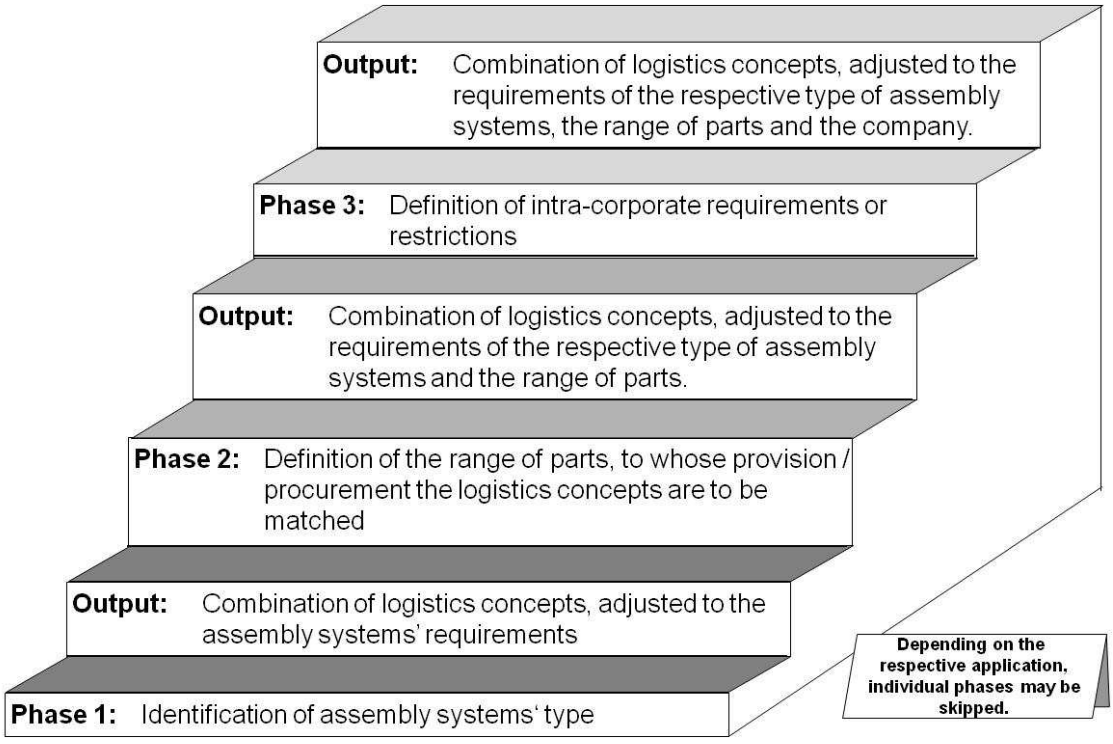

Fig. 2. 3-phase-model for the combination of identifying logistic concepts
Rys. 2. 3-fazowy model kombinacji identyfikacji koncepcji logistycznych

CONCLUSIONS: 3-PHASE MODEL ENHANCES/BOOSTS LOGISTIC CAPACITY/ EFFECTIVENESS

Companies are thus enabled to make swift and target-oriented adjustments to their logistic concepts in answer to changing market demands. The results of the research project documented in this article are logistically effective: The right part is in the right place at the right time. Less stock outage and wrong parts during assembly result in a reduced number of stoppages in the production process and an overall improved efficiency of assembly systems. Hence, the adherence to delivery schedules increases and delivery times are reduced.

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ELASTYCZNE KONCEPCJE LOGISTYCZNE W SYSTEMIE MONTAŻOWYM

STRESZCZENIE. Logistyka jest kluczowym obszarem w małych i średnich przedsiębiorstwach. Praca omawia koncepcje logistyczne w systemach montażowych. W chwili obecnej IPH pracuje nad projektem metody połączenia koncepcji alokacji i dostaw w systemach montażowych w celu zwiększenia efektywności logistycznej małych i średnich przedsiębiorstw. Przedsiębiorstwa te, przy zastosowaniu przedstawianej metody, będą w stanie szybciej adaptować się do zmieniających się warunkach na rynku.

Słowa kluczowe: koncepcja logistyczna, koncepcja alokacji, koncepcja dostaw, system montażowy

FLEXIBLE LOGISTIKKONZEPTE FÜR MONTAGESYSTEME

ZUSAMMENFASSUNG. Wie können sich kleine und mittlere Unternehmen (kmU) den wachsenden Anforderungen des Marktes hinsichtlich Termintreue und Bestandssenkung stellen? Ein im IPH im Rahmen des Forschungsprojekts "Logistische Wandlungsfähigkeit von Montagesystemen (LoWaMos)" in der Entwicklung befindlicher Handlungsleitfaden hilft bei der anforderungsgerechten Auswahl, Kombination und Konfiguration im Unternehmen einsetzbarer Beschaffungs- und Bereitstellungskonzepte für Montagesysteme.

Codewörter: Logistikkonzept, Bereitstellungskonzept, Lieferkonzept, Montagesystem

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