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SCM Challenges and Opportunities in the Timber Construction Sector

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***Abstract*—**The purpose of this paper is to identify the main challenges faced by companies in the timber construction sector and to provide improvement opportunities that can be implemented on a short-, medium- and long-term basis. To identify the challenges and propose actions for each company a literature review and a multiple case research were conducted using the Quick Scan Audit Methodology. Finally, the findings and outcomes are compared with each other to support companies in the timer construction sector when implementing and restructuring their day-to-day activities.

***Keywords*—**Supply chain management, supply chain challenges and opportunities, timber construction sector.

I. Introduction

TO remain profitable companies – irrespective of size, sector, type of product or revenue – are under intense pressure to reduce costs and downsize resources. Furthermore, a big variety of products and suppliers and increased customer expectations challenge companies to compete on the market. Besides that, the increased number of individuals and organizations carrying out activities on the product before end consumption and inconsistencies in human behaviors and actions challenges the companies in their day to day activities. Supply chains are becoming more and more complex [1] and those companies that are able to master complexity have the chance to be significantly more profitable [2]. These challenges are inadequately addressed in literature and little attention has been paid to research up to now [3].

As the role of manufacturers is to add value to the product and sell them as custom-made as possible to their customers, companies have identified the potential of controlling the flow of materials from suppliers through the value adding processes and distribution channels to customers [4]. However, only those companies that are open and prepared for change and understand the supply chain as a whole (its processes and inter-relations) will be able to realize the potential of controlling the flow [4].

The aim of the paper is to identify the main challenges and opportunities of the furniture and timber construction sector which form the basis for further analysis in an upcoming research project.

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The paper is, therefore, organized as follows: The methodology section (Section II) describes the procedure used to evaluate the supply chains – the Quick Scan Audit Methodology. In Section III supply chain management challenges (SCM Challenges) of five different industries are summarized. Good Practices and challenges of six carpentries are identified and improvement opportunities as part of an action plan are highlighted in Section IV (Findings). Finally, challenges identified in the timber construction sector are linked to SCM challenges described in Section V to see whether they are similar or different.

II. Methodology

In order to identify the challenges and opportunities a multi-staged approach was conducted: literature review, multiple case research and Quick Scan Audit Methodology (QSAM).

In a first step, a literature review based on the stages planning the review, conducting the review and reporting dissemination was conducted [5]. Therefore, the key words principles, activities and practices were identified and used in an additive combination for the search in titles, abstracts and full texts. For this search the databases Ebsco Business Source Premier, Emerald and Science Direct were selected. Following that, the quality of the promising articles following the guidelines of [6] was examined and the identified publications were analyzed and filtered by challenges and trends in general and with a special focus on the furniture and timber construction sector.

The conducted literature review was the basis for the multiple case researches, which consisted of six participating companies of the furniture and timber construction sector in Austria. The project was executed from Oct, 2013 – June, 2014. This multiple case research included workshops, on-site inspections and interviews with the chief executive officer and the responsible employees of sales, manufacturing, production planning and IT. Interview partners and their responsibilities are displayed in Table I.

TABLE I
Overview Interview Partners and Responsibilities

Company	No. of interview partners	Responsibilities
1	3	CEO, carpenters
2	4	CEO, architect, production planning, carpenter
3	3	CEO, sales & IT, carpenter
4	2	CEO, carpenter
5	2	CEO, carpenter
6	2	CEO, carpenter

Quick Scan Audit Methodology was used as a team-based approach. QSAM involves the phases data collection and data analysis based on interviews, archival data and benchmarking and gives a snapshot of each participating company [7].

The aim of this multiple case research with a comparably small sample size was an exploratory analysis and not to provide a representative overview.

III. SCM Challenges

Previous studies and our interview series have shown that supply chain structures can differ considerably from one industry to another [8]. Therefore, [9] summarized trends and challenges across five different industry sectors: Automotive, cosmetics, electronics, semiconductor and hospitals/healthcare sector [9].

The strongest challenge of the automotive sector lies in the individualization of products, as cars are especially subject to a high degree of variety [9]. Although companies share manufacturing platforms and resources to limit the variety upwards in the supply chain, the variety of options available for the customer is increasing downwards [10].

In contrast to the automotive sector, the cosmetic industry is struggling with no flexibility of capacities and expresses the need for more individualized products [9].

A major challenge for the high-tech electronics sector is cost pressure, which is also a challenge the semiconductor industry is facing as is the product safety for the end-user [9].

The healthcare industry is also characterized by a more complex supply chain structure than is seen in other sectors [11] and is suffering from the high cost pressure [12]. Furthermore, the healthcare industry is facing a lack of process understanding and standard operational procedures, the unavailability of data, organizational politics and personal agendas [11].

Table II highlights the strongest challenges in these five different industry sectors.

TABLE II
Major Challenges per Industry Sector [9]

Industry sector	Major challenges
Automotive	Individualized products, Special warehousing requirements
Cosmetics	More flexible capacities, Individualized products
Electronics	Cost pressure, Product safety
Semiconductor	Cost pressure
Hospitals - health care	Cost pressure improvement of customer service

IV. Findings

The companies of Upper Austria's furniture and timber construction sector which were considered are six carpentries, which are all focusing on the "purchase-and-make-to-order"-concept. This goes in line with a current study executed by [13] showing a shift across industries in Austria from make-to-stock (MTS) to make-to-order (MTO) or even purchase-and-make-to-order (P-MTO) or engineer-to-order (ETO) (Table III).

TABLE III
Customer Decoupling Point of Industries [10]

Industry	ETO	P-MTO	MTO	ATO	MTS
Metal	12	4	8	1	2
Electronics	5	4	4	4	
Iron	5	2	7		1
Automotive	2	5	5	1	
Chemicals		2	5	1	
Mechanics	4	2			
Coal	1		3		
Paper	1		2		
Oil					2
Cement	1				
Plastics			1		
Others	4	1	1		1
Total	35	20	36	7	6

For carpentries, the reasons for this shift towards ETO are sophisticated customers who require innovative, individualized and custom-made furniture. Very often, the customers are looking for a furnishing solution for their whole house (e.g. windows, kitchen, bathroom, living-room, etc.) from one single source.

One major strength of our research is that all six companies participating in our project are from the same industry and they agreed to share results and make a cross-company comparison of strengths and weaknesses. Although all these companies are carpentries, they vary in terms of customers and geographical location (Table IV). The main customer group of each carpentry is marked with * in Table IV.

Company 1 is the only one which has set up a second mainstay as a funeral undertaker. Companies 2 and 6 are the only ones which provide furnishing for medical institutions, whereas company 2 is specialized on pharmacies, doctors and opticians and company 6 focuses on hospitals. Furthermore, company 2 has its own architectural office, whereas company 4 only provides interior design.

TABLE IV
Participating Companies Characterized by Products and Customer Structure

Company	Products	Customer structure
1	Kitchen, doors, floors, burial	Private customers* Corporate customers
2	Shop equipment, furnishing, architecture	Pharmacies* Doctors Private customers Opticians
3	Shop/business equipment, kitchen, windows, facade engineering, winter gardens	Corporate customers* Private customers
4	Furnishing, stairs, doors, parquet flooring, interior design	Private customers* Corporate customers
5	Hotel equipment, furnishing	Corporate customers/Hotels* Private customers
6	Equipment for hospitals, hotels, restaurants and discotheques, private objects, stairs	Hospitals* Hotels* Restaurants* Discotheques* Private customers

Additionally, company 4 provides furnishing, doors, stairs and parquet flooring. Company 3 offers facades and conservatories; however, this part of business is declining. Companies 5 and 6 are providing equipment for hotels, whereas company 6 also offers equipment for restaurants and discotheques. Companies 1 and 4 have mainly private customers, in contrast to companies 2, 3, 4 and 6 which have mainly corporate customers, while all have different customer groups (e.g. pharmacies, hospitals, hotels).

As all these carpentries are spread over the whole of Upper Austria, they do not directly compete with each other. Hence, they cooperate in order to be able to learn from each other.

The scheduled *orders* of companies 2-6 indicate a high *stability* in contrast to company 1, as about 40% of the agreed orders require a change. The reason is seen in the customer structure and therefore in the shift of the customer decoupling point towards the customer.

A fact which all carpentries have in common is that customer orders are not certain which makes it very difficult to forecast. It is not possible to predict when a customer requires a kitchen for example. This uncertainty could be reduced for example by more cooperation with other businesses (e.g. architect, housing association, construction company, etc.)

Company 1 is the only company that has no *restricted space* on-site, as the production is located in a quiet, outlying neighborhood. Due to this geographically remote location company 1 built a large showroom about six kilometers away from the production site, which is closer to their customers.

Common to all participating carpentries is the *quick and unbureaucratic decision-making process* as well as the involvement of employees in decision-making and designing of processes and organizational structures. The reason for this lies in the small size of each company.

The *utilization of machines* is not efficient at company 1 and 3, as there are machines that are only rarely needed and therefore block the space on the shop floor. For company 3, this poor utilization in combination with the restricted space is a major challenge hindering the company by realizing a high throughput. Company 3 has to decide whether customer orders needing machines with access capacity can be gained or the machines have to be removed to improve capacity utilization and the flow of the remaining orders.

Based on these identified challenges an individual action plan was set up for each carpentry. An example of the steps of such an action plan is shown in Table V. This action plan shows six activities of warehousing, production and after-sales processes and acquisition of new customers, which are prioritized by effort and benefit of the action and time for implementation.

The remaining material and waste should be identified and documented and, in addition to this, places for assembling the furniture on trial before delivery should be defined and marked.

TABLE V
EXTRACT OF AN ACTION PLAN

Action	Effort	Benefit	Time	Priority
Reorganize the storage of material	L	M	MT	5
Define process of post-order-calculation	L	H	ST	3
Identify and document production steps (additional work) for extraordinary products	L	H	ST	1
Define after-sales process	L	H	ST	2
Define and label the space for moving carpenter's bench	L	H	MT	4
Acquire new customers/establish another mainstay	M	M	MT	6

H=high, M=medium, L=low
LT=long-term, MT=medium-term, ST=short-term

Furthermore, actions for operational safety should be specified and the after sales process which includes customer care activities should be designed. This after sales process includes receiving customer feedback (e.g. of furniture, assembling at the customer) or a personal conversation with the customer about the charged work (before payment) as well as the invitation of customers to events (e.g. in-house exhibitions, company visits) or the distribution of greeting cards (e.g. at Christmas).

The carpentries also listed that not utilized machines should be relocated for more space at the shop floor and bottlenecks of machines (e.g. circular saw) should be eliminated by improved planning of capacities and resources. Finally, the harmonization of interfaces is going to be considered by implementing and integrating appropriate IT-applications.

V. CONCLUSION

All the identified challenges and opportunities were compared to each other and finally summarized. Good practices that were found in almost all carpentries were clustered in the five categories supplier, customer, resources employees and organization (Table VI).

Based on the best practices found the challenges identified in the six carpentries are manifold, but almost all companies are facing them.

Therefore, there are high uncertainties of customer demand and seasonal variations. Furthermore, there are partial bottlenecks at machines (e.g. circular saw) or no utilization of machines (e.g. machine for facade engineering) which results in less space on the shop floor. Less space is also found for assembling the furniture on trial before delivery.

Additionally, the storage of remaining material and scrap is confusing and decentralized, which results in less space, old material and fixed capital.

Difficulties were also seen in the handling of bulky objects, as there was no technical equipment (e.g. a small crane) available to lift big wooden plates to the machines, which influences the operational safety. Most carpentries have a lift trucker, but it is only usable for material handling outside the building.

TABLE VI
GOOD PRACTICES OF PARTICIPATING CARPENTRIES

Supplier
Most carpentries reduced their supplier base and focused on a few suppliers. To reduce the risk of non-delivery, the carpentries have a network of partners on which they can rely. This can only be realized with a good and partner-like cooperation with suppliers and other companies (e.g. architect, painting company, plumber, etc.), which was found in all six companies.
Customer
Almost all companies have a stable planning of customer orders although they follow an individual customer approach, offer innovative products (e.g. wooden bathtub) and are facing uncertainty of incoming orders. All six companies also have a large customer base which contains private and corporate customers. Some carpentries are realizing customer care activities (e.g. send Christmas greeting cards) and have already implemented an after sales process.
Resources
All carpentries are equipped with modern machineries (e.g. CNC machine) some have already established a second main pillar (e.g. funeral undertaker, facade engineering).
Employees
The level of fluctuation is very low in all six companies, which is due to the good involvement of employees in the decision-making and the design of processes as well as the continuous education and training of employees.
Organization
Noteworthy was the existing awareness of change in all carpentries and the quick and unbureaucratic decision-making process.

Finally, some companies have several, isolated IT-applications, which are not compatible and have non-harmonized interfaces. This results in errors between sales, production planning and work scheduling.

Overall, all participating carpentries face similar challenges, although they are satisfying different customer groups with various products. It is remarkable that these companies are willing to improve and therefore cooperate and exchange experiences and competences. Generally, carpentries are dealing with almost the same challenges as companies of other industries do, which includes warehousing (e.g. lack of space, special warehousing requirements), material flow (e.g. flexible capacity, utilization of machines) and customer service (e.g. after sales activities, individualized products).

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