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Big Data Analytics and Supply Chain Management – Insights from expert interviews

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Abstract. Digital transformation with its emerging rich corporate and public data pools as well as developments like cyber-physical systems and the Internet of Things, are presenting challenges for and opportunities from Big Data Analytics on corporate and supply chain level. For this qualitative research, semi-structured interviews with 16 top-level managers were conducted, testing existing constructs while gaining additional insight. This research identifies the reluctance towards information sharing based on the fear of loss of competitive advantage. Furthermore, the impact of Big Data Analytics on supply chain design and performance through the adoption of product-service systems is highlighted. Additionally, the study highlights that implications are not commonly applicable across organisations, but rather appear to be specific to industries or supply chains.

1 Introduction

When analysed, Big Data can drive new business models and innovation in corporates as well as the supply chain, promising higher performance, faster decision making and competitive advantage [1, 2].

The increase in volumes of Big Data poses a challenge for the management of companies and supply chains, as it complicates the identification of the most relevant information. At the same time, harvesting and including all valuable information in the decision-making process presents opportunities of increased competitiveness for the organisations as well as the supply chain. Therefore, guidance for the assessment of the information requirements, when building the corporate's digital agenda, is required.

Experts of the management consulting industry have participated in a Delphi study investigating opportunities and challenges related to the adoption of Big Data Analytics on supply chain [3]. This study is investigating these implications within the supply chain from a practitioner's point of view. Engaging practitioners promises a real-world understanding on the state of implementation of Big Data Analytics as well as insight to the impact of Big Data Analytics by seeking answers to the research questions:

- Which supply chain opportunities and challenges resulting from the adoption of Big Data Analytics are recognised by practitioners?

2 Methodology

For this qualitative research, semi-structured interviews were conducted with the aim of testing the predetermined opportunity and challenge constructs, while gaining additional insight. The developed interview structure enabled the interviewer to consistently guide the interview along the same path, while allowing sufficient space for a more detailed discussion. The interview was structured into three parts. In the introduction section of the conversation interviewer and interviewee got to know each other and exchanged basic information. In the implementation and business process section the interview focussed on understanding the actual situation in the company relating to Big Data Analytics. The third section of the interview focussed on a general view on Big Data Analytics implications on corporate and supply chain level.

The interview closed with a question on general technology trend with the potential of high business impact.

The interview guideline was distributed to the interview partner beforehand. To avoid a bias towards the predefined opportunities and challenges, these constructs were not included in the interview guideline.

A total of 16 interviews with companies from different industries were conducted, of which one interview was done in person and ten were done by telephone. A total of 395 audio minutes were recorded with interview durations varying between 19 and 53 minutes. All but one interview was conducted in German. The participants were wide spread across a range of industries. The education and mining sector were included with one interview each and two interviews with car manufacturers were carried out. Additionally, there are four interviews each in logistics, manufacturing and retail trade present.

The coding was done in two rounds. Initially the coding table was walked through top down and the construct codes were assigned to paraphrases. This was followed by a second pass, starting with the constructs and searching though the paraphrases. The second coding pass was again performed across all the interviews to reduce errors of omission.

3 Findings

The different observations from the interviews were related back to the constructs of supply chain opportunities and challenges [3] . Constructs with occurrences in more than 30% of all interviews are rated as highly relevant. The arrows in Table 1 and Table 2 indicate the change in relevance between the Delphi study and the results of this research.

Table 1. Opportunity constructs by occurrence

Opportunity	Occurrence	Rel.
Information management	13; 81%	↑
Supply chain visibility and transparency	5; 31%	→
Logistics	5; 31%	→
Inventory	5; 31%	→
Innovation and product design	5; 31%	↑
Operations efficiency and maintenance	5; 31%	→
Demand management and production planning	4; 25%	
Product and market strategy	4; 25%	
Integration and collaboration	3; 19%	↓
Responsiveness	3; 19%	↓
Financial implications	3; 19%	
Risk management	2; 13%	

The frequencies of occurrence of the supply chain opportunities in the interviews are shown in

Table 1. Several differences related to the prioritisation of opportunities can be observed. Integration and collaboration as well as responsiveness were in the interviews not seen as of high relevance. Information management, although not ranked high in the Delphi study, was the top construct within the conducted interviews. Enhanced discovery and availability can stimulate initiatives to optimise supplier relations and provide impulses for innovation and new products. In 31% of the interviews, innovation and product design were discussed. In the experts' ranking this was not an opportunity of high relevance. Many of the innovations are connecting the manufacturer directly to end-customers by moving from product to service, or forming completely new arrangements.

Table 2. Challenge constructs by occurrence

Challenge	Occurrence	Rel.
IT capabilities and infrastructure	11; 69%	↑
Talent management and HR	5; 31%	↑
Business strategy and objective	4; 25%	
Integration and collaboration	4; 25%	↓
Information management	4; 25%	
Governance and compliance	3; 19%	↓
Information and cyber security	3; 19%	
Cultural change	3; 19%	
Financial implications	2; 13%	
Ethical and managerial implications	1; 6%	
Transformational change	1; 6%	

The frequencies of occurrence of the supply chain challenges within the interviews conducted are displayed in Table 2. Integration and collaboration as well as information management were in the Delphi study identified as of high relevance. However, practitioners were focussed on challenges relating to information technology capabilities and infrastructure as well as talent management and human resources.

While the survey demonstrates that all implications are recognised by practitioners across several industries, the study reveals that the relevance of opportunities and challenges from Big Data Analytics differs greatly between organisations and industries. Besides the construct-specific issues identified, there are several overarching aspects that are of interest.

3.1 Industries and client segments

Industries view supply chain implications from Big Data Analytics differently. Like industry segments, different client segments carry specific opportunities and challenges. While highly granular end-customers' segmentation enables the manufacturers to price and position inventory more effectively, not all industries will be able to draw this benefit.

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3.2 Maturity of organisational development

A difference in the priorities of the implications from Big Data Analytics found within this study may be the result of varying degrees of maturity of the organisations' digital transformational journey.

Human resource requirements for example differ greatly. Those consolidating their system landscape were rather searching for specialists evaluating and securing systems and their interfaces, while companies with Big Data Analytics projects in progress were in need of data scientists.

Organisations with more advanced Big Data Analytics initiatives tend to focus on supply chain visibility and operational optimisations. In contrast, organisations without consolidated internal data pools and powerful information technology infrastructure investigate big data opportunities for innovation and product development.

3.3 Information sharing & competitive advantage

Information sharing has been shown to have a positive impact on competitive performance in several studies. Within the interviews the fear of publishing private information, which may result in a loss of competitive advantage, was the reason provided for the restrictive behaviour of organisations towards information sharing. However, taking the available public data pools and the possibility to predict economic activity from them, into account, companies need to be clear about the link between their own information resources and competitive advantage to not sacrifice supply chain performance improvement.

3.4 New business development

Several companies are developing new business opportunities based on the adoption of Big Data Analytics. While in some cases, Big Data Analytics has produced valuable information, that can be offered to organisation outside their own supply chain, many of these new business opportunities are the servitization of current products.

By combining existing tangible products with intangible services, new product-service systems are developed. The systems include traditional product or use orientated models and extend into result orientated approaches. Big Data Analytics, based on information from the internet of things, enables companies to offer functional results to their customers.

These new service models are often changing the current supply chain design and are introducing new partners. The product-service models move the company closer to their end-customer with the potential of improved customer value, competitiveness and sustainability, ultimately improving overall supply chain performance.

4 Contribution

The research evaluates 23 constructs of opportunities and challenges from the adoption of Big Data Analytics on a supply chain level and highlights strong differences in perception of relevance between different industry and customer segments. Additionally, the research shows overall impact on the existing supply chain design and performance through the adoption of Big Data Analytics.

This study informs researchers about possible lenses on industry or customer specific implications of Big Data Analytics. Additionally, this research highlights the conflict regarding gain and loss of competitive advantage through information sharing, as a specific area for future research.

From a managerial perspective, this research encourages organisations to gain a clear understanding of linkages between unique, private data and the competitive advantage perceived to be at risk, to not unnecessarily sacrifice company's and supply chain's performance.

References

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