

Bimodal, Multimodal or Platform – What is a Supply Chain Future Strategy?

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Abstract

This paper examines the idea of supply chain strategy in terms of ICT influence on supply chain business model. The aim is to present the most important technologies – Social, Mobile, Analytics (based on Big Data) and Cloud Computing – as the main enablers for reaching competitive advantages by supply chain strategy. Analysis are based on literature and market studies reviews supported by author's empirical research results on supply chain manager's perception on future supply chain development. During the analysis conducted in the paper the definitions of supply chain strategy and supply chain business model was introduced. Further the next phase of supply chain evolution was identified and the base for this new phase – the internet platform based on cloud computing – introduced. This solution, together with the rest SMAC technologies, creates new approach on how flows within supply chains are managed. Due to new potential created by SMAC and ubiquitous uncertainty managers should revise the ability to create multimodal supply chain strategy. That strategy is supported by customised supply chain business models able to meet events in the unpredictable environmental framework. The base for multimodal supply chain strategy development is market segmentation where the differentiator is described by value perceived by particular customer.

Keywords: Supply Chain Strategy, SMAC technologies, Supply Chain Business Model

Introduction

The successful organization of the future will be customer-focused not product or technology focused, supported by a marketing information competence that links the voice of the customer to all the firm's value-driven processes.

Webster, 1997

According to A. T. Kearney study "by 2020, more than 50% of revenues will be funnelled through digital channels and/or driven by digital product, services, or businesses. Yet, most leaders (53%) have not fully integrated digital into their corporate strategies. These findings have significance for every CEO of an established business with one foot on solid ground and the other on the digital playing ground." (Fabel & Mendoza-Pena, 2016). The digital environment has strong influence on the organization strategy and so on the resources and business model configuration. As the company never acts independently of the others it is able to meet the challenges of competitiveness by maximizing gains only through cooperation and integration with other entities. Therefore the perspective of whole supply chain strategy should be revised when analysing ability to reach the highest level of competitiveness of the company.

Supply chain strategy is the ability for value creation by the competitive supply chain business model implementation. The supply chain business model can be understood as the way of how network of organizations creates and delivers value under specific environmental circumstances and by available resources usage that enables it to seize opportunities within certain conditions.

There are two basic types of competitive advantage: cost leadership and differentiation (Porter, 1985). Therefore supply chain managers should revise the range of capabilities (resources) that create and power business models able to maximise value creation and at the same time are capable to gain competitive advantage by cost decreasing or differentiation.

Currently one of the strongest megatrend reshaping supply chain business model is ICT. Within ICT the SMAC technologies should meet particular attention. Social, Mobile, Analytics (based on Big Data) and Cloud computing used in the interconnected mode are those that are able to influence on supply chain strategy in a revolutionary way.

The purpose of the study is to analyse the influence of the most important ICT trend on supply chain strategy. This is done by literature and market studies review. Additionally the results of empirical research conducted by CATI methodology on 122 supply chain managers in Poland during September 2016 was presented. The study concentrated on current and future supply chain management activities in terms of technologies usage and their influence on supply chain processes.

Based on the literature review the definition of supply chain strategy and supply chain business model was developed. Current studies on ICT role in supply chain development allow to conclude that supply chain is entering into new phase of its evolution. This is a result of the ability to gain advantage i. e. from the access to the internet platform based on cloud computing. Such a solution is able to connect many supply chains stakeholders simultaneously. That model, supported with the rest of SMAC technologies, is completely different from traditional linear supply chain model where all the process phases are sequential and follow one after the other.

Further analysis led to the conclusions that due to unpredictable demand and potential of available ICT resources (especially SMAC technologies) companies should revise environmental framework in terms of developing more than just one business model for improving competitive advantage. The segmentation of customers' needs, characteristics of supply side, variety of values created by the same product or geography-related conditions are those that should be revised in terms of accuracy of chosen supply chain models' capabilities. Therefore supply chain managers should examine the potential of multimodal supply chain strategy development that could be powered by SMAC technologies and operational excellence to respond to the challenges of current events by customized supply chains business models.

Supply Chain Strategy

In general strategy is about to decide where the organization wants to go (settling goals), and how to get there (describe the method of achieving those goals). A more complete definition of strategy is based on Porter's competitive advantage that is the object of most corporate strategy. "Competitive advantage grows out of value a firm is able to create for its buyers that exceeds the firm's cost of creating it. Value is what buyers are willing to pay, and superior value stems from offering lower prices than competitors for equivalent benefits or providing unique benefits that more than offset a higher price. There are two basic types of competitive advantage: cost leadership and differentiation." (Porter, 1985). In both cases (cost leadership and differentiation) company should assume the breadth of the target that is supposed to reach. The cost leadership and differentiation strategies seek competitive advantage in a broad range of industry segments, while focus strategies aim to cost advantage or differentiation in a narrow segment. The matrix build on the adopted model of competitive advantage and the scope of the target suggests the type of the strategy that company can follow. This matrix is presented on figure 1.

Figure 1. Porter's Generic Strategies

		COMPETITIVE ADVANTAGE	
		Lower cost	Differentiation
COMPETITIVE SCOPE	Broad target	1. Cost leadership	2. Differentiation
	Narrow target	3A. Cost focus	3B. Differentiation focus

Source: Porter, M. , (1985), *Competitive Advantage*, The Free Press, New York, pp. 12.

The competitive advantage is created based on framework and organization model that is able to fulfil strategy objective in a specific environmental framework. The environmental framework concerns industry or sector (customers, suppliers and competition characteristics), so the market that company wants to compete on. The organizational business model is associated with the resources' configuration able to meet the demand. According to Osterwalder and Pigneur (2010) "a

business model describes the rationale of how an organization creates, delivers, and captures value” in economic, social, cultural or other contexts.

As the company never acts independently of the others, thus the perspective of a supply chain should be revised in terms of competitive advantage and strategy development. According to Christopher "supply chain is the network of connected and interdependent organizations mutually and co-operatively working together to control, manage and improve the flow of materials and information from suppliers to end users" (Christopher, 2016). Supply chains are used to have a service approach as they are “systems delivering value to consumers and customers; and contributing value to suppliers, producers and distributors” (Hines, 2013). Companies engaged in cooperation within the supply chain should seek for achieving common competitive advantage to improve their competitive position. Therefore, each partner involved in supply chain is supposed to add value in the process of competitive advantage creation. Thus they should be managed from the perspective of whole supply chain they cooperate in. Supply chain management can be understood as “the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders” (Lambert, Cooper & Pagh, 1998). In this manner the supply chain can be understood as extended organization.

If the supply chain is a network of organizations, then **supply chain business model can be understood as the way of how network of organizations creates and delivers value under specific environmental circumstances and by available resources usage that enables it to meet opportunities within certain conditions.**

Based on the above definitions the following supply chain strategy concept can be introduced – **supply chain strategy is the ability for value creation by the competitive supply chain business models implementation.**

Competitive supply chain business model corresponds to the market needs. Therefore, it is 'suitable' and conditioned by the ability to respond to the demand in certain time. In most of the cases, the shorter lead times, the higher level of supply chain competitiveness.

With the respect to lead times and current uncertain demand characteristics (both are part of the environmental framework) there can be four generic supply chain strategies distinguished (Christopher, 2016):

Lean – when there are quite long lead times and demand is predictable. Lean strategy can be proper when the resources (capacity) are fixed and so the level of services are variable.

Kanban – when lead times are short and demand is predictable. Kanban is a philosophy of continues replenishment, where as each product (or service) is soled than it is preplaced for another one.

Agile – for unpredictable demand and short lead times. The agile strategy can be used when level of service is fixed and so the level of capacity must vary.

Hybrid (leagile) – when demand is unpredictable and lead times are long. Companies might seek for time reduction or for lean/agile solution. This might require supply chain to be 'de-coupled' through holding strategic inventory in some generic or unfinished form, with final configuration being completed once real demand is known.

The generic supply strategies are shown on figure 2.

Figure 2. Generic supply chain strategies

		DEMAND CHARACTERISTICS	
		Predictable	Unpredictable
SUPPLY CHARACTERISTICS	Long lead times	LEAN Plan and optimise	HYBRID/ LEAGILE De-couple through postponement
	Short lead times	KANBAN Continuous replenishment	AGILE Quick response

Source: Christopher, M. (2016)

To gain a supply chain business model flexibility – the ability to respond quickly to demands' changes – some specific actions are taken supporting competitiveness in terms of lower costs or differentiation strategies, like (Christopher and Holweg, 2011):

- Dual sourcing – to have an alternative for supplying critical components or raw materials.
- Asset sharing – to create additional effect of economies of scale.
- Separating “base” from “surge” demand – to differentiate techniques of resources management - when certain level of demand is predictable and appropriate actions are taken on daily basis to maintain the continuity of the goods flow and demand above that level for practicing postponement techniques.
- Postponement – to customize product in the final phase of its supply chain.
- Flexible labour arrangements – to adjust labour force to actual demand needs.
- Rapid manufacture – to enable the economic manufacture of products in small batches in small facilities.
- Outsourcing – to gain access to capacity (or whole processes) when required and convert fixed costs into variable costs. Nowicka, 2016).

However due to environmental framework changes the supply chain business models should constantly seek for the resources (capacity) increasing their competitive advantage. This capacity should be than flexible to create supply chain business model structure adaptable and responsive to unexpected events. Currently supply chains are under great pressure of technological – mostly information and communication technology (ICT) – disruptive changes.

SMAC technologies and supply chain strategy

As people, business, and “things” increasingly interconnect in the digital economy, existing business models are being radically disrupted. Digital transformation changes the way a company interacts with stakeholders – customers and business partners, creates value, and competes. Digital business is built on new computing infrastructure based on the four pillars of Social, Mobile, Analytics – Big Data – and Cloud computing (SMAC) – accelerated additionally by the Internet of Things (IoT) and machine-to-machine (M2M) learning technologies.

Social media networks support businesses by strengthening and expanding the network of contacts and are able to turn into powerful vehicles for lead generation, customer engagement and management, complaint redressal and brand strengthening by improving customers' loyalty. Companies now track metrics like leads, website traffic, conversions and revenue generated.

Mobile and mobility technologies have radically changed the working environment in enterprises and within supply chains. Mobility has created a demand for enterprise data and access to key applications to be ubiquitous while greatly increasing responsiveness and efficiency among the workforce enabling business decisions in 'real-time'. The cascading effect of such wide access on productivity has also made enterprises favour adoption of enterprise mobility with greater rigour.

Advanced Analytics is the science of examining data to discover underlying information and patterns. Big Data, a popular form of analytics algorithms, offers a suite that comprises of software and infrastructure platforms and advanced analytics that can provide meaningful and contextual insights and real time data analytics. Big Data refers to the volume, variety, and velocity of new and existing – structured and unstructured data pouring through networks into the processors and storage devices, along with the conversion of such data into business advice for enterprises. Gartner, 2012).

Cloud computing makes it possible to access data, applications, and services over the Internet and gives users the ability to work from anywhere, on any device and anytime. Constantly growing number of businesses are already using cloud computing in a public, private, or hybrid environment. The major benefits of cloud include elasticity (due to scale up or down quickly to meet computing power demand) ; affordability (pay-per-use model) ; availability (no need for costly hardware, such as hard drives and servers) and simplicity (IT can be easily use by single employee).

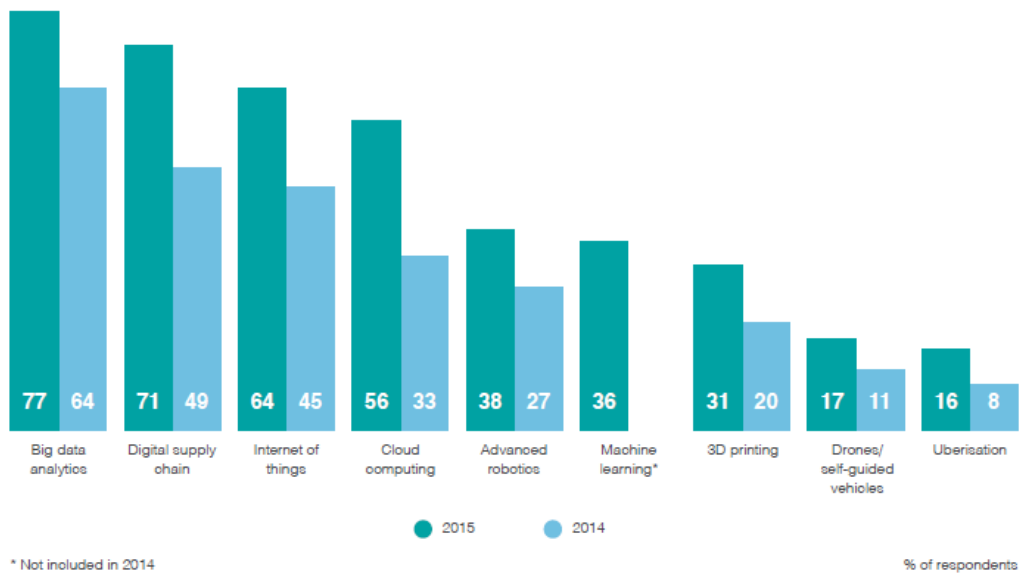
The rise of Mobile and Social media and their ability to churn huge volume of analysable data and the rise of Cloud which enables companies to run large scale Analytics using Big Data tools. As enterprises globally adopt SMAC for operational efficiency, cost reduction, extend the current reach, and gain business edge, they need to assess the impact of the

investment as well as consider their own strengths and weaknesses with respect to how this paradigm shift may affect the overall organisation's culture. However adoption of SMAC collaboratively rather than separately may have better impact on organisations and supply chains. (KPMG, 2014).

These disruptive technologies are giving companies the ability to radically change business models and create new products and services and so competitiveness improvement. As an important resource SMAC technologies are transforming also supply chain business models to achieve strategy goals in more competitive way.

According to SCM World study conducted on 1018 worldwide supply chain executives the most 'disruptive and important' technologies with respect to supply chain strategy in 2015 and 2014 were Big Data analytics, IoT and Cloud computing. Additionally respondents marked the role of digital supply chain as one of the most important aspects that should be examined by supply chain managers. According to the researchers Big data appeal because it promises a way to make sense of complexity and is a method for digesting demand information, which is exploding in volume and urgency with digital demand and omnichannel solutions. Cloud computing and IoT offer heightened awareness of what is happening in supply chain. And the need for visibility has always been a key concern in supply chain. This group of technologies look ready to combine into a sort of supply chain nervous system, picking up and making sense of an essentially infinite stream of sensory information. (SCM World, 2015). The results on disruptive technologies with respect to supply chain strategy in 2015 and 2014 are shown on figure 3.

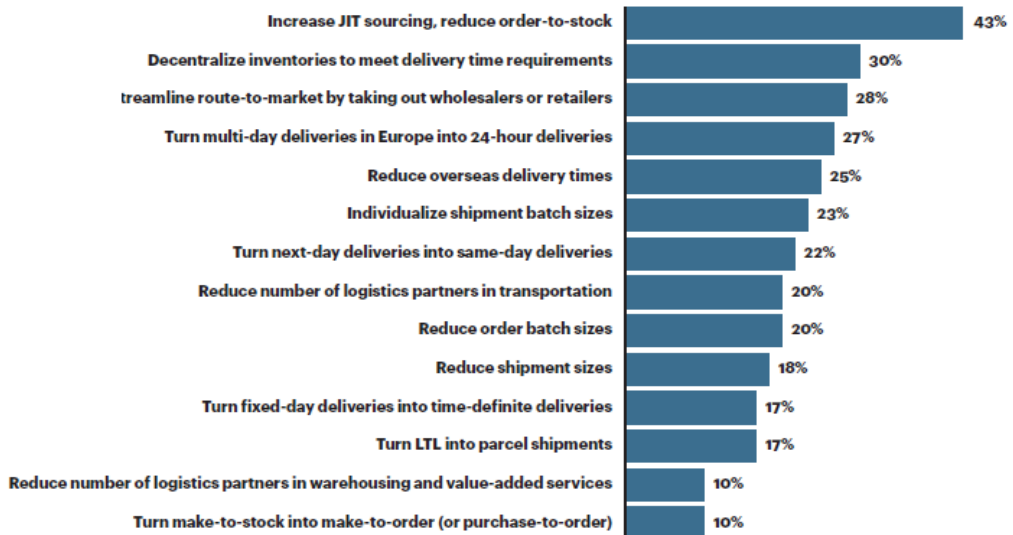
Figure 3. Disruptive technologies with respect to supply chain strategy in 2015 and 2014 (%)



Source: SCM World, (2015), "Future of Supply Chain Report 2015", London, Boston, pp. 9.

Described technologies that create digital transformation started to influence on business models and the way strategy is implemented. Today modern services and products are not necessarily physical. Apps, Airbnb, Netflix, Pandora or Uber represent real enterprises that are based on the Internet platform business models and using SMAC technologies broadly. Some apps, such as Etsy, go a step further by directly linking the creation of goods with customer-generated designs. Those solutions are starting reshape existing supply chains. This begins to be visible on operational level, but soon might be a game-changer for competitive supply chain management. According to A. T. Kearney and WHU Logistics Study (2015) the highest impact of digitalization on supply chain will be seen in the area of increase Just-in-Time sourcing, reduce order-to-stock (43% of respondents seeing 'clear' or "very strong" effect by 2017) ; decentralize inventories to meet delivery time requirements (30%) or streamline route-to-market by taking out wholesalers or retailers (28%). The detailed results of the study are shown on figure 4.

Figure 4. Impact of digitalization on supply chain management



Note: JIT is just in time, and LTL is less than truckload.

Source: A. T. Kearney/WHU, (2015), Digital Supply Chains: Increasingly Critical for Competitive Edge, A. T. Kearney/WHU Logistics Study 2015, pp. 12.

Evolution of supply chain business models

Digital revolution influences on supply chain strategy implementation. Therefore it also has an impact on how supply chains models evaluate. According to Potter, Towill & Christopher the first supply chain evolution phase philosophy was product driven supply chains. It was dated before the 1990s and activities were determined by unit production costs. During 1990s wider usage of software started to be introduced influencing on batch sizes production modifications and information distribution. This second phase was market oriented and lean concept started to be analyzed in terms of its implementation within supply chains' operations. The third phase was called 'market-driven' supply chains and was dated on 2000s. The widespread emergence of alternative e-commerce distribution channels started to be developed. During 2010s the level of customization increased creating customer-driven supply chains. According to Potter, Towill and Christopher "the order winner" concentrates on lead times and the main performance metrics are technological capability and level of servitisation. Potter, et. al, (2015). Then the next phase – 2020s. – In supply chain migratory model can be notice. Its philosophy is still based on customer centric approach, but due to increased ability for interaction by ICT usage, it is more related to concentrate on customer experience and engagement on how supply chain structure is designed. Those supply chains are based on e-business solutions and ubiquitous virtual reality. The 'order winner' is the one who is able to react on real-time basis responding in innovative way supplying personalized solutions (product and/or service). Finally it influence on the ability to create customized supply chain business model that reacts on the event's bases. The migratory supply chain model presented as the subsequent phases of its development is presented on table 1.

Table 1. Supply chain evolution phases

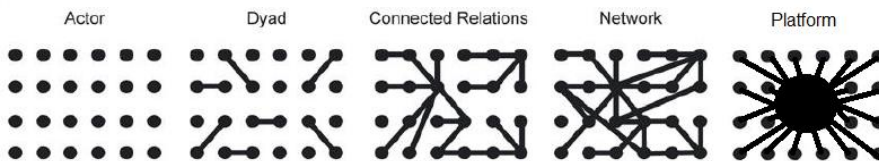
Supply chain evolution phase	I	II	III	IV	VI
Supply chain philosophy	Product driven	Market orientated	Market driven	Customer driven	Customer engagement and experience
Time marker	Until the 1990s	1990s	2000s	Early 2010s	2020s
Supply chain type	Lean functional silos	Lean supply chain	Leagile supply chain	Customized leagile supply chain	Supply platforms
Order winner	Quality	Cost	Availability	Lead time	Ubiquitous virtual supply chains
Market qualifiers	Cost Availability Lead time Sustainability	Availability Lead time Sustainability Quality	Lead time Sustainability Quality Cost	Sustainability Quality Cost Availability	Responsiveness Innovation Agility Cost to serve
Performance metrics	Stock turns Product costs	Throughput time Physical cost	Market share Total cost	Customer satisfaction Value added	Personalized /tailor-made

Source: Potter, A. , Towill, D. R. & Christopher, M. , (2015). Evolution of the migratory supply chain model, "Supply Chain Management: An International Journal", No. 20/6, pp. 603-612 and own elaborations.

Additionally digital revolution and SMAC technologies influence on the supply chain business model in terms of partners integration, flows configuration and their sequences in value creation. Most of existing supply chains have traditional, pipeline model of flows where value is added in particular order from end user to original supplier (i. e. plan, source, make, deliver). However adapting i. e. internet platform based on cloud computing model disrupt upstream and downstream linkages and its sequenced flows. Therefore reshapes existing approach to supply chain structure and models or even supply chain "as we know it" itself.

Figure 5 illustrates the evolution of complexity in the interconnected network of supply chain relationships, indicating the interplay between interconnectedness and complexity in the shift towards the supply platform paradigm. Each dot represents a company (actor – supplier, distributor, retailer, etc.) and this is where both actors establish dyadic relationships. They might interact within more than only one dyad. Firms are connected directly and indirectly with numerous of other firms, typically via non-linear and complex relationships. Braziotis et. al. , 2013). Due to the technology development whole supply chains can be 'moved' to the virtual reality (like e-business model) and developed on the internet platform based on cloud computing environment. The platform enables to coordinate information and money follows, but still it rarely can be used for goods distribution. Products' flows are still the domain of physical distribution and so the traditional linear pipeline exists between already virtually connected companies.

Figure 5. From supply chain to supply platform



Source: KPMG, T. , Wilkinson, I. F. & Johnston, W. J. 2004), "Managing in complex business networks", Industrial Marketing Management, Vol. 33 No. 3, pp. 175-183 and own elaborations.

Due to the increasing role of SMAC technologies in supply chain model development there is a need for verification of the approach on how supply strategy might be implement to gain competitive advantages. As shown on table 1 the supply chain in under the process of evolution and even that digital transformation may cause revolution in some of the cases,

most of the supply chain business models transformation will have step-by-step path. Therefore the concept of differentiation of supply chain business models is should be examined.

The differentiation of supply chain business models is necessary as the concept of "one-size-fits-all" does not provide maximum value. Even two fundamentally different supply chain business models: a market-response for innovative products and a cost efficient for functional products (Fisher, 1997) are not sufficient in current and future environmental framework.

Recently Gartner introduced similar concept of bimodal supply chain strategy. According to this idea companies should adapt the digital world while still operating in the 'analogy' world. Bimodal (mode 1 – evolutionary – is the linear, pipeline model of supply chain and mode 2 – revolutionary – involves creative thinking, risk-taking and technology involvement) is about closing the gap between traditional and revolutionary models of supply chains. The concept considers the agile approach to invest in technology, leadership and talent. Mode 1 goes through the traditional development and deployment paradigm of long cycles, it automates the predictable and consists of i. e. the legacy ERP investments that have been made. It is optimized for areas that are well-understood and focuses on exploiting what is known, while renovating the legacy environment into the state that is fit for a digital world. Mode 2 is smart, using SMAC technologies – i. e. cloud-based supply platforms – and collaborative. It is exploratory, experimenting to solve new problems and optimized for areas of uncertainty. www.gartner.com/it-glossary/bimodal/). The capabilities supporting mode 2 are based on top of mode 1. In this way supply chain might become stable approach to unpredictable demand changes. They are able to develop from batch, functionally oriented operations and processes to real time, network and scenario-based supply chain planning (Durbha, 2016). They are also the model for electronic business (e-business) development.

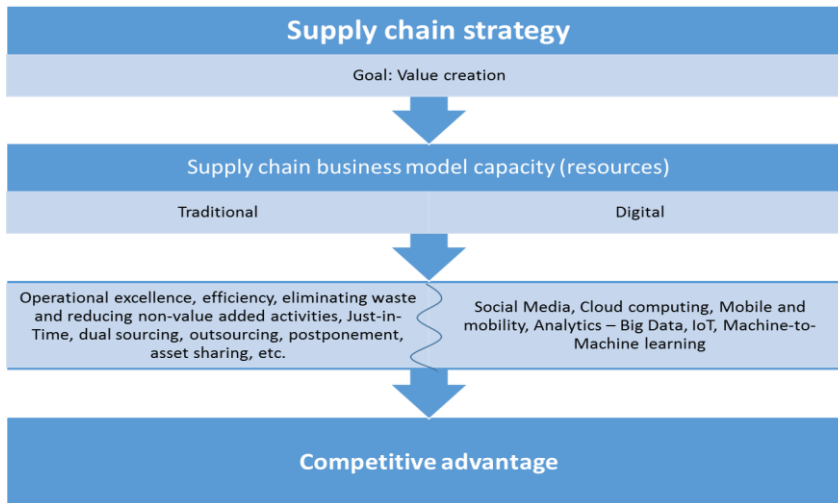
Supply chain business model diversity and customization is driven by segmentation. The first approach to segmentation is differentiation of customers' needs. This is the lowest level of division for final segmentation of supply chain business model activities due to the fact that even value perception of single product may vary between the different customers. In the broader view the segmentation can be led by many approaches and logic, like: product-related (i. e. product life cycle phase, physical characteristics, demand uncertainties or forecast accuracy), customer-related (i. e. customer segment, customer collaboration capabilities, and buying behaviour or buyer personality types), supply-related (level of engagement in product development, level of value creation, or uniqueness) or geography-related (regionalization of the market, distance between customers or suppliers, or clear geographic boundaries of the market) aspects. McCarthy et al. , 2016). Additionally there can be a multi-factor approach for segmentation as a result of different logic and aspects' combination. Those influence for example on omnichannel further development.

Segmentation is a starting point for supply chain model diversification and customization. During this process the aspects of supply network configuration, product delivery strategies, customer-order de-coupling point positioning, strategic inventory positioning and transport mode selection or type of the relation between the particular partners (so the capacity – resources) configuration should be in place.

As the needs may vary and the same product might have different values from the perspective of single customer the type of supply chain model will probably never be clearly mode 1 or mode 2. On a specified part of the supply chain mode 1 may be the best, but for the other parts of the flow the mode 2 or again mode 1 might be better solutions. Therefore companies should rather revise the ability to use multimodal approach for their supply chain business models – so the capability to easy 'switch' between modes or adopting part of the supply chain business model to particular demand characteristics.

Thus currently **multimodal supply chain strategy should be analysed in terms of value creation by ability to arrange combination of the capabilities of supply chain business model that are developed on the event basis.** The multimodal supply chain strategy concept is shown on figure 6.

Figure 6. Multimodal supply chain strategy – business model capacity diversification



Source: own elaborations.

Conclusions and further directions of supply chain strategy development

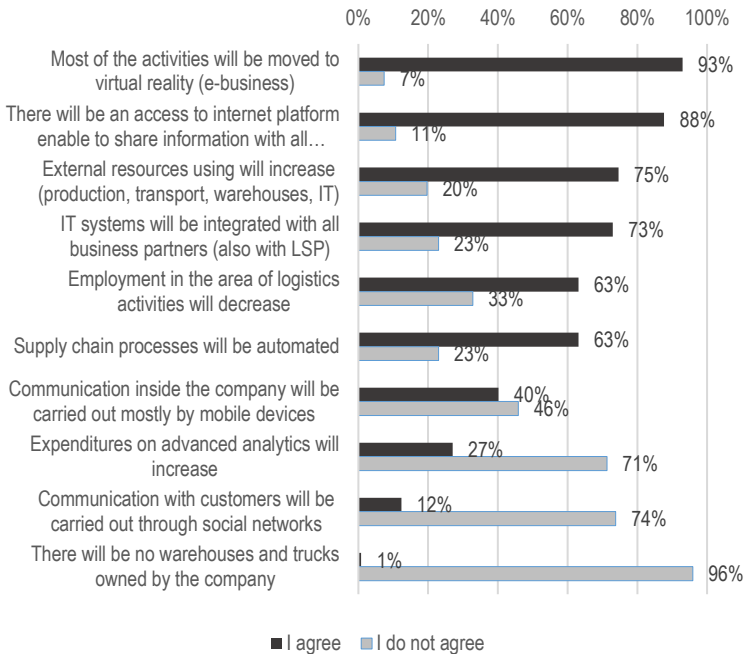
Business environmental framework started to be strongly influenced by disruptive ICT technologies. Digital transformation impacts also on supply chain and their strategy development should be revised.

Most of the existing supply chains have linear model and are centred on operational excellence, efficiency, Just-in-Time deliveries, and lean activities eliminating waste and reducing non-value added activities. With high demand fluctuations and available SMAC technology resources the new innovative solutions started to be introduced into the supply chain strategies. The value creation and delivery can be gain by building the supply chain business model that is able to arrange combination of the capabilities – resources that are selected and implemented on the event basis. That is a concept of multimodal supply chain strategy. **Multimodal supply chain strategy should be analysed in terms of value creation by ability to arrange combination of the capabilities of supply chain business model that are developed on the event basis.**

However supply chain is under constant process of its evolution. The environmental framework creates both – opportunity and threats for supply chain managers. Currently ICT and SMAC technologies play central role in the direction of business models development. This trend will probably dominate any other capacity development of business models in terms of their ability to gain competitive advantage by supply chain strategy in the future.

Those assumptions were verified by author's research conducted by CATI methodology on 122 supply chain managers in Poland during September 2016. The study subject was on current and future supply chain management activities in terms of technologies usage and their influence on supply chain processes. According to respondents the most likely occurrence, which will take place within the next five years is the development of e-business by moving most of the activities to virtual reality (93% of managers agreed on that). This means process automatization or even elimination of part of existing supply chains as they will not add value to the system any more. Managers expect also that within next five years there will be a widespread access to the internet platform that enables information sharing between supply chain stakeholders (88% agreed on that statement). Additionally the increase of external resources is expected. This solution would support value creation by the resources that are not owned by companies directly engaged in the supply chain. In terms of ICT and SMAC technologies usage, managers additionally claimed that communication with customers will probably not be carried out through Social media soon (only 12% agreed on this statement) and 71% do not agreed that expenditures on advanced Analytics will increase. The detailed results are presented on figure 7.

Figure 7. Supply chain managers' predictions over the next five years



Source: own elaborations.

Those results show the level of awareness on how ICT can reconfigure or revolutionise future supply chain business model. However, they do not explain if managers are prepared to gain on new supply chain strategy development. The research just caught the moment when the multimodal supply chain strategy should be deeply revised in terms of configure the right capacity for right value creation and gain competitive advantage.

To meet this challenge, the segmentation of customers' needs, characteristics of supply side, variety of values created by the same product or geography-related conditions are those that should be revised in terms of accuracy of chosen supply chain models' capabilities.

Segmentation is a starting point for supply chain model diversification and customization. During this process the aspects of supply network configuration, product delivery strategies, customer-order de-coupling point positioning, strategic inventory positioning and transport mode selection or type of the relation between the particular partners and arability of SMAC technologies or other ICT solutions (so the supply chain business model capacity – resources) configuration should be analysed.

Additionally, during the existing phase of supply chain development the multimodal supply chain strategy should be the one to be carefully revised for near future competitive advantages creation.

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