DYNAMIC ALIGNMENT OF DIGITAL SUPPLY CHAINS BUSINESS MODELS

Jochen Nürk[1,2]

[1] *Mendel University in Brno, Czech Republic*
[2] *SAP SE, Walldorf, Germany*

EUROPEAN JOURNAL OF BUSINESS SCIENCE AND TECHNOLOGY

Volume 5 Issue 1
ISSN 2694-7161
www.ejobsat.com

ABSTRACT

A model for managing strategic alignment and dynamic capabilities (DC) of Supply Chain Management (SCM) information systems (IS) has been developed and applied to a traditional German steel company and a highly innovative Austrian steel company. Different concepts of leading researchers have been combined to get a holistic and detailed view of IS capabilities' impact on strategic fit. The model enables companies to identify ideal levels to strategic fit needed from SC integration and its antecedents for predefining architectural artefacts as sources for dynamic capabilities. The study contributes to new insights into the IT productivity paradox, where possibilities from IS investments remain unused. Essential concepts for optimising SC performance by reducing SC complexity and increasing SC agility have been identified and integrated. The study highlights value enabler and Artificial Intelligence (AI) methods of digital SC models and how the model's ontology can be used to increase alignment autonomy. Finally, the approach supports organisational learning and development of cognitive profiles through collective assimilation and sensemaking effects.

KEY WORDS

ambidexterity, digital business models, dynamic capabilities, strategic alignment, supply chain management

JEL CODES

M100, M110, M150, O310, O320

1 INTRODUCTION

The motivation: Businesses demand of aligning SCM IS to their strategy increases globally based on ongoing changes of industry conditions and industry consolidations like Mergers and Acquisitions (M&A) as well as from technological change driven by the digital transformation

NÜRK, Jochen. 2019. Dynamic Alignment of Digital Supply Chains Business Models. *European Journal of Business Science and Technology*, 5 (1): 41–82. ISSN 2694-7161,
DOI http://dx.doi.org/10.11118/ejobsat.v5i1.161.

such as the Industry 4.0 initiative. The opportunities of SCM IS alignment are creating differentiated business value while companies need simultaneously managing IT costs and focusing on IT investments that are sources of competitive advantage. Procedures and tools for Supply Chain Performance Management (SCPM) using key performance indicators (KPI) are provided by best practice endeavours such as the 2009 SCORE model, which is offered by the US Supply Chain Management Institute and based on the Balanced-Score Card approach (Kaplan and Norton, 1992, 2001). However, a best practice for assessing the strategic fit of SCM IS and the related business and IT architectures appropriate to derive reasonable actions from is missing so far. Digital business models and manufacturing ecosystems such as driven by the Industry 4.0 initiative focuses on the autonomy in controlling business processes enabled by components such as Smart Services and Cyber-Physical Systems that provide smooth collaboration of ecosystem members connected via the internet at unforeseen events as well. While Artificial Intelligence (AI) methods are used primarily for managing the operational processes such as sensing of conditions, decision making based on business rules steering the physical systems, the author misses autonomy on the architecture levels for aligning business models and SCM IS onto changing environmental conditions.

The research objective: The main objective of this qualitative research was to explore new knowledge and methodology for the strategic alignment of SCM IS. For this reason, a generic, capability-based model being developed that is grounded in theoretical evidence by key constructs of leading researchers in the fields that have been integrated to get a holistic view and a detailed view of strategic alignment. The model should help companies to identify cases of misfit and the context-specific set of IS capabilities for SCM on multi-levels that lead to strategic fit and superior SC performance. Empirical evidence of the model's transferability to companies in the steel industry was searched by testing it at two companies that have been selected as polar types by a traditional and a highly innovative company (Koulikoff-Souviron and Harrison, 2005, pp. 270–271). There is evidence that firms have successfully attained higher profitability through IS, enabling revenue growth (Mithas et al., 2011, pp. 237–243, 248–253) and IS executives are using IS-based resources to increase competitive advantages, by aligning IS plans with business plans (Kearns and Lederer, 2000, pp. 265–270). However, there is an observation that massive IS investments in advanced economies were not adequately reflected in the resulted business performance since the 1990s (Zukis et al., 2008, p. 5). Brynjolfsson calls this phenomenon as the IT Productivity Paradox, which refers to unused potentials from IT investments (Bashiri et al., 2010, p. 2; Brynjolfsson, 1993, pp. 67–75; Pinsonneault and Rivard, 1998). The study explores the causes and reasons of the phenomenon in the sample industry and develops the model useful for identifying these and prevent organisations from such miss-investments. Finally, this study explores knowledge and methodology for the strategic alignment of SCM IS utilising possibilities of emerging digitalisation technology such as of Industry 4.0 and Artificial Intelligence (AI). The study aimed to support autonomy in strategic alignment by adopting its ontology to AI-based concepts. For providing the context, the building blocks of digital business models and their enabler for dynamic capabilities (DC) for SCM have been explored.

The addressed gap in the literature: A 2016 systematic review about business-IT alignment by Spósito et al. (2016) concludes that there are many new ideas developed in the field, but with less development forward on existing constructs less and less empirical evidence from adoption in practice. For closing this gap, a concise strategic alignment model has been developed by combining key constructs of leading researchers; and grounded it in empirical evidence by applying and testing in at two global, leading companies in the steel industry.

The research question and objective: For addressing the stated research objectives, the following research question and main objective have been implemented:

- **RQ:** How, and to what extent does a capability-based model support the degree of strategic alignment of SCM information systems?
- **RO:** Explore, how, and to what extent does a capability-based model support the degree strategic alignment of SCM information systems.

The research sub-objectives: For working out the main research objectives, the following sub-objectives have been implemented:

- **RO1:** Develop a model for a holistic and detailed assessment of the strategic alignment of SCM IS, and test it at companies in the steel industry;
- **RO2:** Explore causes and reasons for the phenomenon of the IT Productivity Paradox as related to SCM IS;
- **RO3:** Explore the impact IS capabilities for SCM IS on strategic fit and how to govern these.

2 BACKGROUND AND THEORY DEVELOPMENT

The academic background and used key concepts: To compete in today's dynamic markets, firms must adapt their competitive strategies frequently and so need to align their business models and IS to comply with those new rules (Johnson et al., 2008, p. 3; McLaren et al., 2011, p. 909). For this reason, strategic alignment positively influences IS effectiveness and leads to higher business profitability (Avison et al., 2004, p. 224; Luftman, 2003, p. 9; Porter, 1987, p. 7). Previous approaches for measuring strategic fit or misfit between IS capabilities and competitive strategy, adopted by, for instance McLaren et al. (2011), Chan et al. (1997), Avison et al. (2004), and Sabherwal and Chan (2001), do not provide measurements on a detailed level. For obtain a holistic and a detailed view of IS capabilities' impact on strategic fit and business performance, different approaches of leading researchers have been combined into a new model. The model combines a profile-deviation approach (used by McLaren et al., 2011, pp. 918–919; Sabherwal and Chan, 2001, p. 13; Doty et al., 1993, p. 1198) with a cross-domain measurement approach (used by Avison et al., 2004, p. 230; Henderson et al., 1996) to enable assessing second-order effects of IS capabilities across SCM domains, which are called spill-over effects by Tallon (2012). The configurational theory has been adopted to the extent as capabilities can be assessed onto their fit to each other, which related to Mintzberg's postulation *"for being maximally effective, organisations must design configurations, those are internally consistent and fit in multiple contextual dimensions"* (Doty et al., 1993, p. 1198; Mintzberg, 1978, pp. 941–943).

A robust model for managing fit of SC integration antecedents: In referring to the contingency theory, *"there is no universally superior strategy or way to manage in a given environment; instead, the context and structure must fit together if an organisation is to perform well"* (Donaldson, 2006, pp. 20–22; Pennings, 1975, pp. 394–395). The contingency theory postulates that alignment between patterns of relevant strategic, contextual, and structural factors leads to superior company performance and can prevent misalignment (Oh and Pinsonneault, 2007, p. 241; Doty et al., 1993, p. 1196). In referring to the systems perspective, Childerhouse and Towill (2011, p. 7445) state that SC integration achievements result in better performance by optimising an entire SC scenario rather than by optimising each of the sub-systems involved. They argue that through integration, trade-offs and far-reaching decisions can be carried out, based on shared information and coordination (Childerhouse and Towill, 2011, p. 7445). Various researchers define SC integration by the dimensions of organisational relationships, information sharing, coordination and resource sharing (for example van Donk and van der Vaart, 2005a, pp. 99–107; Childerhouse and Towill, 2011, p. 7443). Van Donk and van der Vaart (2005a, p. 100) point out that the increasing practice of integration efforts in volatile and uncertain demand situa-

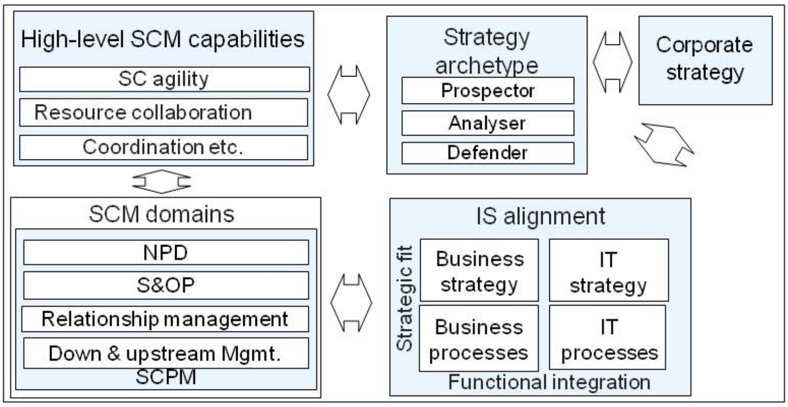

Fig. 1: High-level research model (an author's view; encases Miles' and Snow's strategy types, the SAM dimensions (Henderson et al., 1996), and the MSF model (McLaren et al., 2011)

tions will limit the adverse effects on SC performance. Many authors emphasise integration as an essential dimension of SCM, but the scope and context and their views vary considerably, and the objective of SC integration is not universally accepted as an ideal state and is not a question of *'high integration fits all'* (Godsell, 2008, p. 24; Childerhouse and Towill, 2011, p. 7445). For this reason, a robust, generic model is needed for manage the strategic fit of SC integration and their antecedent capabilities on different levels and multiple dimensions; to identify context-specific information about SC integration and SCM IS fit in detail.

Building on components of proven concepts: As highlighted in Fig. 1, the theoretical framework combines concepts of McLaren et al. (2011) and Sabherwal and Chan (2001), Avison et al. (2004) and Henderson et al. (1996), which provide the foundation on which developments of the present study is based.

Competitive strategy types and levels of support to fit: According to Miles and Snow, each of the archetypes *Defender*, *Prospectors*, *Analysers*, and *Reactor* shows an internally consistent pattern of competitive strategy, wherefore Conant et al. (1990) developed an 11 dimensional measure involving product-market breadth, success posture, surveillance, growth, process goals, competency breadth, adaptability, administrative focus, planning, organisational structure and control (Miles and Snow, 1978; Conant et al., 1990, pp. 367–370; McLaren et al., 2011, p. 916). These unique patterns of response can help to determine a company's strategy type, according to Miles and Snows archetypes. Moreover, McLaren et al. (2004, pp. 52–58) found out that Miles' and Snow's archetypes show patterns of ideal levels of support for IS capabilities for SCM that are needed for strategic fit. They identified that businesses categorised as Prospector or Defender show a higher performance when key IS capabilities fit the theoretical ideal for their archetypes, which has critically reviewed by the study.

The concept of capabilities: In referring to Grant's (1996a) theory of the capability hierarchy, capabilities have been assessed on different levels of aggregation, and higher-level capabilities are integrated by involving lower-level capabilities such as specific knowledge, as illustrated in Fig. 2 (Grant, 1996a, p. 337). The higher the level of the capabilities in the hierarchy and the more aggregated the capabilities are, the more far-ranging cross-functional integration is needed; for example, new product development incorporates particularly wide-ranging integration (Grant, 1996a, p. 377). Capabilities at the highest level in the hierarchy directly support the ultimate business strategy regarding positioning the organisation in the target market. Hence, Venkatraman's (1989a) STROBE measures were used at the highest level of the capability hierarchy for assessing the strategic impact of SCM capabilities.

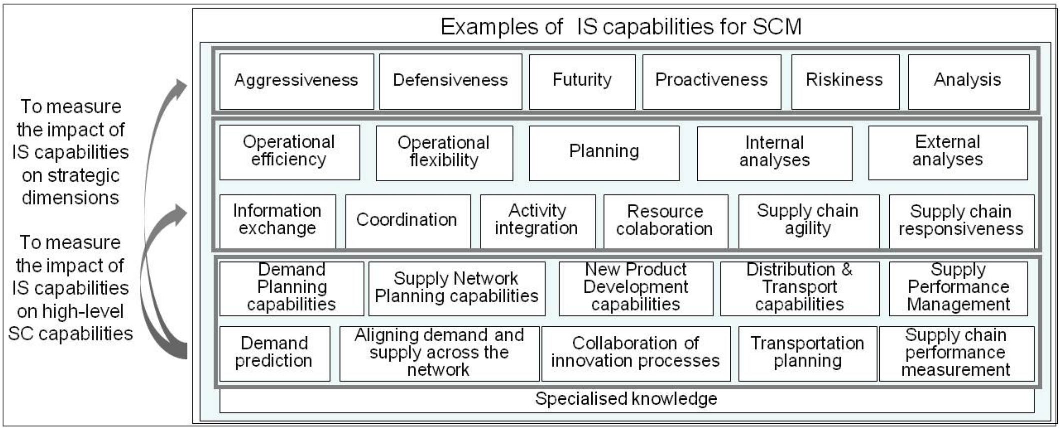

Fig. 2: Strategic fit of different levels (an author's view, encasing Grant's capability hierarchy)

Dynamic capabilities: The theory of dynamic capability, as an extension of Edith Penrose's theory of the resource-based view (1959) is described as a firm's ability to integrate, build, and reconfigure internal and external competencies to address rapid change in business environments (Teece et al., 1997, pp. 515–516). DCs are potentials for innovative capacity that enable firms to implement highly effective strategic alignment by reconfiguring their capabilities to sustain competitive advantage in fast-changing business environments (Teece et al., 1997, p. 511) through rent creating mechanisms (Makadok, 2001). The present research explores how DC related to SCM IS can be managed in an integrated and holistic way for dynamic alignment of SCM IS and in an ambidexterity way for exploration and exploitation (O'Reilly and Tushman, 2007).

Strategic alignment by IS capabilities for SCM: For exploring IS capabilities of SC domains, strategic alignment has been divided–as an adaptation of Venkatraman's definition of strategic alignment–into two components: (1) the concept of *'strategic fit of SCM'*, which represents the measurement of fit of IS capabilities with regard to supporting the firm's competitive position, and (2) the concept of *'functional integration of SCM'*, which represents factors that foster the alignment within the internal IS infrastructure for SCM. The degree of strategic fit of SCM IS is expressed by the levels of support IS capabilities for SCM offing on strategic fit and the levels of functional integration. For consider SCM processes relevant to the steel industry, all SCM domains have been incorporated to identify the levels of support of IS capabilities for the strategic fit of steel firms' supply chains. Moreover, IS capabilities for SCM have been explored about their ideal levels and their actual levels of support to strategic fit. Capabilities embody a firm's qualifications for effectively combining resources for creating and sustaining competitive advantages knowledge integration from multiple sources across the supply chain (Wu et al., 2006, p. 502; Amit and Schoemaker, 1993, pp. 33–44; Grant, 1996b, pp. 115–116).

High-order SC capabilities as antecedents of SC integration: The literature suggests the growing significance of SC integration and collaboration with channel partners throughout the supply chain to secure business opportunities, and to focus on operations' effectiveness and efficiency. Wu et al. (2006) proposed the high-order SC capabilities *information exchange, coordination, activity integration* and *resource collaboration* for supporting cross-functional and inter-organisational activities within the domains of SCM (Wu et al., 2006, pp. 493–495). Hence, these high-order capabilities and further such as *responsiveness* and *agility* are uses as antecedents of SC integration and strategic fit in the present study as they allow aggregated measurements of operational SC capabilities across organisations

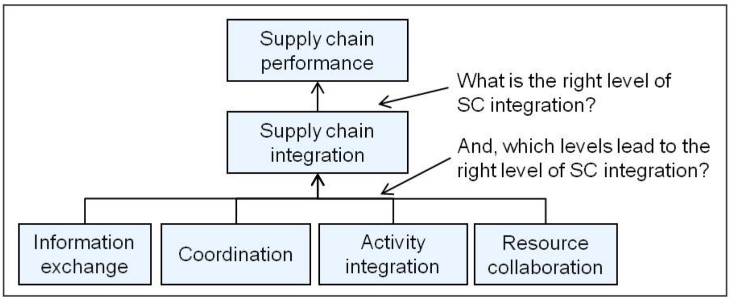

Fig. 3: SC integration antecedents (an author's view, encasing Wu et al.'s 2006 SC capabilities)

(Simatupang et al., 2002, pp. 291–306; Wu et al., 2006, pp. 494–495). Fig. 3 illustrates the SCM capabilities discussed and their relation to SC integration and finally to SC performance. Fig. 2 shows that these high-order SC capabilities are seen placed on a high level in the hierarchy and supported by functional capabilities implemented by SCM IS. Business performance and strategic alignment can be seen as supported by these high-level SC capabilities, as shown below.

Strategic alignment through the right levels of integration: SC integration capabilities are key drivers of business performance in today's business environment (Wu et al., 2006, p. 495; Shaw et al., 2005, p. 3497; Wang, 2011, pp. 42–43; Liu et al., 2013, p. 1453), but their required levels depend on several situational factors (Godsell, 2008, p. 24). SC integration seems to refer to the orchestration of other SCM capabilities, such as information exchange, coordination, and resource collaboration, which leads to the question of the right levels to fit of these antecedent capabilities. As McLaren et al. focus on the generic set of five higher-level IS capabilities, the necessity to enrich the model with capabilities for SC integration is seen, to obtain useful results that support organisations in strategic alignment in today's demanding business environment.

Measuring SCM IS' strategic fit using a profile deviation approach: Because both competitive strategy and IS capabilities are multidimensional constructs, to operationalise their strategic fit requires investigation of a considerable number of contingency relationships unless a configurational approach is used (McLaren et al., 2011, pp. 915–916; Sabherwal and Chan, 2001, p. 13). Therefore, a profile deviation approach has been used for integrating measurements of IS capabilities, on different levels, on their impact on the dimensions of strategic fit. For this reason, capabilities that are organisationally and functionally related to the processes of an SC domain were measured using profiles. Fig. 4 shows how the profile deviation approach has been adopted for assessing the strategic fit of SCM IS. Profiles of IS capabilities with theoretical ideal levels – derived from the business strategy – are compared with profiles of IS capabilities with actually-implemented levels. While ideal levels are linked to an organisation's business strategy, actual levels of support are typically a result of the transformation of the IT strategy. As stated by Prieto and de Carvalho (2011, p. 1409), to possess capabilities with levels of support to strategic fit and not exhaust these for competitive advantage or for generating growth means they will be automatically wasted. Therefore, capabilities' actual levels of support that are higher than the needed levels are seen to have a negative impact on the overall level of strategic fit. The Euclidean distance method has been used for calculating vectors of capabilities' degree of fit as it was validated by previous research such as of McLaren et al. (2011). With this approach, a measure as an indication of the strategic fit of the whole SCM IS, and measurements for the SCM domains and SCM processes can be calculated. By this means, measurements of strategic misfit have been worked out using identified levels of misfit identified for detailed IS capability.

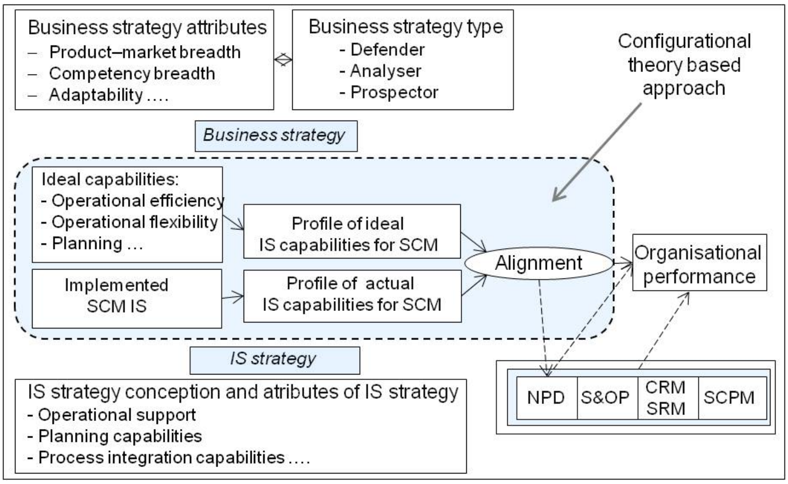

Fig. 4: A configurational theory-based concept for measure SCM IS's strategic fit (an author's view, adapted from Sabherwal and Chan, 2001)

Differences and similarities of the model to previous models: McLaren et al. inspired the present research with their 2011 MSF model. However, they give no description of the measurement model's content that is needed to identify the relevant IS capabilities, and they stated neither full IS capabilities for neither SCM nor anything about which domains they come. Moreover, the measurement instrument for analysis needs to be developed in the field study for each case individually. McLaren et al. used a questionnaire originated by Conant et al. (1990) to determine the firm's competitive strategy type and a justification table for identifying ideal levels that need the be provided by the generic capabilities. A reasonable measuring instrument needs to be developed for each study individually by identifying IS capabilities relevant to the case. The IS capabilities identified need refer to the generic capabilities given by McLaren et al., which is a prerequisite for integrating the case-specific measurement instrument in the MSF model. Thus, from the present study's point of view, McLaren et al. delivered a useful framework for building an applicable measurement model. For obtain a holistic assessment of SCM IS impact on strategic fit, the measurement model has been enhanced using concepts of leading researchers.

Proving McLaren et al.'s classification system: For proving the classification-system of predefined levels of support to fit by five generic SC capabilities pronounced by McLaren et al., their level of support for strategic alignment needs to be compared with the ideal levels of support identified by the present study. In their research, McLaren et al. (2011, p. 914) emphasise IS capabilities for SCM that are relevant for a firm's strategic fit as follows: (i) operational efficiency; (ii) operational flexibility; (iii) planning; (iv) internal analysis; and (v) external analysis. Furthermore, they disclose ideal levels of these generic IS capabilities, related to the firms' competitive strategy archetypes for supporting strategic fit. A cross-domain approach has been used in the present research to reflect the structures of the affected supply chain areas and their dependencies concerning both strategic integration and functional integration (Avison et al., 2004, p. 230; Henderson and Venkatraman, 1990, pp. 6–28). The IS capabilities identified must be mapped to the generic capabilities stated. For this reason, the generic capabilities propounded by McLaren et al. have been analysed by the present study related to the following SCM processes identified for the steel industry: (i) New Product Development, (ii) SC planning, (iii) SC operations, (iv) Relationship Management, and (v) SC Performance Management.

3 RESEARCH METHODOLOGY AND CASE STUDIES

As the nature of this research is to develop a new methodology and proof it in specific business contexts, a qualitative research methodology has been select. Qualitative research allows combining quantitative and qualitative methods such as case studies where the researcher is part of the sample to be explored. Finally, it is open to considering facts that were not expected at starting the research, and, therefore, is well suited for developing a new theory by linking data and theory iteratively (Eisenhardt, 1989, p. 533; Bryman and Bell, 2003, pp. 424–516; Silva and Hirschheim, 2007, pp. 333–334; Kaplan and Duchon, 1988, pp. 574–583; Yin, 2009, pp. 130–134).

Essential theory development based on secondary data: An exhaustive literature review has been conducted to identify key concepts for developing the research question and objectives and for grounding the research in theoretical evidence (Yin, 2009, p. 130). Regarding the multidisciplinary nature of the study, a wide range of literature from a variety of fields has been reviewed to select useful ideas. Hence, the following fields were systematically reviewed by focusing on key researcher:

1. *strategic alignment and measurement models* – as the main subject; concepts of business strategy and IS strategy as central components of strategic alignment;
2. *capabilities and IS capabilities* – as a capability-oriented approach has been used for assessing strategic fit and maintain DC for SCM IS;
3. *Supply Chain Management* – as a methodology for managing the degree of strategic fit of SCM IS have been developed and tested;
4. *Artefacts of IS for SCM* – as an objective of the research was to develop the model for maintaining strategic fit using EAM practice.

Methodical evidence implied in the theoretical framework: In referring to Klein et al. (2006b, pp. 88–91) framing/data theory for concept of mental models a design research approach has been used for developing the theoretical framework and deriving the measurement model and methods. The critical constructs introduced above have been integrated so as to feature the favoured characteristics by the measurement model holistically, but, arriving it as simple as possible. Moreover, the methodology had to enable participatory design by experts of the subject and members of the target practice (Blomberg et al., 1993, pp. 123–150). *Theory triangulation*, as described by Yin (2009, p. 116) has been added to the research theory by investigating different complementing and revival concepts of strategic fit and through synthesising useful concepts of different key researchers in strategic alignment (Yin, 2009, pp. 130–134). The synthesis brings the findings together and leads to the development of the research question and the research objective. In referring to Yin's (2009, pp. 130–162) *logic models* for increasing case study evidence, the main building blocks of the present research methodology are the literature review and synthesis – in order *'to rely on proven theoretical propositions'* – form the basis for the development of the research question and objective and the development of the research theory and methodological framework – in order to develop *logic models*.

The rationale for case study research: While case studies in SC integration make it hard to generalise findings, specifically if there is no clear theoretical framework supporting these, surveys incorporated only limited aspects of integration and fail to consider what actually happens in SC relationships and to address the context or business conditions (van Donk and van der Vaart, 2005b, p. 32). They suggest the use of a multi-case study for research in integrative practice to bridge the gap between single case studies and surveys, and to develop knowledge in the field in its prevailing stage (van Donk and van der Vaart, 2005b, p. 33). Hence, three case studies were used as primary sources in order *'to use multiple sources of data'* for developing the final research theory and for testing the strategic fit measurement model. Therefore, the developed model has been applied to companies in the steel industry, and semi-structured interviews have been used for collecting data from case study participants to the research objectives.

Exploratory field study at SAP instead of a pilot case study: A pilot case study is typically used for exploration-based research, which helps to test and refine the basic research theory and data collection plans (Yin, 2009, p. 92). Hence, the scope of a pilot case study can cover both substantive and methodological issues and helps to refine relevant questions and conceptual clarification of the research design. For reviewing the research theory and collecting qualitative data, a case study at the author's employer SAP SE has been used instead of a pilot study as SAP is a leading vendor for SCM solutions for the steel industry and takes care of the sectors' challenges and needs. Moreover, the author has access to SAP's field organisations on a global basis. Hence, an exhaustive case study within the SAP organisation has provided rich information about the industry related to the research objectives rather than using a single, industrial sample of a pilot case study. As a core objective of the case study at SAP, the entire concept of the model had been reviewed. Moreover, the model's content has been developed by identifying the right set of IS capabilities for SCM processes relevant to the steel business and prepared these as an industry template. For this reason, IS capabilities have identified by expert discussions on an individual level required to point out the industry and organisation specific vital differentiators that are relevant for a strategic fit. The case study at SAP has been conducted by session sequences with each of 12 experts. Comprehensive work sessions were conducted with each of the participants, including semi-structured interviews, and the validation of the case study outcome. Leading experts who developed SCM solutions for all manufacturing industries were involved, and, therefore, were able to assess the research theory regarding its generality and adaptability to other industries. More than 20 additional experts have been consulted for in-depth discussions of topics identified during the case study. Five reports (each between 12,500 and 18,000 words in length) have created as the outcome and signed by the experts. These reports have served as raw data for the findings arrived.

The rationale for sample selection and participants of industrial case studies: The sample organisations are both global players based in Austria and Germany, with subsidiaries and international involvement around the globe. Moreover, both steel companies are engaged in both high-end product segments and low-end ones. The Austrian steel company is well known for highly innovative involvement in both collaborative product development concerning high-end products, and in driving IS innovations. In referring to Kuolikoff-Souviron and Harrison (2005, pp. 270–271), the present study goes for polar types in sampling the highly innovative Austrian steel company (A), that offers high-end products to the automotive industry on the one hand, and in sampling the traditional German steel company (B) with a stable product portfolio for the packaging industry on the other hand. Hence, the polar type rationale is seen in the products the companies offer and the resulting different characteristics in their SCM processes. Both organisations are large steel producers and have to plan and synchronise their supply chains on a global scale. The industrial case studies have been conducted by session streams as well, where six participants including the companies CIOs belonged to the core teams, and additional participants from the companies' business and IT teams contributed to the assessment of the SC domains they are managing and consulting. Finally, the companies' senior management contributed to the identification of the companies' competitive strategy type.

Qualitative data analysis using content analysis: For testing the model by validating measurements against the qualitative data collected, the directed content analysis approach, according to Mayring (2014) has been used. The recorded interview data have been transcribed carefully and *fitted* into a *frame* (measurement model) of predefined categories of capabilities so as to triangulate these against the quantitative calculated levels of strategic fit. The rationale

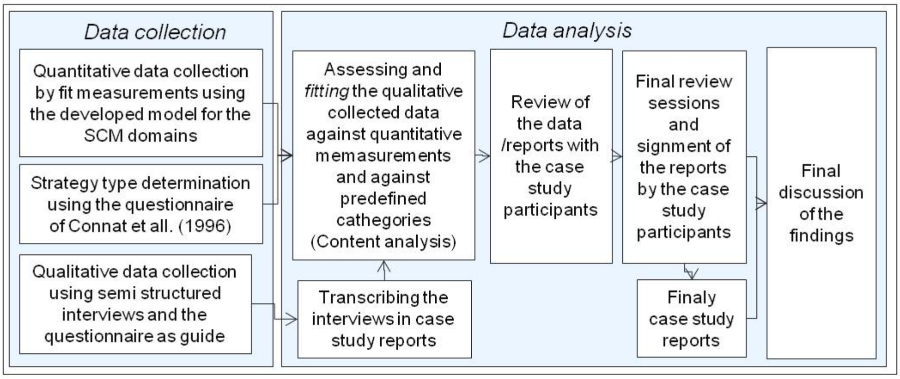

Fig. 5: The case study data collection and analysis process (an author's view)

for the *directed content analysis* approaches due to Hsieh and Shannon (2005, pp. 1281–1283) is based on the complexity of SCM data, as complex SCM processes and their relationship to the research objective was analysed, and terms of SCM are often used differently in individual organisations. Both categorising approaches, according to Mayring (2014), have been adopted. The *inductive category formation* has been used for identifying and weighing new categories and content for developing in-depth findings to the research objectives. The *deductive category application* was used by manually *fitting* interview data meaningful to predefined categories for the reason to prove the measurement model on construct validity and triangulating the qualitative data with the measurements as mentioned above.

3.1 Strategic Fit Assessment and Interim Result

Competitive strategy type assessments: As a first step, the scope of the strategic business areas and the relevant SCM processes to be assessed were determined by joint sessions. Based on that scope, the strategic fit measurement was calibrated using the prepared template. As a second step, the questionnaire of Conant et al. (1990) has been filled out by the senior management for identifying the strategy type according to Miles and Snow. The identified strategy type has been used to determine ideal levels of higher-order SCM capabilities, according to McLaren et al. (2011). The results of the strategy type assessments do not show unique strategy types for all rated business dimensions. It shows the business of company A (Fig. 6) categorised by the leading strategy type Defender and by the second strategy type Protector, which reflect the company's characteristic on a high level.

A hybrid strategy with strong defender focus and strengths in innovation: The questionnaire response was also reflected by the result of the semi-structured interviews, which leads to the following view: the sample organisation shows a predominantly defender strategy type in a stable market position and steady market growth with a strong focus on high-end products, and, therefore with significant strengths in engineering. This prospector position with engineering competency breadth is reflected by the activities for searching business opportunities as an innovator in the market. According to the organisation's engineering strengths, new market opportunities result mostly from innovation offered from a stable customer base. At the same time, along with this prospector/innovator position, the sample organisation shows strong defender strategy characteristics for securing margins and a stable financial position through operational excellence. Because of the stable defender strategic position and the prospector position in engineering that allows screening the market for new opportunities, the product-market focus shows an analyser strategy type. Based on the preparatory steps, the

Tab. 1: Response to strategy type questionnaire of company A (Conant et al., 1990)

Business domain	**Dimension**	**Rated characteristics**	**Strategy type**
Entrepreneurial	Product–market focus	In comparison to competitors, our products are stable in certain markets while innovative in other markets.	Analyser
	Market leadership	In contrast to competitors, we have an image in the marketplace by offering selective products of high quality.	Defender
	Market surveillance	We are continuously monitoring the marketplace.	Prospector
	Market growth	In comparison to competitors, the increase or losses in demand are possible from concentrating more fully on developing our present markets.	Defender
Engineering	Process goals	One of our most important goals is our dedication and commitment to keep costs under control.	Defender
	Competency breadth	Our managers have broad entrepreneurial skills, being flexible, and enable change to be created.	Prospector
	Infrastructure adaptability	The one thing that protects us from competitive failure is that we can do a limited number of things exceptionally well.	Defender
Administrative	Administrative focus	Our management tends to concentrate on a secure financial position through cost and quality control measures.	Defender
	Planning	Our organisation prepares for the future by focusing on problems that, if solved, will maintain and improve our current offerings and market position.	Defender
	Org. structure	In comparison to our competitors, the structure of our organisation is product-market oriented.	Prospector
	Control	Unlike many of our competitors, we use decentralised procedures to evaluate our performance, and many members are involved.	Prospector

strategic fit measurement has been conducted. Initial sessions have shown that the assessment delivered fruitful quantitative results for the rating of capabilities' levels to fit.

Strategic fit assessment: Each relationship between the IS capability provided by the SCM IS and the high-order SC capability needed to support fit has been rated with the following levels: 'high', 'medium', 'low', and 'not relevant'. Besides, support of IS capabilities to fit through SC capabilities of other SCM domains have been considered for assessing second-order effects from such spill-over effects. Original assessment sheets of SC domains using the Euclidean distance method for calculating strategic fit are shown in the Appendix. Besides, rich qualitative information has collected about the contribution of SCM IS capabilities to fit for the different domains and causes and reasons for the IT productivity paradox. Finally, the model itself has been rated using a five-point Likert scale on the appropriateness for measures the degree of strategic fit of a steel firm's SCM IS when considering their competitive strategy.

Strategic fit measurement and analysis of the model: For calculating the strategic fit ratio using the Euclidean distance method, the rated levels have been replaced using the following numeric values: 0 for *'not relevant'*, 1 for *'low'*, 2 for *'medium'*; and 3 for *'high'* levels of support of fit. The means of ideal levels and actual levels of support of fit have been calculated for each combination of IS capability and high-order SCM capability as derived from the assessment sheet and figured out in Tab. 2. The aggregated ideal levels show the significance of the S&OP domain's capabilities to strategic fit. The same procedure has been used for calculating aggregated levels of support by IS capabilities to strategic dimensions according to

Tab. 2: IS capabilities for S&OP support of fit (case study A)

IS capability	Ideal level	Actual level	Fit	Quotation or paraphrased quotation	Paraphrase	Paraphrase category B	Related KPIs
Demand planning	2.3	2.0	1.7	*"One of the most significant spill-over effects of demand prediction is the indirect, but the clear impact on resources balancing for productions of different segments. High levels of visibility in activity integration are the result contributing to smooth operations, SC synchronisation and coordination."* (PA1)	Demand prediction has an impact on well-utilised resources and indirectly on how well the activities are integrated for fulfilling the expected demand.	Enablement: The reached accuracy is a result of high SC modelling and configuration efforts in DP and S&OP.	1. Forecast accuracy 2. Profitability 3. OEE and plant utilisation 4. Delivery adherence 5. Material & resource availability 6. Transportations adherence
Demand review	2.2	1.9	1.7				
Demand alignment with operations	1.9	1.7	2.0				
Real-time visibility of demand changes across SC	2.6	2.1	2.2	*"Increased visibility of demand changes' impact on material flow has improved customer-order due-date adherence, reliability, and improved operational excellence as well."* (PA1)	Increased SC visibility improves operational excellence and delivery adherence.		
SC modelling	2.4	1.7	2.6	*"Simulation capabilities support strategic decisions, pro-activeness, risk mgmt. also, increase SC agility by better decisions."* (PA1)	Capabilities for modelling and simulating different business situations and contradicting objectives are vital drivers.		
Plan simulation	2.4	2.2	1.4				

Venkatraman's (1989a) STROBE measures, as shown in Fig. 2. Finally, the strategic fit indicators that are provided by the IS capabilities of the S&OP domain have been calculated as an aggregated measure of each SC capability. Strategic fit indicator values between 0 and 1 indicate a high level of fitness to the strategy of the measurement capability combination. Levels between 1 and 3 indicate the extent of a misfit. By this approach, the strategic fit has been identified at an overall level and individual levels of IS capabilities' impact onto fit through higher-order SC capabilities.

As shown in Tab. 3, the average ideal level of 3.0 and the actual level of 2.95 for *'business predictability'* underpin the strategic significance of this high-order capability. Most capabilities with an aggregated value for the ideal level above '2' show significance to strategic fit as well. Moreover, the levels show that the core objective of predicting the business for the long-term has fulfilled to a high degree by the implemented IS capabilities. High levels of support of IS capabilities for *'exchanging information'* and *'coordinating related activities'* with customers and internal parties are needed to predict the forecast reliably. Potentials for improvements to fit were identified for demand management regarding *'SC responsiveness'* and *'SC agility'*.

However, the main objective of the S&OP processes is to develop a plan based on known and expected demand, while considering expected constraints in supply, such as downtimes for resource maintenance, so that expected demand can be fulfilled. This main objective is rated with high levels for the capability *'coordination'* through IS capabilities of demand planning, which is indirectly fulfilled to a high degree through spill-over effects on the operations processes of the upstream and downstream domains. These secondary levels are also represented for the SCM capability *'coordination'* by IS capabilities for demand alignment that also have a positive indirect effect on *'operational efficiency'*. Tab. 2 shows the aggregated result of the strategic fit measures from the perspective of the IS capabilities for S&OP which has been derived from the columns *'fit ratio'*, *'average degree of ideal levels'* and *'average degree of actual levels'* of the assessment sheet figured out in the Appendix.

Identified potentials for improvement to fit (misfit): The most significant deviation between ideal and actual levels has identified for *'activity integration'* for aligning forecast with production management. Hence, the analysis shows significant potentials for improvement in *'activity integration'* between involved parties. Demand alignment with production management, procurement and logistics represent a core function of central planning. High levels were rated for demand alignment capabilities for providing the required levels for *'SC responsiveness'* and *'SC agility'*. These requirements were fulfilled to a medium level by the actual

Tab. 3: IS capabilities' contribution to fit from S&OP (case study A)

SC capability	Ideal level	Actual level	Fit	Quotation or paraphrased quotation	Paraphrase (category A)	Paraphrase to category B	KPIs
Business predictability	3.0	2.9	1.0	Business predictability is fulfilled to high-level for the long-term. Predictability on characteristics levels is essential. A significant spill-over effect is the indirect balancing of critical resources, which reduces efforts in coordination.	Prediction on characteristics levels is of high relevance with indirect impact on balancing critical resources among the supply chain.	S&OP capabilities provide business predictability capabilities. The accuracy is reached by high efforts of SC modelling in S&OP.	1. Forecast accuracy 2. Revenue 3. Profitability 4. OEE & plant utilisation 5. Delivery adherence 6. Material and labour availability 7. Transportations adherence
Coordination	2.9	2.8	1.7	High levels of *'information exchange'* and *'coordination'* are needed for demand collection & supply alignment.	Contribution to fit from S&OP relates to a high degree on stakeholders' collaboration for aligning demand and supply.	Collaboration capabilities for demand alignment enabled by control and SC modelling for alignment workflows.	
Information exchange	2.8	2.7	1.7				
Activity integration	2.7	2.3	3.0	Misfit in *'activity integration'* between demand management and production planning.			
Operational efficiency	1.8	1.7	1.0	The indirect impact of DP capabilities on the coordination of manufacturing has a positive effect on *'operational efficiency'*.	S&OP capabilities have a positive impact on operational efficiency.	The second-order effects of S&OP enable high levels of operational efficiency.	
SC responsiveness	2.2	2.0	2.2	Medium levels of support to fit by *'SC responsiveness'* and *'SC agility'* underpin the misfit in activity integration between S&OP & production.	High levels of integration between demand management and production planning provide high levels of SC responsiveness (coverage and enablement by modelling the right levels).		
SC agility	2.2	2.0	2.2				
SC risk mgmt.	2.2	2.1	1.4	Plan simulation helps to analyse options against expected risks by improved visibility.			

capabilities. The potential for improvements in *'SC responsiveness'* and *'SC agility'* from demand alignment underpin the misfit in *'activity integration'* capabilities between demand management and production planning. The identified levels of the misfit in *'activity integration'*, *'SC agility'* indicate that improvements in IS capabilities for optimising, simulating, and visualising plans can help to increase levels of fit between demand management and production management. Fig. 6 shows the impact from levels of a misfit onto SC planning by modelling and simulations capabilities and internal alignment by activity integration, SC agility and SC responsiveness. Moreover, it shows also high levels of a misfit in the visibility of supply chain end-to-end processes. Modern Integrated Business Planning (IBP) solutions can be evaluated for improving the strategic fit of SC visibility and alignment. Such IBP solutions emphasise on the collaboration of stakeholders involved in the overall planning consensus process.

The high levels of a misfit in *activity integration*, *SC responsiveness* and *SC agility* indicate needed improvements in *collaboration* between stakeholders and transparency of the planning process. On the other side, the level '1' of fit in *operational efficiency* shows that the S&OP processes have a very positive impact on the efficient utilisation of the production assets by spill-over effects. The level '2' for *coordination* and *information exchange* and the vast extent of misfit of *activity* integration with the value '3' indicates the need for improving SC visibility and stakeholder collaboration as well. Alignment of changes in customer demand with the available production capacity in the most profitable way is a highly demanding task for all involved parties for optimising contribution margins. Hence, there are remaining potentials for improvements in profit-oriented plan optimisation. Moreover, there were improvement potentials seen for increasing SC transparency by visualising the impact of demand dynamics on production, supply, and Financials, throughout and in time. The assessment shows that the IS capabilities support the sample organisation's business strategy to a high degree through the SC capabilities. The direct impact of IS capabilities to the strategic dimension due to Venkatraman's STROBE measures is visible with significance for *'riskiness'* and *'defensiveness'*.

Strategy type of organisation B: There was a collective sense among the case study participants and the company's managing board about the view of the company being in a

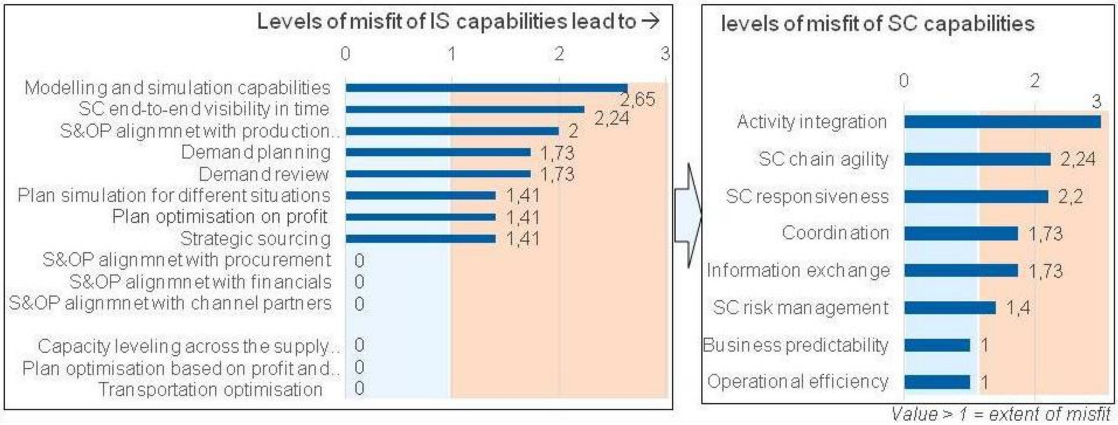

Fig. 6: Levels of SC misfit from IS capabilities for S&OP at company A

strong Defender strategy position with characteristics and behaviour of an Analyser in observing the market for new opportunities for securing the position in a long-term perspective. The response to the questionnaire also reflects this strategic positioning. According to the discussions, the sample organisation has a robust product portfolio but is very active in searching new customers in new geographic markets to sustain the competitive position, which underpins the Analyser characteristics in market surveillance.

The strategic relevance of company B's SCM process and their fit: The processes of the upstream and downstream domain, the S&OP domain, and the Relationship Management domain, have been identified as strategically relevant for securing the company's Defender strategy position through high levels of efficiency and agility. These processes have to provide the necessary conditions for *'SC responsiveness'* and *'SC agility'* by alignment activities and active information exchange with customers. Backlog management has been identified as the backbone process for securing effective asset utilisation and for satisfying strategic customers' demand reliably and with the required profitability at the same time. The backlog management process bases primarily on collaboration between sales and production management and requires underpinning inputs from demand management and relationship management processes for preparing the necessary conditions for effective demand alignment by *information exchange* with customers. Hence, backlog management's effectiveness is, based on high levels of *'activity integration'* between demand management, relationship management, and operations. It helps the company to fill customer orders highly effectively and efficiently by its use of supplying organisational parties. Moreover, these strengths support highly responsive changes in the order backlog such as through very high levels of integration of collaborative activities between involved parties. For that reason, its strength in this core SCM process helps the company to secure the *Defender strategy position* by providing operational excellence in efficiency and agility. Also, the flexibility described in the planning and operations processes allows the company to act in new markets by taking chances on new opportunities based on the existing product portfolio. Based on the maturity of the company's processes, high-levels of fit of IS capabilities for SCM were identified in general. Nevertheless, significant opportunities for improvements were identified for SCM core processes as summarised below.

Improvement potentials from identified levels of a misfit at company B: High potentials of improvement were identified for the SCM *activity integration* within the company's parties, using IS capabilities of *demand management* and production/inventory management. The same levels of improvement were identified for *activity integration* with external channel partners, such as the parent company for managing raw material supply. Moreover, further opportunities have been identified about *operational efficiency* and *flexibility* of internal and external transportation management activities. Because active and efficient backlog management with high levels of integration among the parties involved' has been identified as core strength, improvements were estimated instead from predecessor processes such as demand management, since demand is managed manually. For this reason, support by Integrated Business Planning (IBP) capabilities promises to support the operational backlog management process without losing flexibility. Moreover, the assessment shows that increased transparency of SC optimisation potentials can support SC integration, SC risk management and operational excellence.

4 FINDINGS AND DISCUSSION

4.1 Commonalities and Contrasts of the Assessed Business Models

Context-specific profiles of IS capabilities and levels of support needed to strategic fit: For both companies, the actual implemented and ideal levels of SCM IS capabilities to support strategic fit of their SC business models were identified considering context-specific implications. Moreover, levels of a misfit from SC integration and antecedent capabilities have been calculated that expresses the impact onto business strategy. A holistic picture of SCM IS strategic fit from IS capabilities' effect on process levels and second-order effects within and across SC domains has been yielded from triangulating the calculated figures with the qualitative extracted information. The strategic fit assessments provide the companies with a solid basis for defining qualified and focused action plans.

High visibility of contrasting key priorities in SC capabilities for SCM: Due to the polar type sample selection, valuable contrasting information has been found and can make visible such as crucial differences in the companies' strategic positioning and the impact on the differentiation of there is capabilities for SCM. For instance, where spillover effects from SC planning to SC operations processes are very important for company A's strategy adoption, spill-over effects from relationship management to SC operations are vital enablers for company B's strategic strengths as highlighted in Fig. 7. Hence, operational excellence of company B is based to a significant extent on *second-order effects* of proper relationship management providing high levels of flexibility. The participants expect significant effort reduction in the coordination of operational processes from enhanced collaboration capabilities by modern IBP solutions in the future. Interestingly, the highly innovative company A needs more demanding planning capabilities in comparison to the low-end company. This finding rebuts the assumption of McLaren et al. (2011) that companies showing *Defender* strategy type characteristics need a higher level of support to fit from planning capabilities as companies related to an *Innovator* strategy type. Fig. 7 highlights the companies' second-order effects.

1. High levels of support of fit of high-order SCM capability *'coordination'* indirectly by high levels of *'IS capabilities for S&OP'* at sample company A.
2. High levels of support to fit of *'coordination'* indirectly by high levels from *'IS capabilities for relationship management'* at sample company B.

Differences in second-order effects through IS capabilities' spill-over effects: The case study at company A affirms the assumption that steel companies in the high-end sector, such as automotive suppliers have very complex SCM processes, particularly in SC planning. On the one hand, they need to deal with variant configuration throughout their planning and operations processes in the same way as Engineering-to-Order (ETO) producers in the

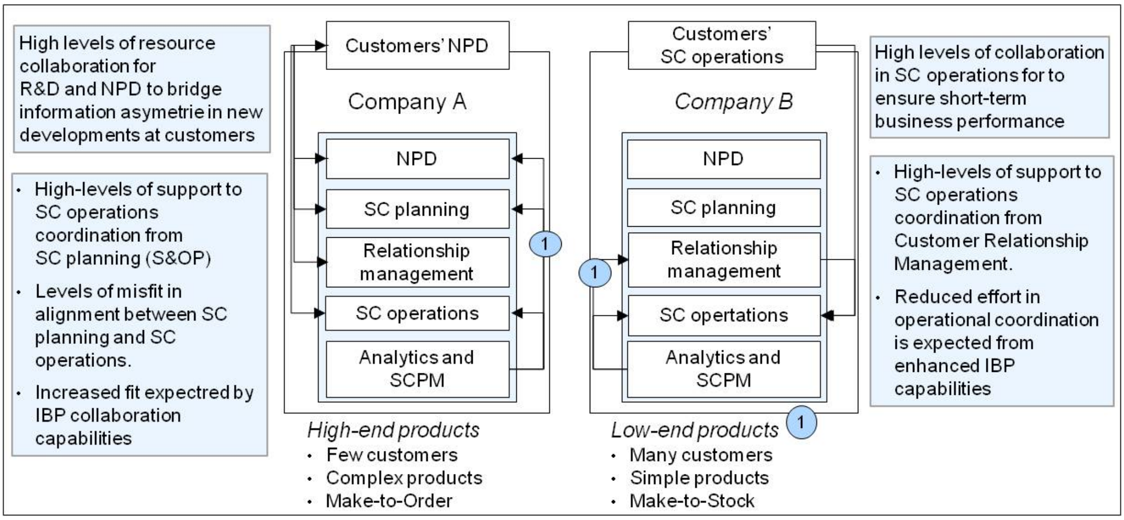

Fig. 7: Strategic support from second-order effects of IS capabilities across the supply chain

discrete manufacturing industry. On the other hand, they have the same logistics and SCM requirements as the process industry in managing their production flow. To find the optimal plan needs demanding SC planning capabilities such as characteristic based demand planning capabilities for modelling different levels of profit contributions by different customers for the same product. Such information can be considered by S&OP optimiser solutions to create master plans that prefer profitable orders for allocation at available finite resource capacity. However, the planned profitability needs to be realised by operational excellence. Hence, high levels of support to operational excellence are required from SC capabilities such as *resource collaboration* and *coordination* of upstream and downstream processes, which are implied from antecedents of NPD and the S&OP domain. High levels of operational excellence have been identified at company B based on second-order effects from high levels of *operational collaboration* with customers. Hence, high levels of support to fit by *upstream and downstream coordination* are implied by the capabilities of relationship management. The participants expect reduced efforts in *operational coordination* from enhanced S&OP capabilities. Interestingly, the highly innovative company A needs more demanding planning capabilities in comparison to the low-end company. This finding rebuts the assumption of McLaren et al. (2011) that companies showing Defender strategy type characteristics need a higher level of support to fit from planning capabilities as companies related to an Innovator strategy type.

Relationship capital as a DC: Collaborative NPD using engineers positioned at the customers as Key Accounts pro-vide company A with relationship capital as an absorptive capacity, which provides insights on further demand and developments and enables to identify business opportunities by vertical forward integration. Collaborative knowledge management and knowledge assimilation act as antecedents of developed DC relationship capital, which enables company A to moderate the business functions innovation management, NPD and SC planning due to business needs. Company A's strengths in SC planning and simulations act as antecedents for moderating operational excellence providing fast, useful plan alternatives. Company B's relationship capital provides degrees of freedom in fulfilling promised service levels on an exceptional basis, and, therefore, acts as an absorptive capacity enable to re-plan and synchronise operational order volumes to deal with unforeseen events in a profitable way.

4.2 Assessment of the Strategic Fit Measurement Model

Findings of the model test and review of the applicability: The model's appropriateness to measure the degree of fit of steel firms' SCM IS in a concise way was rated by all the participants between *'fits'* and *'fits very well'* as an average of a five-point Likert scale as shown in Tab. 4.

The approach of rating 'actual levels' against ideal levels of IS capabilities for SCM has been approved as very useful for evaluating the fit of an SCM IS to a prevailing strategy in detail. Increased transparency of needed levels of IS capabilities' support to fit across end-to-end processes has been particularly useful valued, which can be identified using the model and were regarded by the participants for the following:

1. *Transparency of improvement potentials* – the strategic fit assessment can point out potentials where SCM capabilities can be better utilised or where constraints at specific points prevent the optimal utilisation of the whole supply chain (TOC analysis).

2. *Balanced IS investments based on increased transparency* – uncontrolled placed IT investments result in a lack of clarity as to whether prerequisites from predecessor processes are given, which are required for exhausting the given advantages. Because it is difficult for big companies to reach transparency throughout the supply chain to support the strategy on the right level, the model has been rated as a best practice for SCM IS alignment in the steel industry and for large-scale enterprises in general.

3. *Comparison of the capability approach and KPI measurements* – benchmarking using KPIs helps to improve the business processes continuously, but it will not help to align the business and IS systems to future requirements. The capability approach, therefore, is more oriented toward the future, for showing structural problems in the business model, and where they can arise in cases of strategy refinements.

4. *Secondary levels of support of fit through spill-over effects* – the ability to highlight the essential relationships across SCM domains by assessing IS capabilities' levels of indirect support for business processes of other SCM domains has been rated as particularly useful. This feature helps to increase the transparency of where a business performance from given IS investment is exhausted in the supply chain. Hence, the present study's model helps to assess second-order effects in supply chains caused by spillover effects, which help for TOC analysis across domains and on IS architecture level.

5. *Contribution to organisational learning* – The development of a common understanding of the actual situation of fit across all domains and a shared awareness about overall business objectives and the effects of one's own efforts to achieve these is seen as very valuable among the stakeholders involved. Hence, the model has been rated as very valuable and is seen as a best practice for strategic fit assessment of SCM IS.

4.3 Assessment of the Capability Concept and Strategy Type Schema

The field experts rate the capability concept and the capability content used by the different levels as very reasonable and coherent for investigating their impact on strategic fit (1) at the strategic level; (2) at the level of higher-order SC capabilities; and (3) at the specific level of IS capabilities. Because of the growing volatility of business conditions in the steel industry, the experts see the high-order capabilities *SC agility* and *SC responsiveness* as a moderator between business strategy and IS capabilities as particularly important. Furthermore, they agree on the importance of capabilities such as *coordination*, *activity integration*, and *resource collaboration* as drivers for SC integration. The domain shape has been assessed as very useful for investigating SCM IS impact from an SCM cross-domain perspective. The structure of the model has been rated as flexible and generic

Tab. 4: Validation result of the strategic fit measurement model assessment

Criteria	Fit	Quotation or paraphrased quotation (extraction) to validation criteria
To the sample company	Fits very well	The model has been rated as very valuable for identifying levels of a fit/misfit on an aggregation level for informing senior management and on an individual level for creating plans of action. It has been rated as very useful for balancing capabilities of end-to-end processes across supply networks to avoid ineffective IS investment and to increase the speed to fit by focused alignment efforts. It enables to develop reference capability patterns for different product segments and for different business situations to increase agility.
Eligibility to assess the strategic fit	Fits very well	The model fulfils requirements to assess the fit of steel companies' SCM IS very good, particularly at different levels, in levering processes of different domains. Different priorities can be considered for processes, capabilities, and domains.
The fit of the assessment procedure	Fits	The two-step approach has been rated as valuable for identifying areas of strategic relevance in a first step, and for defining the required level of detail to assess the fit of SCM IS. Also, to assess fit in a second step. The procedure seems very useful for scoping activities, and for supporting EAM cycles and due diligence activities.
Profile deviation approach	Fits	The profile deviation approach has been rated as valuable for benchmarking actual levels against ideal levels. Also, it has been rated as valuable for rating 'actual levels' of fit against target levels of transition stages/architectures.
Capability versus KPI approach	Fits	In comparison to KPI measurements, the capability approach has been rated as highly valuable and more appropriate to evaluate the fit of levels that reflect future business strategies. KPI measures can remain the same after a change in processes, but the capabilities can be different for reaching the KPIs after a strategic change.
Organisational learning	Fits	The model's application can develop a collective view of the participants needed levels to support fit and the overall objectives for improving the awareness of members' contributions to performance. So can create, therefore an aligned flux of action.
SCM domain structure	Fits	The ability to assess indirect effects of IS capabilities help to increase transparency on where in the supply chain given IS investments are exhausted. Priorities and relationships between capabilities and processes of different domains can be well identified and assessed.
Performance drivers	Fits	The model helps to identify critical drivers of SC performance. The assessment can deliver valuable information on IS capabilities' contribution to SC performance key driver.
Usability of the model	Fits	The usability of the model has been rated as easy to use. However, a common understanding of the SCM capabilities' meaning is needed.
The generality of the model	Fits	The model's construct has been rated as highly adaptable to firms in other industries as a high degree of generality has been established. However, the IS capability content needs to be adjusted to the prevailing industry needs.
Key points need to be considered	Fits	The interpretation of the capability levels (low, medium, and high) depends on the organisation's individual strategic needs. For assessing the fit of cross-organisational end-to-end processes, it is suggested to rely on levels such as process throughput.
Missing aspects	Fits	The model focuses on the measurement of fit and misfit, and, therefore, on scoping of alignment requirements. There is no aspect missing.

for companies in other industries to adopt it for measuring SCM IS's fit the strategy. Hence, it has been thought as reasonable by the involved experts to establish and maintain a repository for sector-specific measurement templates. The model has been rated as valuable for informing senior management as it provides a quick overview of the right balance between strategy and a company's SC model, and critical gaps. There is a shared view among the participants that, in comparison to KPI measurements, the capability approach helps to identify structural strengths and gaps in firms' SCM models and provides information about how to address these gaps. Hence, the strategic-fit measurement model has been rated as very valuable to provide transparency of firms' capability patterns.

Strategy types and capability pattern of steel companies: From their professional experience in the steel industry, the experts at SAP faced a mix of different strategic characteristics and requirements with a focus on the defender strategy type according to the Miles and Snow archetypes. However, at the same companies, there are also, in most cases, products and areas of high innovation. They conclude that steel companies show, by their product segments, a trend in two types of strategic orientation:

1. *'high-end products'* such as those for automotive customers, which relates to the Miles and Snow strategy archetype Innovator; and
2. *'low-end products'* such as those for the construction industry, which relates to the Miles and Snow strategy archetype Defender.

The strategy categorisation approach is rated as very useful for identifying areas with a significant deviation from the leading business strategies. Reference capability patterns can help companies to transform strategic changes to business and IS infrastructure more quickly, and, provide enhanced transparency of the capability levels needed for target architectures. Such artefacts can also support activities for harmonising, adopting and scaling of steel companies' SCM models as part of M&A projects. These findings provide evidence of the contribution to the development of DC and absorptive capacity provided by maintaining capability patterns.

Comparing predefined levels to fit of previous research against levels from the case studies: McLaren et al. (2011) identified five generic SCM capabilities (*operational efficiency*, *operational flexibility*, *planning*, *internal analysis*, and *external analysis*) with ideal levels (McLaren et al., 2011, p. 918) of support of fit in reference to Miles and Snow strategy archetypes. They compared actual levels identified by strategic fit assessments against these predefined levels. By comparison, the present study identified the actual levels and the ideal levels for each capability separately. For assessing the classification scheme of McLaren et al., ideal levels predefined to generic SC capabilities were compared with ideal levels of present assessed SC capabilities that refer to the former in a highest possible accurate way as presented in Fig. 8. As the strategy type identified by the questionnaire survey shows a hybrid with a stable Defender position and significant Prospector strengths, the ideal levels of both strategy archetypes are shown as reference levels for the five generic SC capabilities.

Context dominates levels of fit by IS capabilities for SCM: The review shows high deviation between ideal-levels of the five generic capabilities identified by previous research and the ideal levels of the present study's capabilities; for example, medium levels of *'operational efficiency'* of the present study A being compared to high levels from previous research for both the Defender and the Prospector strategy characteristics. The result of this comparison affirms the assumption of the present study that ideal levels identified by previous research are not suitable as reference levels for determining the fit of the steel company in the accuracy required to express needed context-specific levels to fit. The review of the classification scheme using data from case study B strengthens this finding with more evidence.

The average ideal levels identified for all SC domains in case study B show a high correlation with the ideal levels identified by McLaren et al.'s previous research. However, there are high variations in ideal levels for the same SC capabilities of different SC domains that lead to a core finding as follows.

Core finding to SCM IS fit measurement a businesses' strategy types: For aligning a firm's SC operating model onto the business strategy, ideal levels of SC capabilities' support to strategic fit need to be identified according to the company's individual needs rather than to use predefined ideal levels of reference strategy

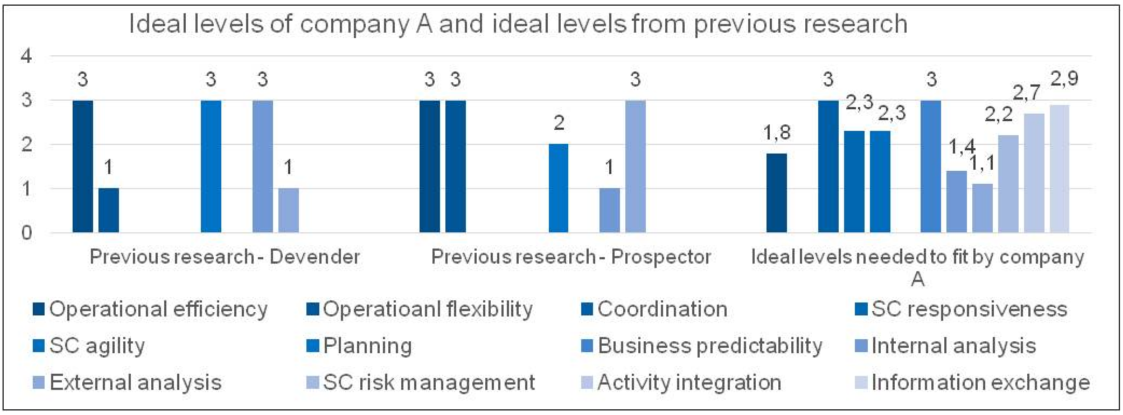

Fig. 8: Comparing ideal levels of company A with predefined ideal level by McLaren et al. (2011)

types. Moreover, for identifying ideal levels of support for companies' SCM IS's fit, it is essential to investigate antecedent capabilities of SC integration such as *SC agility*, *SC responsiveness*, and *activity-integration* to consider appropriately business conditions steel companies are facing. Finally, ideal levels of support to fit by high-order SC capabilities from IS capability need to be investigated separately for each SCM domain to consider *first-order* effects and *second-order* effects across the supply chain appropriately.

4.4 Causes and Reasons for the IT Productivity Paradox

The declining contribution of IT to productivity growth: The steady growth of IT spending over the last three decades reflects the tenet of technology-enhanced productivity. However, the evidence suggested that IT's contribution to growth in productivity has been declining since 2001 (e.g. Zukis et al., 2008). The phenomenon of the gap between projected and realised performance is referred to as the *'IT productivity paradox'* by researchers such as Brynjolfsson (1993) and Pinsonneault and Rivard (1998). There are several explanations such as by Brynjolfsson (1993, pp. 67–75): (1) *miss-measurement*, (2) *redistribution*–there are profits, but they come at the expense of others, leaving little net gain, (3) *time lags*, and (4) *mismanagement*–there are no gains because of the unusual difficulties in managing IT or information. A primary objective of research into the phenomenon of the IS productivity paradox is to improve the balance of investments in IS and the exploited business value concerning the company's competitive advantage (Bashiri et al., 2010, p. 2). Hence, the causes and reasons for the IT productivity paradox have been explored for the steel industry, using the qualitative case study at SAP and the industrial case studies. The phenomenon has been explored from the perspective of more transparency in the contribution of IS investments in strategic fit.

Leading causes of the phenomenon in the sample industry: Based on the observation from customer projects in the global steel industry, the experts at SAP for SCM and business transformations stated that *'quick wins'* were made fast by SCM implementations in the early 80s and 90s but win behind these *'low hanging fruits'* are highly dependent on integration aspects of the SCM processes to the organisational environment. Finally, *'talent management'* has been identified as a core challenge for mastering the complexity of steel companies SC processes. The following top issues were identified:

1. *insufficient alignment of SC objectives* in multiple tier supply chain networks;
2. *insufficient SC modelling* use for dealing with supply chain complexity;
3. *insufficient SC integration and end-to-end visibility* caused by heterogeneous SCM IS;

4. *lack of project governance* as a reason for SCM implementations' misfit.

Alignment effectiveness by a focus on value management: One of the main reasons for insufficient alignment results are fragmented IS landscapes as a result of M&A and too small scopes of IS implementations. Different IS systems have not only an impact on increased TCO but, more important, they have different approaches to address the business needs and for reaching the objectives. This phenomenon can be addressed by increased IT budgets' proportion released for innovation at the same time, while IT complexity must be managed out and focus needs to be set on business value creation. The technology can address drivers and inhibitors of IT value by impacting innovation and complexity and inflexibility. For example, software as a service (SaaS) and Cloud solutions allow users to *'pay for usage'* and significantly reduce the capital wasted in supporting software and hardware. By managing in favour of innovation and against complexity, companies can once again drive value through IT spending. The following high-level priorities are suggested to drive IT value contribution to organisations:

1. *Prioritise IT value management* to create differentiated business value by focusing simultaneously on IT costs and – primarily – on sources of competitive advantage.

2. *Management out of complexity* allows the reallocation of funds and higher levels of IT productivity for innovation by identifying cases of a misfit on all IS levels.

3. *'Management in' of innovation* – the use of IT for creating innovation most effectively may be the best to generate sustainable value from IT spending. Emerging digitalisation technology provides new sources of IS innovation, and Enterprise Architecture Management (EAM) provides a methodology for adopting the value in time (Ross, 2006).

4.5 The Impact of Business Model Types onto SC Dynamics

Market-oriented versus sales-driven businesses have been identified as main differentiators regarding who is driving the SC processes and how the SC dynamics is characterised. According to the interviewees, sales-driven businesses are able to adapt their SC model fast to new requirements from the market. In such businesses, sales can determine the portfolio and the forecast, whereas the production units have to follow and fulfil. Marketing-oriented business – where the steel companies belong to – need a taller horizon to plan and achieve their business as they often cannot adapt their SC models in the short-term. Hence, they need sophisticated planning capabilities to be able to make the best of each business situation that will come with the available resources by considering contradicting objectives of the stakeholders. These are such as high plant utilisation that is wished by plant managers but also prioritised order fulfilment for strategic customers that is wished by sales managers, and the senior management focuses on the overall profitability. Due to these findings, the present study draws on the view combining Miles and Snow archetypes with the *marketing-oriented* and *sales-driven* view for categorising companies and their segments regarding their needs in SC dynamics and SC modelling. The x-axis in Fig. 9 shows increasing SC dynamics based on adoption activities such as scaling out business models, while the y-axis shows increasing SC complexity from innovations and differentiation.

Balancing market-grow and market-share using product portfolio analysis: The Portfolio Analysis provides practitioners with a well-recognised concept for balancing fit of a company's portfolio regarding the dimensions market growth and market share. It provides information such as the proportion of products with a high market share but a low growth rate those come to the end of their life-cycle and need to be replaced by innovations. This approach shows which products are at the end of their life-cycle and needs to be

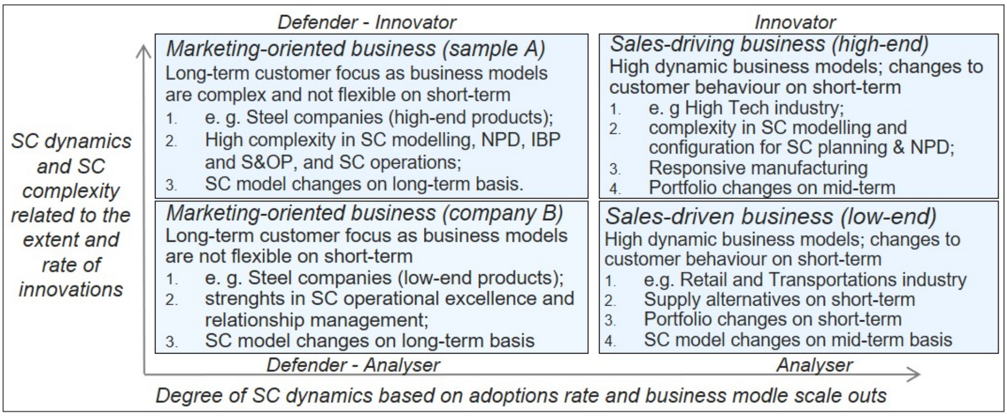

Fig. 9: Market-oriented vs. sales-driven business and the impact on SC dynamics (an author's view)

replaced by innovations. Hence, the portfolio analysis provides a valuable tool for identifying areas of innovations and for deriving focused development of DC for SCM that promises significant value potentials.

Ambidexterity–dynamic-capability for balancing exploration and exploitation: Ambidexterity refers to managing the inherent conflicts from explorative variability creation and exploitative variability reduction process on multi-levels of organisations (Bledow et al., 2009). Hence, it refers to a company's ability to balance exploration activities and exploitation activities in a way to optimally acquire and assimilate new knowledge that can be exploited in innovations and will result ultimately in business performance. *Ambidexterity* refers in this context to the balance between absorptive capacity acquisition and business performance exploitation, whereas balance needs to consider structural, contextual, domain and organisational dimensions. In this regard, an organisation's Portfolio Management (PM) and Innovation Management such as New Product Management (NPD) and Research and Development (R&D) need to collaborate in a closed way to sustain revenue and with balanced innovation for a consistent value stream. A company's core strengths and capabilities determine the portfolio with a focus on high-end products in case of *Innovator* business model characteristics and focus on low-end products for the *Defender* strategy type. According to the case study findings, the extent of *Marketing-based* versus *sales-driven* business has a significant impact on the short-term and mid-term agility for changing resource capacity and capabilities.

SC differentiation using customer and product segmentation: The modelling of capability-patterns as yielded from the strategic fit analysis have been estimated as very useful for expressing needed levels for SC differentiation that can be used for IS configuration per companies' product segments. Based on this finding, a company's customer/product segments can be enhanced by the capability approach by dimensions and characteristics useful for describing SC strategy and SC differentiation. By this approach, the model combines information that needs to be interpreted together for reaching coherence between portfolio strategy, marketing strategy and supply chain strategy and differentiating criteria. The SC strategy can be presented for each product segment by capability-pattern describing the requirements and characteristics of architectural artefacts needed for SC differentiation.

The impact of SC dynamics on SC complexity and SC performance: According to the SCM experts' experience, the complexity implied in SCM IS has been often the primary concern of companies against the implementation of these solutions. When systems settings were made in one place in the SCM IS to align processes, side-effects on other places within SCM processes are often not predictable. The complexity of supply

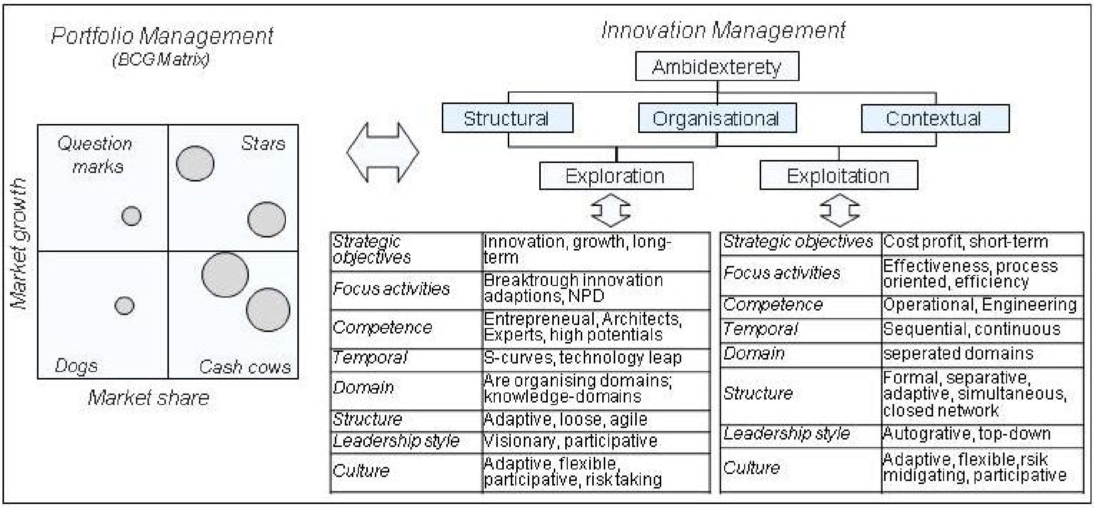

Fig. 10: Ambidexterity: balancing exploration and exploitation (an author's view)

chains and SCM IS implementations often cannot be handled. Moreover, SCM processes are often highly automated and balanced against the known business situation but failed in cases when things change. Therefore, configurations of SCM IS are often not robust against a massive change in business conditions. Another aspect the experts observed is that physical resources of steel companies' supply chains are often not balanced against the actual business requirements. When a bottleneck resource needs to be utilised to their available capacity to fulfil customers demand, often SCM IS systems could not help to get feasible and consistent planning results. For that reason, the experts estimated SC design and SC modelling as the most significant practices for dealing with the SC dynamic and SC complexity that steel companies are facing. Mainly, balance long-term business objectives against short-term order fulfilment in a way to maximise sales-profit and utilise resources effectively but to avoid extensive stock-inventory presents a key challenge. Fig. 12 shows the main processes that need to be mastered in a steel company's supply chain to reach business objectives. The targets are partly conflicting, but highly related to each other, so that interdependencies are complex to predict in the case of changing business conditions.

Key trends that contribute to increasing SC complexity: The individual characteristics of steel companies' products and the production capabilities have a direct impact on SC complexity. As a result, there is a high interdependency between planning processes and sales of products and the manufacturing of the individual product. Hence, the following key trends have been identified that contribute to increasing SC complexity at steel companies:

1. outsourcing of manufacturing and globalisation of operations;
2. demanding customers and shorter lead times and special delivery requirements;
3. more use of managed inventory programs– vendor managed inventory (VMI);
4. increase in numbers of customised products.

These industry trends have a direct impact on SC design and on the question of how to optimally plan elements such as sales items, facilities and locations, customers and suppliers. In dealing with the wide variety of resulting requirements, planning in varying granularity is practised. These covers high-levels of aggregation at the long-term planning level and high levels of detail on the planning and fulfilment level of individual pieces and orders that need to be synchronised in a detailed and continuous manner. According to the case study findings, in today's typical SCM set-up, the processes are mostly covered by different IS applications that are connected by interfaces. As a consequence, the existing setup of IS applications does cover the company's business from a local point of view. However, the sum of all the local best results is mostly not the best overall possible, as existing information in neighbouring areas cannot leverage based on missing transparency throughout the supply chain processes. The experts see the transformation of such IT brownfield landscapes into new SCM IS as the most critical challenges of steel companies for optimising their overall business objectives. For that reason, SCM IS has to provide modelling capabilities to design integrated feasible plans meeting profitability and other criteria according to corporate objectives. Hence, SC modelling and visualisation capabilities are essential for mastering these objectives in a dynamic environment.

Vital capabilities for mastering SC dynamics: Comprehensive IS capabilities have been identified in the SAP case study and integrated into the measurement model that has been applied to the industrial case studies. For orchestrating the IS capabilities of steel companies' SCM processes so as to moderate SC performance and antecedent SCM capabilities regarding SC dynamics, the following key capabilities have been identified by the present study:

1. SC planning and optimisation capabilities;
2. SC simulation and visualisation capabilities; and
3. SC design and SC modelling capabilities.

Reducing SC complexity: Constraints and sensitivity to business conditions in SC planning and execution scenarios make SCM in steel companies a highly sophisticated task. For this reason, simulation capabilities have been estimated to be a high priority for dealing with SCM complexity. Moreover, participants have rated simulation capabilities as very useful for managing SC dynamics by preparing plans for different situations in advance. SC modelling and SC simulation capabilities have been identified for managing both low-end products and high-end simultaneously and dynamically. Hence, the experts see the approach of creating capability patterns as architectural artefacts as very useful to drive fast re-modelling of supply chains, responsive to changing business conditions. Fig. 11 illustrates how capability patterns can support SCM processes that need to be balanced to reach business objectives. Moreover, predefined capability patterns can contribute to more transparency o SC processes and can help to develop alternative SCM scenarios to respond faster to changes.

The impact of SC moderating capabilities on SC performance: The findings of the present study on moderating SCM capabilities are in line with the process industry's SC problems identified by Shaw et al. (2005) such as in SC network design, SC simulation, and SC planning (Liu, 2011, p. 21; Shaw et al., 2005). Moreover, Papageorgiou (2009) divided the process industry's key capabilities into SCM in SC design, SC planning and scheduling, and supply control (Liu, 2011, p. 21; Papageogriou, 2009). The impact of changes which influence factors such as environmental ones needs to be moderated by *'SC performance'* antecedent capabilities that are orchestrated by *'IS capabilities for SCM'*.

4.6 Dynamic Capability Management using the Study's Concept

DC from architectural artefacts from for moderating fit of SCM IS: The model has been estimated as very useful to determine new levels required for SC capabilities and IS capabilities when the company's business strategy needs to be adjusted to new market conditions. This finding shows the value of the concept for predeveloping capability pattern as architectural artefacts the act as absorptive capacity and can be exploited in business performance by an IS Governance cycle by moderating fast alignment of SCM IS capabilities to changing environmental conditions. Business Model stress tests according to Haaker et al. (2017) can provide a systematic analysis of BM components' robustness in different future situations and environments and enables to identify sources of dynamic capabilities for SCM IS. Business Model Canvas methods and SWAT and PESTE

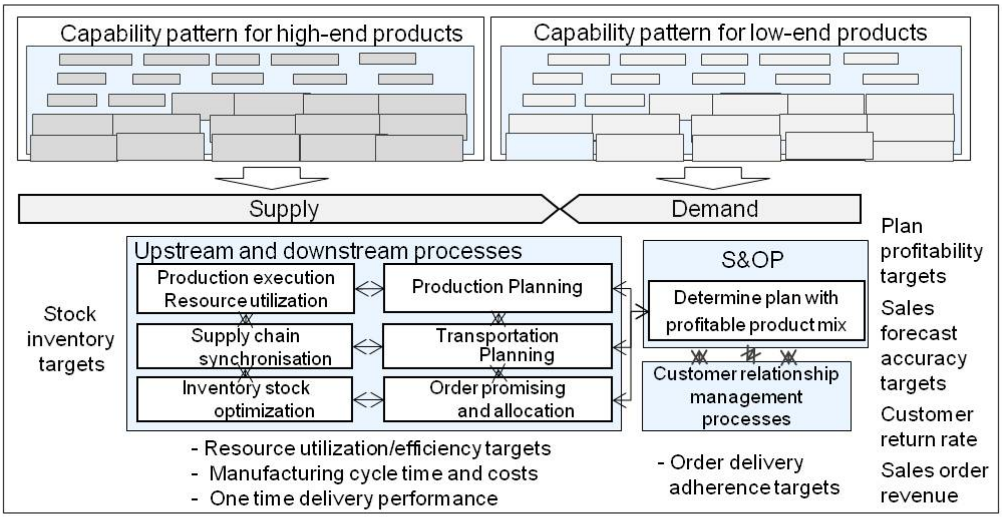

Fig. 11: Supporting SC dynamics using capability-patterns (an author's view)

analysis can help to identify and predict further states with a high probability of occurrence and significant impact on BM components and IS capability for SCM. Digital Twins and simulation and optimisation methods of SCM IS helps to redefine the actual required technical and organisational configurations figured out by the artefacts. Before developing the artefacts, the Return on Investment (ROI) can be calculated using the discounted cash flow (DCF) method to balance the expected business value against the Total Cost of Ownership (TCO) that reflect all initial and ongoing cost related to an IS investment (Kirwin and Mieritz, 2003). Fig. 13 shows how the model can be applied in an Enterprise Architecture Management (EAM) cycle. The right side of the cycle shows the artefact development that refers to DC exploration and the left side highlights the IS implementation that refers to exploiting business performance from the materialised DC/absorptive capacity. In referring to Raisch et al. (2009), the model enables exploration and exploitation of DC in an ambidexterity way for the dimensions *domain*, *organisational*, *context* and the *timely* and *situational*, where the degree of integration between relates to the extent of the dynamics the organisational units face.

Due to the proven procedure, the strategic alignment model needs to be calibrated. Therefore, a two-stage review is to recommend using the first step to identify areas that need further in-depth analysis in a second step. The areas of misfit and their types of misfit such as functionality, data, role, control, usability and organisational needs to be identified, analysed and documented as input for developing artefacts. Moreover, for addressing the needed actions to close the technical and organisational gaps in SC interoperability required to support SC integration at the level required for strategic fit. In referring to Strong and Volkoff (2010, pp. 747–749), misfit can be addressed by *coverage*, which relates to functionality and features provided by SCM IS, and it can be addressed by *'enablement'* through context-specific SCM IS modelling and configuration of the application and data. This differentiation is seen as very important as the ability to deal with the complexity in SCM in a simplified way relates to a significant extent on SC modelling and secondly on technical features of purchased IS solutions.

Organisational learning mechanisms: All learning stages that are crucial for enhancing organisations' competitiveness such as structural, cultural, psychological and policy mechanisms (Knoppen et al., 2015, pp. 544–550) are seen supported by the present IS Governance approach. Moreover, the evidence for organisa-

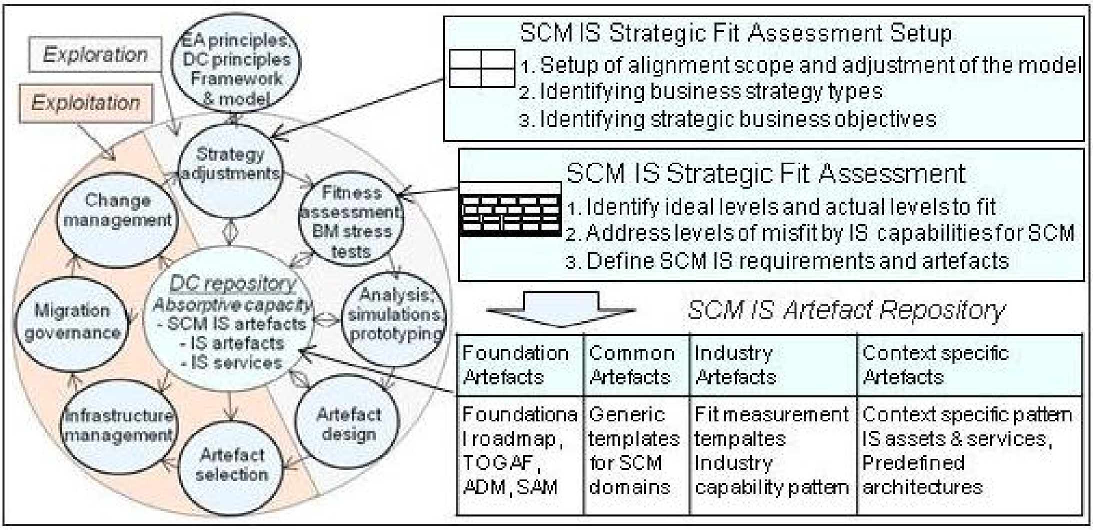

Fig. 12: The SCM IS dynamic alignment methodology (an author's view, encasing TOGAF)

tional learning is seen by sensemaking effects according to Weick et al. (2005) at applying the model, such as arriving at a common understanding of SCM IS capabilities effects and their use for directed actions with clear, prioritised objectives. The approach supports deutero learning by providing the participants with the big picture of where their efforts have an impact on business objectives and by their continuous reflection of developed artefacts and routines, which develops and align their cognitive profiles as well.

4.7 Dynamic Capabilities of Digital Business Models

Trusted collaboration in SC ecosystems by a Blockchain approach: A blockchain, as a shared, ledger technology, improves business network efficiency by the increased visibility of business transactions to all members of an ecosystem. The key benefits are significantly reduced settlement time and overhead costs and reduced risks of collusion and tampering because of full transparency to all actors. Hence, the system inherent fraud prevention and reduced integration complexity that results in increasing efficiency. The Internet of Things (IoT) and the Blockchain technologies offer new ways to do business even in complex supply chains (Armstrong, 2016). Internet-capable sensors capture granular real-time data about products and logistic events with timestamps at different locations throughout the supply chain. Hence, the blockchain technology can support trusted collaboration in digital SC ecosystems by capabilities such as real-time transfer of control data and 'digital assets' and Smart Contracts for system-enforced inter-company business-rules for the process autonomy. Neutral collaboration platforms for shared business data and business logic enable new business models with trusted scenarios for multiple parties, which led to the following benefits:

1. cost reduction and risk minimisation of automation scenarios;
2. secure and reliable tracking of SC events and fraud reduction by increased transparency;
3. increased real-time SC visibility within ecosystems and consistent progress information;
4. real-time ad-hoc processing of exceptions using machine-learning capabilities.

4.7.1 Platform and Data-Driven Business Models

Platform-driven business model–outside in innovations: Digital business models are characterised by innovations in the value chains and their transformation to the cross-industry digital ecosystem. Platforms are used for connecting intelligent products and driving processes personalised to user/customer through data-driven and dynamically configured smart services. Moreover, service platforms enable modular orchestration of value chains through the dynamic configuration of digital and physical services. Big data technology allows data collection across various technical and physical domains (e.g. Energy sector, traffic, and whether to name a few) and from different social and business contexts (e.g. consumer behaviour and perceptions, demographics). Such cross-context data seems useful for analysing demand patterns and analogies across markets and provides enhanced capabilities for searching network effects and scaling effects in the markets. Moreover, new sources of value are searched from collaborative business models enabled by Platform technology as they support the orchestration of entire ecosystems of interconnected customers, producers, service providers and suppliers. Initiatives such as industry 4.0 enable companies to create ecosystems with enhanced collaboration capabilities allowing new business strategies as ecosystem partners can commonly share services and can complement resources and processes in a highly integrated and autonomous way.

Rules and value enablers of platform-driven business models: Among the most important rules for designing and optimising platform business models belong (1) *network effects*, (2) *distribution power law* and (3) *asymmetric competition* for providing different ways to grow (Daugherty et al., 2016). Digital business models that are developed based on these rules can scale exponentially, and, can complement existing traditional business models. *A distribution power law* relates to scalable platform business that allows others to generate profits in a way avoiding diminishing returns that would be related to traditional value chains (Daugherty et al., 2016).

Network effects and macroeconomic impact of platform business models: Network effects come from products that are attractive to users and from *interoperability capabilities* rather than from scale effects of the organisations' quantitative size. While the economy of scale in SCM typically are realised on the supply side, network effects arise primarily on the demand side. The concept of *network effects* has been popularised by Metcalfe (a co-inventor of the Ethernet). Metcalfe's law state that *"the cost of an IT network was directly proportional to the number of network cards installed, but the value of the network was proportional to the square of the number of users (cost of N results in a value of N^2)."* The actual numbers of this proposition are not affirmed so far, but, the stated positive and negative effects of the concept are indisputable. IoT Platforms provide the infrastructure to create intellectual property and to offer the right to use it to other users by earning income from it. Finally, platforms provide the infrastructure to transfer digital goods to others and to enforce property rights. Demand-side economies-of-scale focuses on network effects of two-sided markets, where value creation is enabled by platform ecosystems incorporating stakeholders such as customers, partners, producers, retailers, transportations, service providers and others. (Daugherty et al., 2016). Tab. 1 contrasts significant differences in traditional business models and platform-based business models.

Asset-light business models: A core trend of the digital transformations is a move from *asset-heavy* to *asset-light* business models, where intangible assets create value. The advantages of these are growth with reduced risks through shared investments with others. Companies without tangible assets seem at first sight as not solidly based, but, the market power seems to distribute opposing to this assumption, which can be observed by companies such as Amazon and Google. Market platforms are successful in *asset-light* business models. All types of *outsourcing* physical production to other companies such as by *sub-contracting*, where the intellectual property is protected or is not a source of differentiation can be seen as asset-light business models (Kachaner and Whybrew, 2014). Finally, *product-to-service-transformation* such as the transition from computer selling to offering services like IT

Tab. 5: Traditional vs digital business models (author's view enhanced from Daugherty et al., 2016)

Traditional industrial business models	Digital, platform-driven business models
Products, services	Products, services, platform services
Linear value chains	Non-linear ecosystems
The supply-side economy of scale	The demand-side economy of scale
Organic grow and merger & acquisition	Network effects & asymmetric driven growth
Physical assets	Digital assets
Asset-driven market value	Ecosystem driven market value
Power from controlling the supply chain	Power from optimising the ecosystem

consulting shows useful when the products get commodity.

Between 'asset-heavy' and 'asset-light' business models: Due to the present study's findings, there are seen two main areas of value from platform-driven innovations as follows:

1. *Asset-heavy business* can be supported by platform innovations in operational excellence by methods such as (1) operational sensing and (2) condition monitoring for process autonomy and (3) performance management. Preferred Artefactual Intelligence (AI) methods are Cyber-Physical Systems (CPS), machine learning capabilities, optimisation, simulations and business model stress tests using digital twins. Moreover, they can be complemented with *asset-light* business such as outsourcing, resource-collaboration, payment-per-use and marketplaces.

2. *Asset-light* business can focus, for instance, on network effects of the demand side and resource-sharing with partners for compensating short-term capacity overloads to minimise capital invested. Preferred AI methods for demand-side processes are *'user modelling and personalisation and service adaptation'* (UMPA) for autonomous service adoption to meet users needs at marketplaces.

Fig. 13 shows the levels and methods of platform business architecture. The platform provides the technical infrastructure for developing and operating intelligent business services with learning and self-adapting capabilities. The platform orchestrates sensing capabilities for supply-side monitoring and condition management. Example companies with platform strategies for enhancing their existing business are Fiat (connected car), Caterpillar (connected machines), Schneider Electric (smart cities, buildings, and homes), and Philips (smart health). *Asset-light business models* are such as those of Google and Uber, while Apple and Amazon drive both, *asset-heavy business* by retail of physical products and asset-light business (iTunes, Amazon-Prime) by digital products via marketplaces.

New value propositions and profit models: New value can come from the product and service individualisation for customers' particular situation. Moreover, it can come from significant improvements in quality and cost-effectiveness preferably realised by simplified processes. New profit models can be based on flexible pricing models that can be usage-based, output-based, and value-based (profit sharing). Moreover, the monetisation of smart data can be a value driver and contributor to profit. Finally, the integration of services from partners and competitors into the own offering can play a significant role in exhausting network effects with highly economical way. Hence, Smart Services and Platforms form the basis of innovative digital business models. To summarise, the primary value drivers are (1) *Improved performance, functionality* and *reliability* of processes and products, (2) *BM innovations* and *new commercial models* (as-a-service, pay per use) and new sources of revenues and profits (performance guarantees, smart data), and (3) *faster innovation cycles.*

Smart Service, as core components of digital business models, are generating value for

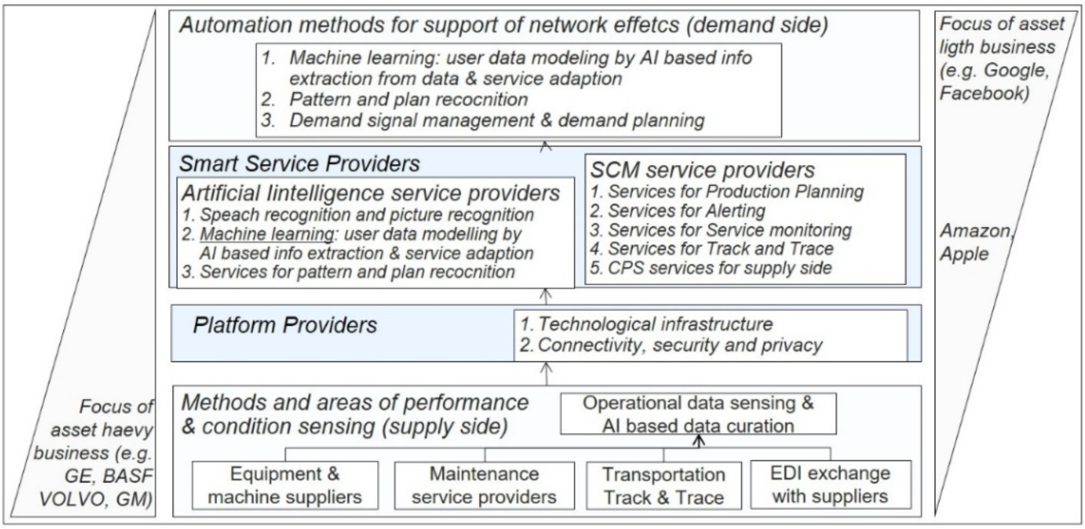

Fig. 13: Layers and opportunities of platform-driven business for asset-light and asset-heavy business models (an author's view), adapted from Kagermann et al. (2015)

businesses and customers and further ecosystem members. They are managed via platforms and can be provided by internal and external service providers for orchestrating and operating the modular processes of ecosystems. They interact with sensors, systems and actors, and are based on algorithms and be able to adapt to changing contexts over time. Cost of smart services is minimal as the marginal costs of digital value creation are nearly zero (Rifkin, 2015) and can be distributed across the ecosystem that uses the service. While economists and managers have focused so far on the reduction of marginal cost, the paradigm change from physical assets to digital assets can reduce these nearly zero. Finally, Smart Services shift the focus from product ownership to their value-oriented usage.

Potentials of Smart Services are the detection of deviations in business processes and deriving measures for responses. Moreover, they can orchestrate processes by predefined rules and can be combined flexibly with other services and adapt to environmental needs. Based on these capabilities, they can increase process effectiveness and efficiency, help to avoid waste, increase resource usage and solve unforeseen problems at an early stage. Smart Services potentials for external processes cover the autonomous interaction with customers to gather and analyse data individually and on a large scale. In sum, the potentials can lead to increase innovative strength and increase turnover and profitability as well as increase customer loyalty and can provide a significant competitive differentiator. Fast innovation cycles for Smart Services can be accelerated by generic enables such as Open Source concepts and scalable platforms. Wahlster (2018) reported the following solutions based on Smart Services:

1. *Sensing:* Collaborative Robots, Virtual Agents, Autonomous System (Cars, Ships, Trains);

2. *Understanding:* Intelligent Smart Home, Answering Engines; Digital IT Assistants;

3. *Acting:* Intelligent Help Systems; Recommendation and Persuasion Systems, Intelligent Tutor and Training Systems (Wahlster, 2018).

AI methods such as the following are supporting these Smart applications:

1. *Sensing* is supported by methods such as signal symbol transformation, multi-sensor fusion, pattern recognition, emotion/user/context recognition;

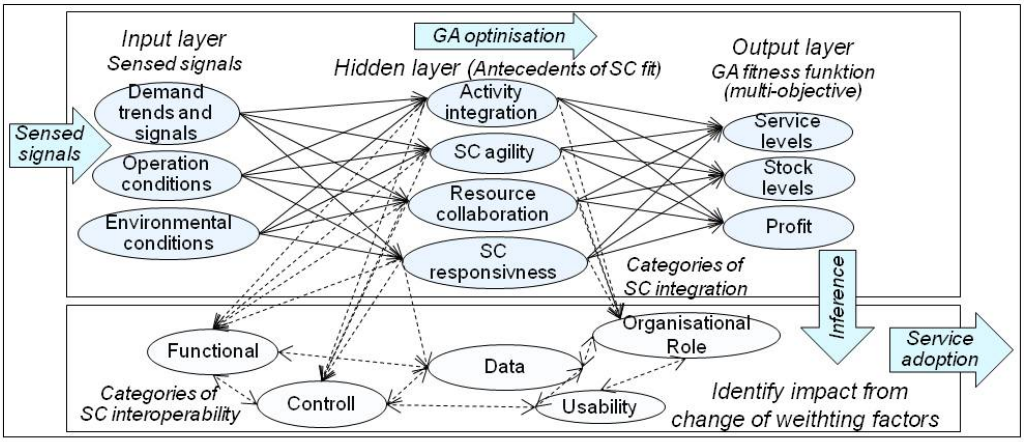

Fig. 14: Using the research theory for a GA-ANN based autonomous alignment (an author's view)

2. *Understanding* is support by methods such as text/video/dialogue understanding, information extraction, machine learning, action planning and plan recognition.
3. *Acting* is supported by methods such as sensor motoric feedback, adaptive user interaction, multi-agent collaboration techniques, personalised presentation (Wahlster, 2018).

Demand-side Artificial Intelligence (AI) methods enable to generate and adapt user data models and services of web-based applications at their usage by identifying the users' needs, interests and preferences. By this approach, user models present properties of individual users and their cognitive and behavioural characteristics established by variables and their declaration, which can be used to personalise products and services to these users. Because user modelling covers many aspects of the human nature those vary in different contexts, interoperability of application-independent models that merges psychology and artificial intelligence and ontology modelling standards are significant. Wahlster (2018) reported the following AI techniques used in practice for self-learning smart services:

1. *Interactive configuration* using constraint processing to get desired features.
2. *Recommendation techniques* for configurations such as knowledge-based and demographically based recommendations; recommendations based on previous choices and ratings; collaborative filtering across domains.
3. *Personalised service-interaction* to customers' concerns using knowledge about their interests that influence their choice.

4.7.2 The Study's Contribution to Digital Business Models

Absorptive capacity allocation and effects in SC ecosystems: The study's approach makes visible where relationship capital that has been invested in certain places of the supply chain shows a positive effect on business performance. The author of the study sees this effect as particularly useful for digital business models as these focus on network effects as sources for new business value that arise from collaboration across SC ecosystems partners and interoperability capabilities. For this purpose, the approach supports transparency of SC interoperability on different levels as a core enabler of network effects and the efforts and effects across the value chain. Moreover, the focus on cross-organisational value development of digital businesses through utilising AI methods and Smart technology drives increasing dynamism of SC business models, which underpins the value of the present study's methodology.

Dynamic alignment using GA and adopting the concept's ontology to an ANN: The ontology of the presents study's concept can be translated into a machine-readable semantic such as the Web Ontology Language (OWL). OWL and the vocabulary of the Resource Description Framework (RDF) are components of the Semantic Web, which is an initiative by the World Wide Web Consortium for standardisation of knowledge digitalisation as an extension of the www. Fig. 14 demonstrates how the concept can be adapted to an Artificial Neuronal Network (ANN) for optimisation using a Genetic Algorithm (GA), where Note-to-Note relationships of the ANN show the high-order SC capabilities. The idea is to identify the changes in the note weight factors necessary to compensate for the changes of the sensed conditions to reach the objectives of the fitness function again after environmental changes. The identified deltas can be used to determine ideal response by categories of misfit/interoperability (inference) for re-configuration. The concept can be used as a basis for autonomous alignment of SCM IS and for simulation purposes using Digital Twins. For that purpose, the physical supply chain needs to be monitored by sensors to collect data of the relevant conditions and transform these for the input vectors of the GA optimisation process.

5 CONCLUSION

A best practice for the strategic alignment of SCM IS–a holistic view by combined concepts: The study closed the gaps of missing best practice for assessing the strategic fit of SCM IS and missing methodology for orchestrating DC on multi-levels related to SCM IS. In referring to Minsberg's *P*'s for *plan* and *pattern*, the methodology has been developed for identifying and aligning patterns of a company's SCM IS capabilities in detail–that refers to the *resource-based view*–to match context-specific needs of the *market-based view*. The combination of a *profile deviation approach* (that was used in 2011 by McLaren et al.) that based on the *configurational theory* with a *domain approach* (that is related to Henderson's and Venkatraman's 1996 *Strategic Alignment Model (SAM)* and used by Avison et al. (2004) for strategic fit analysis), the methodology enables to manage strategic alignment with regard to the dimensions domain, organisational and contextual. According to the contingency theory, there is no universally superior strategy or way to manage in a given environment (Venkatraman, 1989b). Instead, the context and structure must fit together if an organisation is to perform well (Van de Ven and Drazin, 1985). Because SC integration is not a question of *'high integration fits all'*, rather the degree of integration depends on several situational factors (Bagchi et al., 2005; Childerhouse and Towill, 2011; Godsell, 2008), a *hierarchical capability structure* (according to Grant, 1996a) has been integrated for assessing fitness at different levels of aggregation to identify context-specific characteristics of SC integration antecedents and their impact on SC performance. The study enables the analysis of antecedent capabilities of SC integration such as *'information exchange'*, *'coordination'*, *'activity integration'* and *'resource collaboration'* (Wu et al., 2006; Rai et al., 2006; Childerhouse and Towill, 2011) and their needs and contribution to strategic fit of SCM IS for individual business contexts.

Based on the integrated domain concept, the model enables to identify second-order effects of IS capabilities along the supply chain caused by spill-over effects (Tallon, 2012). This approach helps to identify unused potentials from IT investments that *Brynjolfsson* called the *IT Productivity Paradox* and to identify bottlenecks from IS capabilities across domains that refer to *Goldratt's Theory-of-Constraints (TOC)*. While TOC focus in practice on performance management of business process using balanced scorecards and KPI management, the present study' model enables TOC analysis at the architectural level before IS investments are allocated and shows cross-domain effects that are not visible before. By the use of the model in an IS governance cycle, a methodology has been provided for exploring, materialising and deposit DC as an *absorptive capacity* for fast exploitation into business performance. Based on the configurational theory for identifying ideal configurations and the SC domain structure, the concept is in line with the systems theory and enables strategic alignment of SCM IS to contingencies across organisations, context, domains and situations on multi-levels. Operational excellence, as a hot topic in SCM of manufacturing companies, will be provided by the effectiveness of the SCM IS architecture by the present approach, and secondly, be realised by operational efficiency controlled by SCPM using business metrics. Moreover, the model enables harmonisation and simplification of SCM IS architectures to prevent from implementing too much complexity. Finally, the approach has been assessed as particularly useful for supporting scale-out scenarios and due diligence assessments of M&A activities by enabling to identify the potentials and synergies of the companies' SC models as a more reliable basis as the approach using only financial key figures.

DC enabled by IS Governance: Development of absorptive capacity refers to a firm's ability to acquire, assimilate, and deposit external knowledge and commercialise it by exploiting it for organisational performance (Liu et al., 2013, p. 1454; Brettel et al., 2011, pp. 164–174). According to Liu et al. (2013, p. 1460), developing *absorptive capacity* and DC related to SCM has an indirect positive effect on *'SC agility'* as a driver of *'SC performance'*. In referring to Blome et al. (2013) and Liu et al. (2003), developing absorptive capacity related to antecedent capabilities of *'SC integration'* contributes to DC of *'SC agility'* and *'SC responsiveness'*, and, hence contributes to *'SC performance'*. The present approach enables organisations to predefine patterns of capabilities as architectural artefacts, which express industry-specific and context-specific configurations to fit business strategies. These artefacts will lead to increased SC agility and SC performance through faster IS adoption in fast-changing business environments. Hence, the study contributes to the DC renewal process, and SCM IS alignment by providing a framework, methods and routines for managing DC through sensing, assessing, managerial-decision-making, artefact development, selection and implementation for aligning business models to the prevailing strategy. Finally, the methodology supports to manage the balance and dynamics of DC exploration and exploiting (Brettel et al., 2011), which O'Reilly and Tushman (2007) refer to ambidexterity.

Evolutionary vs behavioural economic or best practice vs innovation: For making the most from DC both evolutionary and behavioural economics aspects are essential and considered by the present concept. For Teece (1982, 2018), best practice are not necessarily DC as he focuses on Schumpeterian's innovation (1934) combined with higher-order routines (Arndt and Pierce, 2018, p. 414) such as asset orchestration activities, which involve *"new combinations"* that are not merely adaptive. Such re-combinations can be new technologies as well (Arndt and Pierce, 2018, p. 413). However, Eisenhardt and Martin (2000) suggest the use of best practices and simple rules such as decision-making heuristics as DC as they see companies in the same industry with a reasonable amount of competitive homogeneity expressed through significant commonalities across capabilities (Arndt and Pierce, 2018, p. 414). In referring to Arndt and Pierce (2018, p. 413), the present concept's mechanisms, routines and repositories for developing and exploiting DC is seen founded in evolutionary economics. The methods identified for developing Smart business models allow a significant degree of freedom for creativity to consider the Schumpeterian view of innovation for developing DC. However, aspects of the behavioural theory play also an essential role in the concept such as dealing with heterogeneity, individual expectations and goal formation.

Sensemaking and organisational learning: In considering *design-science* aspects according to Hevner et al. (2004) and *sensemaking aspects* such as *'framing'* according to Klein et al. (2006a, p. 71), a coherent research theory and methodological framework have been developed, which enabled to prove the model on framing data as meaningful for strategic fit. By this approach, content analysis, according to Mayring (2014) is implied in the model for deductive category formation by *fitting* meaningful data to predefined categories to triangulate qualitative and quantitative data at applying the model. Hence, high levels of construct validity are provided by the approach (Yin, 2009). According to Weick et al. (2005), sensemaking in organisations is not a question of accuracy, but rather about plausibility and the development of a collective mindset for understanding the past and the present, and to develop a directed flux of action to master the future. Sensemaking properties according to Weick et al. (2005) were identified as supported to a high degree in applying the model by supporting a collective view of objectives and directed actions and increased shared awareness about the value of supply chain members' efforts spent on SCM processes on the overall business performance.

Contextual factors are dominating the levels of IS capabilities required to fit: The present study shows a high variability of levels needed to fit by (1) generic/high-order SC capabilities and (2) detailed IS capabilities for companies that show the same strategy type due to Miles and Snow. Hence, the present study proposes Miles and Snow strategy archetypes as a reference for high-end product and low-end product strategies, but it is highly recommended to identify ideal levels of support of fit using firm/context-specific assessments. Hybrid strategy types have been identified for both sample organisations. The study provides evidence that a higher level of detail in IS capabilities and their levels of support to fit is needed sooner then it was used in previous research for considering strategic orientations and the resulting requirements for SC differentiation appropriately. Moreover, SC domains' IS capabilities need to be assessed individually for their ideal levels rather than to use predefined ideal levels of reference strategy types because situational and context-specific support need to be prioritised in today's business dynamics for inferring appropriated levels of SC capabilities. Finally, ideal levels of support to fit by second-order effects across the supply chain need to be considered appropriately.

SC models' dynamics driven by complexity and adoption: We found out that the combination of strategy types according to Miles and Snow with the categories of marketing-oriented business and sales-driven business helps to differentiate companies' SC models in regard of their dynamics and whether complexity or adoptions drive it. This finding helps to categorise SC models in their design requirements regarding the extent of complexity in SC differentiation and the required degree of dynamics for adoptions. Moreover, it provides the basis, in combination with the customer and product segmentation, for defining detailed SC strategies and expressing the related SC differentiation by capability pattern per segment. This approach provides significantly increased transparency in companies' product segments and their related SC strategy and differentiation and finally, of IS capabilities for managing the supply chains. Finally, it helps in benchmarking implemented configurations against ideal ones to firms' competitive strategy, and fast scaling out IS capabilities to new business models.

The contribution to digital business models: As shown by the study, the approach makes visible where and when relationship capital allocated as absorptive capacity shows a positive effect on business performance in the supply chain, which can significantly depend on the businesses' strategic orientation. The author sees this effect significant for digital business models as these focuses on new sources of value such from network effects across SC ecosystems. Essential sources of network effects are – among the right products – high levels of interoperability for scaling at minimal marginal cost (Rifkin, 2015). Hence, the present approach supports transparency of SC interoperability on different levels and efforts and value contributed from ecosystem members. The focus on cross-organisational and collaborative value development utilising AI methods and Smart technology drives dynamism of business models. For this reason, the concept shows high potentials for support autonomous strategic alignment of digital business models by adopting the ontology to machine-learning services, Cyber-Physical Systems (CPS) and Smart Services.

Criticism of previous research: Henderson's and Venkatraman's 1996 SAM provides a useful methodical framework for assessing the relationships of strategic fit and functional integration between IT and business domains but lacks quantitative measurement and benchmarking capabilities, which have been integrated and combined by the present study. Five generic SC capabilities were used by McLaren et al. (2011) for predefining ideal levels of support to strategic fit in reference to Miles and Snow strategy archetypes. The present study shows the categorisation of *high-end products* that relate to the Innovator strategy type and *low-end products* that relate to the Defender strategy type – according to Miles and Snow – as useful for expressing ideal levels of support needed for the strategic fit of product segments in the steel industry. However, the present study provides clear evidence that for deriving reasonable actions from assessment results, a higher level of detail in IS capabilities' levels of support to fit is needed to consider strategic orientations and the resulting requirements for SC differentiation appropriately. Moreover, SC domains' IS capabilities need to be assessed individually and for each SC domain for their levels as situational and context-specific support need to be prioritised in today's business dynamics for providing the right levels of *responsiveness*, *agility* and *resource-collaboration*.

6 REFERENCES

Amit, R. and Schoemaker, P. J. H. 1993. Strategic Assets and Organizational Rent. *Strategic Management Journal*, 14 (1), 33–46.

Armstrong, S. 2016. Eight Things You Need to Know About the Future of Retail. *Wired UK* [online]. Available at: http://www.wired.co.uk/magazine/march-2016.

Arndt, F. and Pierce, L. 2018. The Behavioural and Evolutionary Roots of Dynamic Capabilities. *Industrial and Corporate Change*, 27 (2), 413–424.

Avison, D., Jones, J., Powell, P. and Wilson, D. 2004. Using and Validating the Strategic Alignment Model. *The Journal of Strategic Information Systems*, 13 (3), 223–246.

Bagchi, P. K., Ha, B. C., Skjøtt-Larsen, T. and Sørensen, L. B. 2005. Supply Chain Integration: A European Survey. *The International Journal of Logistics Management*, 16 (2), 275–294.

Bashiri, I., Engels, C. and Heinzelmann, M. 2010. *Strategic Alignment: Zur Ausrichtung von Business, IT und Business Inteligence*. Springer-Verlag, Berlin, Heidelberg. ISBN 978-3-642-11437-3.

Bledow, R., Frese, M., Anderson, M., Erez, M. and Farr, J. 2009. A Dialectic Perspective on Innovation: Conflicting Demands, Multiple Pathways, and Ambidexterity. *Industrial and Organizational Psychology*, 2 (3), 305–337.

Blome, C., Schoenherr, T. and Rexhausen, D. 2013. Antecedents and Enablers of Supply Chain Agility and Its Effect on Performance: A Dynamic Capabilities Perspective. *International Journal of Production Research*, 51 (4), 1295–1318.

Blomberg, J., Giacomi, J., Mosher, A. and Swenton-Wall, P. 1993. Ethnographic Field Methods and their Relation to Design. In Schuler, D. and Namioka, A. (eds.). *Participatory Design: Principles and Practices*, Chapter 7, pp. 123–155.

Brettel, M., Greve, G. I., Flatten, T. C. 2011. Giving up Linearity: Absorptive Capacity and Performance. *Journal of Managerial Issues*, 23 (2), 164–189.

Bryman, A. and Bell, E. 2003. *Business Research Methods*. 3rd ed. Oxford Press.

Brynjolfsson, E. 1993. The Productivity Paradox of Information Technology. *Communications of the ACM*, 36 (12), 66–77.

Chan, Y. E., Huff, S. L., Barclay, D. W. and Copeland, D. G. 1997. Business Strategic Orientation, Information Systems Strategic Orientation, and Strategic Alignment. *Information Systems Research*, 8 (2), 125–150.

Childerhouse, P. and Towill, D. R. 2011. Arcs of Supply Chain Integration. *International Journal of Production Research*, 49 (24), 7441–7468.

Conant, J. S., Mokwa, M. P. and Varadarajan, P. R. 1990. Strategic Types, Distinctive Marketing Competencies, and Organizational Performance: A Multiple Measures-Based Study. *Strategic Management Journal*, 11 (5), 365–383.

Daugherty, P., Carrel-Billiard, M. and Biltz, M. J. 2016. *People First: The Primacy of People in a Digital Age*. Accenture Technology Vision 2016 report.

Donaldson, L. 2006. The Contingency Theory of Organizational Design: Challenges and Opportunities. In Burton, R. M., Håkonsson, D. D., Eriksen, B. and Snow, C. C. (eds.). *Organization Design: The Evolving State-of-the-Art*, Chapter 2. Information and Organization Design Series, Vol. 6.

Doty, D. H., Glick, W. H. and Huber, G. P. 1993. Fit, Equifinality, and Organizational Effectiveness: A Test of Two Configurational Theories. *The Academy of Management Journal*, 36 (6), 1196–1250.

Eisenhardt, K. M. 1989. Building Theories from Case Study Research. *Academy of Management Review*, 14 (4), 532–550.

Eisenhardt, K. M., Martin, J. A. 2000. Dynamic Capabilities: What Are They? *Strategic Management Journal*, 21 (10/11), 1105–1121.

Godsell, J. 2008. *Developing Customer Responsive Supply Chain Strategy: An Empirical Investigation of the Relationship between Market Segmentation and Supply Chain Strategy*. PhD thesis, School of Management, Granfield University, UK.

Grant, R. M. 1996a. Prospering in Dynamically-Competitive Environments: Organizational Capability as Knowledge Integration. *Organization Science*, 7 (4), 375–387.

Grant, R. M. 1996b. Toward a Knowledge-Based Theory of the Firm. *Strategic Management Journal*, 17 (S2), 109–122.

Haaker, T., Bouwman, H., Janssen, W. and de Reuver, M. 2017. Business Model Stress Testing: A Practical Approach to Test the Robustness of a Business Model. *Futures*, 89, 14–25.

Henderson, J. C. and Venkatraman, N. 1990. *Strategic Alignment: A Model For Organizational Transformation via Information Technology*. CISR Working Paper No. 2017.

Henderson, J. C., Venkatraman, N. and Oldach, S. 1996. Aligning Business and IT Strategies. In Luftman, J. N. (ed.). *Competing in the Information Age: Strategic Alignment in Practice*, pp. 21–41. New York: Oxford University Press.

Hevner, A. R., March, S. T., Park, J. and Ram, S. 2004. Design Science in Information Systems Research. *MIS Quarterly*, 28 (1), 75–105.

Hsieh, H.-F. and Shannon, S. E. 2005. Three Approaches to Qualitative Content Analysis. *Qualitative Health Research*, 15 (9), 1277–1288.

Johnson, M. W., Christensen, C. M. and Kagermann, H. 2008. Reinventing Your Business Model. *Harvard Business Review*, 86 (12), 50–59.

Kachaner, N. and Whybrew, A. 2014. *When "Asset Light" Is Right*. The Boston Consulting Group.

Kagermann, H., Riemensperger, F., Hoke, D., Schuh, G., Scheer, A.-W., Spath, D., Leukert, B., Wahlster, W., Rohleder, B. and Schweer, D. (eds.). 2015. *Smart Service Welt Recommendations for the Strategic Initiative Web-based Services for Businesses*. Acatech – National Academy of Science and Engineering.

Kaplan, B. and Duchon, D. 1988. Combining Qualitative and Quantitative Methods in Information System Research: A Case Study. *MIS Quarterly*, 12 (4), 571–586.

Kaplan, R. S. and Norton, D. P. 1992. The Balance Score Card – Measures that Drive Performance. *Harvard Business Review*, 70 (1), 71–79.

Kaplan, R. S. and Norton, D. P. 2001. Transforming the Balanced Scorecard from Performance Measurement to Strategic Management: Part II. *Accounting Horizons*, 15 (2), 147–160.

Kearns, G. S. and Lederer, A. L. 2000. The Effect of Strategic Alignment on the Use of IS-Based Resources for Competitive Advantages. *The Journal of Strategic Information Systems*, 9 (4), 265–293.

Kirwin, B. and Mieritz, L. 2003. *Total Cost of Ownership as a Common Denominator*. Gardner Research Note in Business Management of IT: Financial Management.

Klein, G., Moon, B. and Hoffman, R. R. 2006a. Making Sense of Sensemaking 1: Alternative Perspectives. *IEEE Computer Society*, 21 (4), 70–73.

Klein, G., Moon, B. and Hoffman, R. R. 2006b. Making Sense of Sensemaking 2: A Macrocognitive Model. *IEEE Computer Society*, 21 (5), 88–92.

Knoppen, D., Johnston, D. and Sáenz, M. J. 2015. Supply Chain Relationships as a Context for Learning Leading to Innovation. *The International Journal of Logistics Management*, 26 (3), 543–567.

Koulikoff-Souviron, M. and Harrison, A. 2005. Using Case Study Methods in Researching Supply Chains. In Kotzab, H., Seuring, S., Müller, M. and Reiner, G. (eds.). *Research Methodologies in Supply Chain Management*, pp. 267–282. Physica-Verlag HD.

Liu, S. 2011. *Supply Chain Management in the Process Industry*. PhD Thesis, University College London, UK.

Liu, H., Ke, W., Wie, K. K. and Hua, Z. 2013. The Impact of IT Capabilities on Firm Performance: The Mediating Roles of Absorptive Capacity and Supply Chain Agility. *Decision Support Systems*, 54 (3), 1452–1462.

Luftman, J. 2003. Assessing It/Business Alignment. *Information Systems Management*, 20 (4), 9–15.

Makadok, R. 2001. Toward a Synthesis of Resource-Based and Dynamic-Capabilities Views of Rent. *Strategic Management Journal*, 22 (5), 387–401.

Mayring, P. 2014. *Qualitative Content Analysis: Theoretical Foundation, Basic Procedures and Software Solution*. Social Science Open Access Repository.

McLaren, T. S., Head, M. M. and Yuan, Y. 2004. Using Competitive Strategy Patterns to Determine Ideal Supply Chain Management Information Systems Capabilities. *International Journal of Internet and Enterprise Management*, 2 (1), 45–61.

McLaren, T. S., Head, M. M., Yuan, Y. and Chan, Y. E. 2011. A Multilevel Model for Measuring Fit Between a Firm's Competitive Strategy and Information Systems Capabilities. *MIS Quarterly*, 35 (4), 909–929.

Miles, R. E. and Snow, C. C. 1978. *Organizational Strategy, Structure and Process*. New York: McGraw-Hill.

Mintzberg, H. 1978. Pattern in Strategy Formation. *Management Science*, 24 (9), 934–948.

Mithas, S., Ramasubbu, N. and Sambamurthy, V. 2011. How Information Management Capability Influence Firm Performance. *MIS Quarterly*, 35 (1), 237–256.

Oh, W. and Pinsonneault, A. 2007. On the Assessment of the Strategic Value of Information Technologies: Conceptual and Analytical Approaches. *MIS Quarterly*, 31 (2), 239–265.

O'Reilly, C. A. and Tushman, M. L. 2007. *Ambidexterity as a Dynamic Capability: Resolving the Innovator's Dilemma*. Harvard Business School Working Paper No. 07-088.

Papageorgiou, L. G. 2009. Supply Chain Optimisation for the Process Industries: Advances and Opportunities. *Computers & Chemical Engineering*, 33 (12), 1931–1938.

Pennings, J. M. 1975. The Relevance of the Structural-Contingency Model for Organizational Effectiveness. *Administrative Science Quarterly*, 20 (3), 393–410.

Penrose, E. 1959. *The Theory of the Growth of the Firm*. Oxford Press: New York.

Pinsonneault, A. and Rivard, S. 1998. Information Technology and the Nature of Managerial Work: From the Productivity Paradox to the Icarus Paradox? *MIS Quarterly*, 22 (3), 287–311.

Porter, M. E. 1987. From Competitive Advantage to Corporate Strategy. *Harvard Business Review*, 65 (3), 43–59.

Prieto, V. C. and de Carvalho, M. M. 2011. Strategic Alignment and Performance: Brazilian Companies in the Medical Diagnostics Sector. *The Service Industries Journal*, 31 (9), 1405–1427.

Rai, A., Patnayakuni, R. and Seth, N. 2006. Firm Performance Impacts of Digitally-Enabled Supply Chain Integration Capabilities. *MIS Quarterly*, 30 (2), 225–246.

Raisch, S., Birkinshaw, J., Probst, G. and Tushman, M. L. 2009. Organizational Ambidexterity: Balancing Exploitation and Exploration for Sustained Performance. *Organization Science*, 20 (4), 685–695.

Rifkin, J. 2015. *The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism*. Palgrave Macmillian. ISBN 978-1-137-28011-4.

Ross, J. W. 2006. *Enterprise Architecture: Driving Business Benefit from IT*. CISR Working Paper No. 359.

Sabherwal, R. and Chan, Y. E. 2001. Alignment between Business and IS Strategies: A Study of Prospectors, Analyzers, and Defenders. *Information Systems Research*, 12 (1), 11–33.

Shaw, N. E., Burgess, T. F., de Mattos, C. and Stec, L. Z. 2005. Supply Chain Agility: the Influence of Industry Culture on Asset Capabilities within Capital-Intensive Industries. *International Journal of Production Research*, 43 (16), 3497–3516.

Silva, L. and Hirschheim, R. 2007. Fighting against Windmills: Strategic Information Systems and Organisational Deep Structures. *MIS Quarterly*, 31 (2), 327–354.

Simatupang, T. M., Wright, A. C. and Sridharan, R. 2002. The Knowledge of Coordination for Supply Chain Integration. *Business Process Management Journal*, 8 (3), 289–308.

Spósito, M. A. F., Dias Neto, A. C. and Barreto, R. S. 2016. Business-IT Alignment Research Field – A Systematic Literature Review. *Proceedings of the 18th International Conference on Enterprise Information Systems – Volume 1*, pp. 549–558.

Strong, D. M. and Volkoff, O. 2010. Understanding Organisation–Enterprise System Fit: A Path To Theorising The Information Technology Artifact. *MIS Quarterly*, 34 (4), 731–756.

Tallon, P. P. 2012. Value Chain Linkages and the Spillover Effects of Strategic Information Technology Alignment: A Process-Level View. *Journal of Management Information Systems*, 28 (3), 9–44.

Teece, D. J. 1982. Towards an Economic Theory of the Multiproduct Firm. *Journal of Economic Behaviour & Organization*, 3 (1), 39–63.

Teece, D. J., Pisano, G. and Shuen, A. 1997. Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18 (7), 509–533.

Teece, D. J. 2018. Business Models and Dynamic Capabilities. *Long Range Planning*, 51 (1), 40–49.

Van de Ven, A. H. and Drazin, R. 1984. *The Concept of Fit in Contingency Theory.* Strategic Management Research Center, Indiana University.

van Donk, D. P. and van der Vaart, T. 2005a. A Case of Shared Resources, Uncertainty and Supply Chain Integration in the Process Industry. *International Journal of Production Economics*, 96 (1), 97–108.

van Donk, D. P. and van der Vaart, T. 2005b. A Critical Discussion on the Theoretical and Methodical Advancements in Supply Chain Integration Research. In Kotzab, H., Seuring, S., Müller, M. and Reiner, G. (eds.). *Research Methodologies in Supply Chain Management*, pp. 31–46. Physica-Verlag HD.

Venkatraman, N. 1989a. Strategic Orientation of Business Enterprises: The Construct, Dimensionality, and Measurement. *Management Science*, 35 (8), 942–962.

Venkatraman, N. 1989b. The Concept of Fit in Strategic Research: towards Verbal and Statistical Correspondence. *The Academy of Management Review*, 14 (3), 423–444.

Wahlster, W. 2018. *Smart Service Welt: Technological Enablers for Smart Services.* Week 2, Part 5.

Wang, R. 2011. *A Taxonomic Study of Agility Strategies and Supporting Supply Chain Management Practices.* PhD Thesis, University of Exeter.

Weick, K. E., Sutcliffe, K. M. and Obstfeld, D. 2005. Organizing and the Process of Sensemaking. *Organization Science*, 16 (4), 409–421.

Wu, F., Yeniyurt, S., Kim, D. and Cavusgil, S. T. 2006. The Impact of Information Technology on SC Capabilities and Firm Performance: a Resource-Based View. *Industrial Marketing Management*, 35 (4), 493–504.

Yin, R. K. 2009. *Case Study Research: Design and Methods.* 4th ed. Applied Social Research Method Series 5, SAGE.

Zukis, B., Loveland, G., Horowitz, P., Verweij, G. and Bauch, B. 2008. *Why Isn't IT Spending Creates More Value?* Pricewaterhouse-Coopers Report.

7 ANNEX

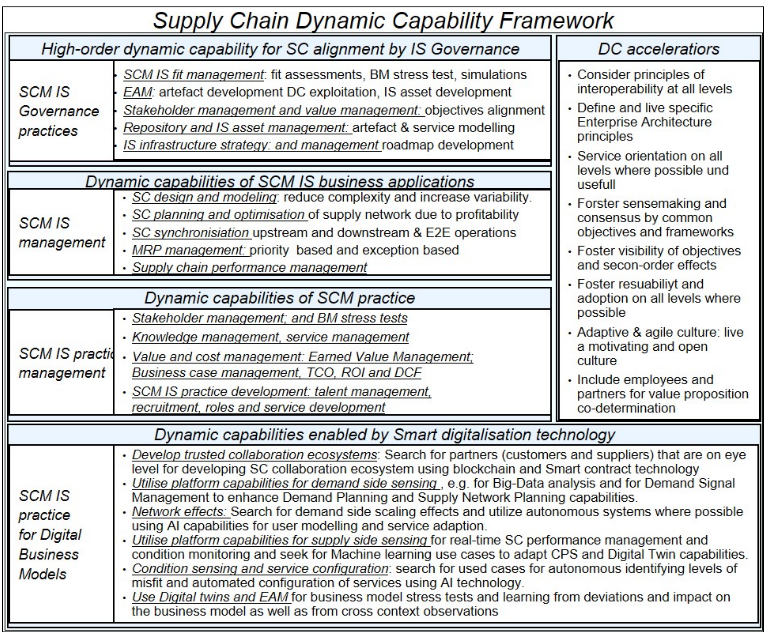

Fig. 15: The Supply Chain Dynamic Capability Framework (an author's view)

Tab. 6: Dynamic capabilities for SCM IS and digital SC business models (an author's view)

Dynamic capability	Exploration methods	Deposit methods	Exploitation methods	Implication & effects	Antecedents	Antecedent to
Sensing	Data collection, information extraction	User modelling, Artefact development	Service & artefact adoption	Autonomous service adaption fast ROI	–	Inference, Service adoption, Sensemaking
Sense-making	consensus on objectives, levels of fit and gaps; fit measurements	Artefacts that as common view of context contingency	Utilise artefacts by adoptionalso, align configurations	Common view and sense of objectives & directions to reach these	Transparency info-sharing, Collective assimilation & Common view	Common objectives, ideal plans, transparency & agility
Optimi-sation	ANN, GA, LP Optimisation, Reference Plans	Reference Plans & configuration	Inference; Plan-recognition; configuration	Optimal plans for profit; fast alignment at volatility	Sensing, Synchronisation, Planning	Operational excellence, context contingency
Inference	premises, arguments, rules & policies; AI-based machine-learning	References; ideal plans; premises; Artefacts for rules, policies	Smart Services; SC visibility; autonomous systems, CPS	Plans, services with ideal levels; Autonomous plan recognition	Optimisation, reasoning, verification, validation	Plan recognition, conclusion drawing, Autonomous systems
Integration	Misfit identification by assessment of integration antecedents	Artefact & IS service development	Artefact selection, recognition and adoption	Context contingency of capabilities	Activity-integration collaboration, agility and more	Strategic fit, operational excellence
Alignment	Strategic fit measurementalso, consensus	EAM repository, Service Libraries	IS Governance, ontology, DC framework	Contingency fit of capabilities to the context	Ideal future state and present status are known	Strategic fit, operational excellence
Orchestra-tion	IS components, services, rules, modular configuration	Libraries of Services Artefacts, IS assets, contracts	Smart Services CPS, Service composition	Better RIO, fast and reliable realignment using proven components	Sensemaking Plan recognition; Consensus artefacts	Business modelling, Architecture alignment
Adoption	Sensing for the scale of economy, EA architecture Harmonisation	Templates of SC model, architectures, processes; IS services	Template roll-out and localisation (configuration alignment)	Generality scalability, Effective business scale-out	Sensemaking between host and local business units, Integration	Successful replication of business models
Reconfi-guration	Sensing, Recogni-tion,artefacts, rules for generic services	Predefined configuration rules, policies artefacts	Artefact selection configuration adoptions	Better RIO from fast and more reliable reconfiguration	Identification and recognition of ideal plansalso, settings	Strategic fit, operational excellence
Inter-operability	Measurements & simulations to identify levels of fit & misfit and gaps	Service and Artefact repository, aligned SCM IS	Plan recognition, implementation of services and artefacts	Closed gaps of misfit, High-levels of fit & business performance	Levels of fit for Function, data control, role, organisational	Integration, strategic fit operational effectiveness
Synchro-nisation	Strategic Fit assessment; Alignment of demand and supply	Master plans and plans references, scheduling capabilities	Utilise plan- and schedule alternatives that fit the situation	Operational excellence, plan and delivery reliability	SC visibility Optimisation, SC modelling, Strategic Fit	SC agility responsiveness; Plan and execution reliability
Autonomy	CPS, Smart Services UMAP machine learning	Predefined rulesets and policies	Ad-hoc configuration	Responsiveness to unforeseen events	Sensing, self-learning configuration	Acting, self-learning service
Responsi-veness	Strategic fit assessment of capabilities & SC domains	Continuous development of artefacts	Continuous fit measures and artefact utilisation	High service levels and operational excellence	SC agility; SC visibility; Integration; Collaboration	Operational excellence by effectiveness service levels
SC agility	Strategic Fit assessment of capabilities & SC domains	Ideal plans; priorities & procedures to situations	Alignment of planning priorities and exception management	Flexibility to changes, but, remaining effectiveness	SC visibility, relationship management; Interoperability	Integration, Responsiveness
Collabo-ration	Strategic Fit assessments	Active relationship maintenance	Activate physical relationships	improved agility and end-to-end performance	Relationship capital	SC agility Integration Responsiveness
Simulation	Optimisation, SC modelling Stress tests	SC artefacts for different ideal plans	Artefact, Plan selection and implementation	Visibility on the impact of changes	Optimisation SC modelling SC visibility	Decision-making, SC agility Responsiveness
SC visibility	Strategic Fit assessment of capabilities & SC domains	IS artefacts; SC Data models, DB schemas	alignment, IT footprint simplification SC modelling	Improved prioritisation Transparency	SC modelling IT footprint simplification	Operational excellence, Integration SC agility
SC modelling	Architectural artefacts Blueprints	Artefacts, repository, services	Recognition, adoption, alignment	Improved visibility reduced complexity	Segmentation differentiation SC strategy	Integration SC visibility, effectiveness
Activity integration	Levels of extent identification by assessments	Artefacts and service definition for needed levels	Utilise artefacts by it IS services configuration	Smooth flow of information, material and value,	SC modelling information flow collaboration	SC agility Integration SC visibility

Appendix Tab. 6 shows DC for SCM, their antecedents and methods for exploring and materialising and deposit, and exploiting these in business performance.

Sales & Operation Planning (1) – Demand Management

Core processes and IS capabilities			Contribution of functional IS capabilities for SCM to high-order SCM capabilities																				Contribution of IS capabilities for SCM to strategic capabilities									
Core processors	IS capabilities	Detailed IS capability	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level
			Business predictability		Information exchange		Coordination		Activity integration		Operational efficieny		Supply chain agility		Supply chain responsiveness		Supply chain risk mgmt.		Internal analysis		External analysis		Aggressive ness		Defensive ness		Futurity		Proactiveness		Riskiness	
Demand manageme nt capabilities	Demand planning capabilities	Capabilities for demand planning	High	High	High	High	High - indirect, by spill-over effects	High - indirect, by spill-over effects	High	Medium	Not relevant	Not relevant	High	Medium	High	Medium	Medium	Medium	Not relevant	Not relevant	High	High	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant
		Capabilities for demand review	High	High	High	High	Medium indirect, by spill-over effects	Medium indirect, by spill-over effects	High	Medium	Not relevant	Not relevant	High	Medium	High	Medium	Medium	medium	Not relevant	Not relevant	High	High	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant
		Modelling & simulating scenarios	High	Medium	High	Medium	High - indirect, by spill-over effects	Medium indirect, by spill-over effects	High	Medium	Not relevant	Not relevant	high	Medium	High	Medium	high	medium	Not relevant	Not relevant	High	High	Medium	Medium	Not relevant	Not relevant	Not relevant	Not relevant	Medium	Medium	Medium	Medium
	Demand alignment capabilities	Forecast alignment to production planning	High	High	High	High	High	High	High - indirect, by spill-over effects	Low - indirect, by spill-over effects	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low	Not relevant	Not relevant	Not relevant	;ot relevant	Low	Low	Medium	Medium	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant
		Capabilities for aligning forecast with procurement	High	High	High	High	High	High	High - indirect, by spill-over effects	High - indirect, by spill-over effects	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low	Not relevant	Not relevant	Not relevant	Not relevant	Low	Low	Medium	Medium	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant
		Capabilities for aligning forecast with financial	High	High	High	High	High	High	High - indirect, by spill-over effects	High - indirect, by spill-over effects	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low	Not relevant	Not relevant	Not relevant	Not relevant	Low	Low	Medium	Medium	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant
		Capabilities for aligning forecast with portfolio management	High	High	High	High	High	High	High - indirect, by spill-over effects	High - indirect, by spill-over effects	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low	Not relevant	Not relevant	Not relevant	Not relevant	Low	Low	Medium	Medium	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant
		Capabilities for aligning demand with channel partners	High	High	High	High	High	High	High - indirect, by spill-over effects	High - indirect, by spill-over effects	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low	Not relevant	Not relevant	Not relevant	Not relevant	Low	Low	Medium	Medium	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant
		Forecast alignment with sales allocations	High	High	High	High	High	High	Medium - indirect, by spill-over effects	Medium - indirect, by spill-over effects	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low	Not relevant	Not relevant	Not relevant	Not relevant	Low	Low	Medium	Medium	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant

Fig. 16: Examples of Strategic fit assessment sheets

Sales & Operation Planning

Core processes and IS capabilities — Contribution of IS capabilities for SCM to strategic capabilities — Calculated levels of fitness and levels of degree of strategic fit

Core processors	IS capabilities	Detailed organisational & functional capability	Business predictability Ideal level	Business predictability Actual level	Information exchange Ideal level	Information exchange Actual level	Coordination Ideal level	Coordination Actual level	Activity integration Ideal level	Activity integration Actual level	Operational efficiency Ideal level	Operational efficiency Actual level	Supply chain agility Ideal level	Supply chain agility Actual level	Supply chain responsiveness Ideal level	Supply chain responsiveness Actual level	Supply chain risk management Ideal level	Supply chain risk management Actual level
Demand mgmt. capabilities	Demand planning capabilities	Capabilities for demand planning	2,00	2,00	3,00	3,00	1,00	1,00	1,00	1,00	3,00	3,00	1,00	1,00	1,00	1,00	2,00	1,00
		Capabilities for demand review	2,00	2,00	2,00	2,00	1,00	1,00	1,00	1,00	3,00	3,00	1,00	1,00	1,00	1,00	2,00	1,00
		Capabilities for modelling and simulating planning scenarios	2,00	2,00	2,00	2,00	1,00	1,00	1,00	1,00	3,00	3,00	1,00	1,00	1,00	1,00	2,00	1,00
		Capabilities for determine forecast based on profit optimization	2,00	2,00	2,00	2,00	1,00	1,00	1,00	1,00	3,00	4,00	1,00	1,00	1,00	1,00	2,00	1,00
	Demand alignment capabilities	Capabilities for aligning forecast with production planning	4,00	3,00	3,00	2,00	3,00	2,00	2,00	1,00	3,00	2,00	3,00	3,00	3,00	3,00	2,00	1,00
		Capabilities for aligning forecast with financial management	3,00	3,00	2,00	2,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,00	1,00
		Capabilities for aligning forecast with sales allocations	3,00	2,00	3,00	2,00	3,00	2,00	2,00	1,00	3,00	2,00	0,00	0,00	0,00	0,00	2,00	1,00
Strategic fit indicator			2,57	2,29	2,43	2,14	1,43	1,14	1,14	0,86	2,57	2,43	1,75	1,75	1,75	1,75	2,00	1,00
Average degree of strategic fit by the SCM capability			1,41		1,41		1,41		1,41		1,73		0,00		0,00		2,65	

Core processors	IS capabilities	Detailed organisational & functional capability	Internal analysis Ideal level	Internal analysis Actual level	External analysis Ideal level	External analysis Actual level	Aggressiveness Ideal level	Aggressiveness Actual level	Defensiveness Ideal level	Defensiveness Actual level	Futurity Ideal level	Futurity Actual level	Proaktiveness Ideal level	Proaktiveness Actual level	Riskiness Ideal level	Riskiness Actual level	Fit indicator	Average degree of ideal levels	Average degree of actual levels
Demand mgmt. capabilities	Demand planning capabilities	Capabilities for demand planning	2,00	1,00	2,00	1,00	3,00	3,00	3,00	3,00	0,00	0,00	3,00	2,00	3,00	3,00	2,00	2,00	1,73
		Capabilities for demand review	2,00	1,00	2,00	1,00	3,00	3,00	3,00	3,00	0,00	0,00	3,00	2,00	3,00	3,00	2,00	1,93	1,67
		Capabilities for modelling and simulating planning scenarios	2,00	1,00	2,00	1,00	3,00	3,00	3,00	3,00	0,00	0,00	3,00	2,00	3,00	3,00	2,00	1,93	1,67
		Capabilities for determine forecast based on profit optimization	2,00	1,00	1,00	1,00	3,00	2,00	3,00	3,00	0,00	0,00	3,00	2,00	3,00	3,00	2,24	1,87	1,67
	Demand alignment capabilities	Capabilities for aligning forecast with production planning	3,00	3,00	0,00	0,00	3,00	3,00	3,00	3,00	0,00	0,00	3,00	2,00	3,00	3,00	2,65	2,53	2,07
		Capabilities for aligning forecast with financial management	2,00	2,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00	0,90	0,80
		Capabilities for aligning forecast with sales allocations	1,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,45	1,70	1,10
Strategic fit indicator			2,00	1,43	1,00	0,57	2,14	2,00	2,14	2,14	0,00	0,00	2,14	1,43	2,14	2,14			
Average degree of strategic fit by the SCM capability			2,00		1,73		1,00		0,00		0,00		2,24		0,00				

Fig. 17: Part of the S&OP calculation sheet of case study B

Upstream & Downstream Management

Core processes and IS capabilities			Contribution of functional IS capabilities for SCM to high-order SCM capabilities																								Contribution of IS capabilities for SCM to strategic capabilities								Calculated levels of fitness and levels of degree of strategic fit		
Core processors	IS capabilities	Detailed IS capability	Fit indicator	Fit indicator	Fit indicator	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Fit indicator	Average degree of ideal levels	Average degree of actual levels
			Information exchange		Operational efficiency		Operational flexibility		Coordination		Activity integration		Resource collaboration		Supply chain agility		Supply chain responsiveness		Supply chain risk management		Internal analysis		External analysis		Aggressiveness		Defensiveness		Futurity		Proaktiveness		Riskiness				
Sales order processing	Capabilities for sales order mgmt.	Capabilities for sales order management	3,00	2,00	3,00	3,00	3,00	3,00	3,00	2,00	3,00	2,00	0,00	0,00	3,00	3,00	3,00	3,00	3,00	3,00	2,00	2,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,73	2,36	2,09
	Capabilities for sales order alignment	Capabilities for aligning sales order items with demand planning	4,00	4,00	2,00	3,00	3,00	3,00	4,00	3,00	3,00	3,00	0,00	0,00	2,00	2,00	4,00	4,00	3,00	2,00	1,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,73	2,36	2,27
		Capabilities for aligning sales order with channel	3,00	1,00	3,00	3,00	3,00	2,00	3,00	1,00	2,00	1,00	0,00	0,00	3,00	2,00	3,00	2,00	3,00	2,00	1,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,61	2,18	1,36
		Capabilities for aligning sales order with inventory	3,00	2,00	0,00	0,00	0,00	0,00	3,00	2,00	3,00	2,00	2,00	2,00	3,00	3,00	3,00	3,00	3,00	2,00	1,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,00	1,91	1,55
		Capabilities for aligning sales with financial	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	0,00	0,00	1,00	1,00	1,00	1,00	3,00	3,00	3,00	3,00	2,00	2,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,27	2,27
Production Planning & Scheduling	Plan to produce	Planning & Scheduling	4,00	3,00	4,00	3,00	4,00	3,00	3,00	2,00	2,00	1,00	2,00	1,00	3,00	4,00	3,00	3,00	2,00	1,00	1,00	1,00	1,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,83	2,64	2,09
	Inventory semi finish	Capabilities for inventory management	2,00	2,00	2,00	3,00	2,00	3,00	2,00	2,00	1,00	1,00	0,00	0,00	3,00	3,00	2,00	2,00	2,00	2,00	1,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,41	1,55	1,73
Manufacturing	Production order mgmt.	Production order management	4,00	3,00	3,00	4,00	3,00	4,00	4,00	3,00	3,00	2,00	0,00	0,00	3,00	3,00	3,00	3,00	0,00	0,00	2,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,45	2,27	2,09
Distribution & Transport	Transportation logistics	Transport logistics - internal	3,00	3,00	3,00	1,00	3,00	1,00	3,00	3,00	3,00	3,00	2,00	2,00	3,00	3,00	3,00	3,00	2,00	2,00	2,00	2,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,83	2,45	2,09
		Transport logistics - external	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	2,00	2,00	3,00	3,00	3,00	3,00	2,00	2,00	2,00	2,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,45	2,45
Strategic fit indicator			3,20	2,60	2,60	2,60	2,70	2,50	3,10	2,33	2,60	2,10	0,80	0,70	2,70	2,70	2,80	2,70	2,30	1,90	1,60	1,50	0,30	0,30	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00			
Average degree of strategic fit by the SCM capability			2,83		2,83		2,83		3,00		2,24		1,00		1,41		1,00		2,00		1,00		0,00		0,00		0,00		0,00		0,00		0,00				

Fig. 18: The upstream and downstream management calculation sheet of case study B

Relationship Management																																	
Core processes and IS capabilities			Contribution of functional IS capabilities for SCM to high-order SCM capabilities																		Contribution of IS capabilities for SCM to strategic capabilities										Calculated levels of fitness and levels of degree of strategic fit		
Core processors	IS capabilities	Detailed organisational & functional capability	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Ideal level	Actual level	Fit indicator	Average degree of ideal levels	Average degree of actual levels
			Information exchange		Coordination		Activity integration		Resource collaboration		Supply chain agility		Supply chain responsiveness		Supply chain risk management		Internal analysis		External analysis		Aggressiveness		Defensiveness		Futurity		Proaktiveness		Riskiness				
Customer relationship management	Capabilities for strategic CRM	Capabilities for customer stakeholder management	1,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,07	0,07
		Capabilities for supporting relationship sustainability	1,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,07	0,07
	Capabilities for operational CRM	Capabilities for lead and backlog management	3,00	2,00	3,00	2,00	3,00	2,00	0,00	0,00	3,00	3,00	3,00	3,00	3,00	3,00	1,00	1,00	0,00	0,00	4,00	3,00	3,00	3,00	0,00	0,00	4,00	3,00	3,00	3,00	2,24	2,36	2,00
		Capabilities for customer contact management	4,00	4,00	4,00	4,00	2,00	2,00	0,00	0,00	0,00	0,00	0,00	0,00	3,00	3,00	4,00	3,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00	1,36	1,14
	Capabilities for sales analytics	Capabilities for sales analysis (e.g. Sales revenue analysis; opportunity analysis)	4,00	4,00	4,00	4,00	4,00	3,00	0,00	0,00	2,00	2,00	0,00	0,00	3,00	3,00	3,00	3,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	1,00	2,29	2,21
Strategic fit indicator			2,60	2,40	3,67	3,33	3,00	2,33	0,00	0,00	2,50	2,50	3,00	3,00	3,00	3,00	2,67	2,33	2,00	2,00	3,00	2,50	2,50	2,50	2,00	2,00	3,00	2,50	2,50	2,50			
Average degree of strategic fit by the SCM capability			1,00		1,00		1,41		0,00		0,00		0,00		0,00		1,00		0,00		1,00		0,00		0,00		1,00		0,00				

Fig. 19: The relationship management calculation sheet of industrial case study B

AUTHOR'S ADDRESS

Jochen Nürk, Faculty of Business and Economics, Mendel University in Brno, Czech Republic; SAP SE, Dietmar-Hopp-Allee 16, 69190 Walldorf, Germany, e-mail: j.nuerk@sap.com