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# Digitalization and its Impact on the Future Role of SCM Executives in Talent Management – An International Cross-Industry Delphi Study

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In the field of supply chain management (SCM), attracting and developing appropriate talent is critical for achieving most SCM goals, as extensive skills are necessary to do the job properly. In order to ensure that future-proof talent can continue to emerge in this discipline, the role of SCM executives is extremely important. Although many studies have been conducted in the field of talent management (TM), the future role of SCM executives has been mostly neglected in research. The present empirical study addresses this gap, taking into consideration the fourth industrial revolution, as innovation in technology continues to drive significant changes in the SCM field. Aiming to investigate the extent to which increasing digitalization is influencing the future role of SCM executives, a Delphi study with 103 experts from industry, academics, and politics/associations was carried out. In order to identify meaningful topic clusters from the data, fuzzy c-means clustering was used. From an actor-network theory perspective, our results show that in some areas of TM, digitalization is leading to a strong fusion of SCM executives and digital technologies, as well as to a clear division of roles, in which either SCM leaders or technology will dominate in the future.

**Keywords:** talent management; digitalization; Delphi method; supply chain

## INTRODUCTION

With the introduction of the term "the war for talents" by some McKinsey consultants in the late-1990s (Collings and Mellahi 2009), the concept of talent management (TM) has become one of the most widespread topics in the discipline of human resource (HR) management for both practitioners and academics (Collings and Mellahi 2009; Collings et al. 2011; Collings 2014; Al Ariss et al. 2014). In recent years, many research contributions have been made in the field of TM, as it has been seen as an increasingly important field for organizations across the world (Iles et al. 2010; Pandita and Ray 2018; Gallardo-Gallardo et al. 2013). The reason for this growing awareness is the continued shortage of talent, which is influenced by various trends, including changes in demographics, globalization, rising mobility (Thunissen et al. 2013; Beechler and Woodward, 2009), and major career shifts (Goffnett et al. 2012). However, the influencing factors for a lack of talent are not only external in nature. Indeed, executives must also play their part (Joyce and Slocum 2012) in one of the most important strategic issues of the twenty-first century (Dries 2013; Collings and Mellahi 2009; Mellahi and Collings 2010). The debate surrounding TM has attracted the attention of senior management to a much stronger extent than in the past (Collings 2014). However, executives recognize the significance of TM (Collings 2014), but often do not

assign talent the necessary priority on their to-do list (Joyce and Slocum 2012; Schuler et al. 2011; Tafti et al. 2017) and frequently do not manage it in an effective way (Collings 2014; Collings et al. 2011). This is by no means surprising given that the role of executives in TM remains a largely unexplored research area.

In the field of supply chain management (SCM), attracting and developing suitable talent is critical for achieving most SCM goals as extensive skills are necessary to do the job properly (van Hoek et al. 2002). In order to ensure that "future-proof" talent can continue to emerge in this discipline, it is important to examine the research gap of the "future role" of SCM executives in TM. To this end, it is essential to consider the fourth industrial revolution, as innovation in technology continues to drive significant changes in the SCM field (White et al. 2008; Goldsby and Zinn 2016; Min et al. 2019; Waller and Fawcett 2013). Industry 4.0 solutions are expected to significantly impact all facets of the organization and operation of a firm's supply chain (Sanders et al. 2019; Klumpp and Zijm 2019). Digital technologies such as additive manufacturing, with its ability to complete production in one step, can result in increasingly decentralized production (Kurpjuweit et al. 2019), revolutionized inventory and warehouse management strategies (Goldsby and Zinn 2016), fewer logistical requirements, and reduced need for different vendor levels as well as the required amount of suppliers (Ivanov et al. 2018). Furthermore, improvements in IT technology such as blockchain technology, big data, or artificial intelligence (AI) applications including the Internet of Things have already automated certain activities in SCM (Dash et al. 2019; Klumpp and Zijm 2019; Min et al. 2019) and have given executives the

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opportunity to focus on strategic considerations (Sanders and Premus 2002). This trend is conceivable in a similar form in the area of SC talent management. We assume that only by taking this central aspect into account it will be possible to develop a sustainable understanding of the SCM executive role. This work aims to investigate the extent to which increasing digitalization is influencing the future role of SCM executives in TM and giving decision makers' orientation on how to prepare SCM leaders for the future. Following Flöthmann and Hoberg (2017), in this study, we focus particularly on the "executive" level, considering SCM managers with a team responsibility. In particular, we focus on two research questions in this study:

*RQ1: How will digitalization influence the role of supply chain executives in talent management?*

*RQ2: Which meaningful topic clusters can be derived to provide guidance for decision makers in developing robust and promising strategies to prepare supply chain executives for the future?*

The Delphi methodology has proven its worth in the assessment and evaluation of future events, and it has been used successfully in various disciplines, such as the social sciences (Strauss and Zeigler 1975; Guglyuvatyy and Stoianoff 2015; Mukherjee et al. 2015; Ocampo et al. 2018), business (Huber and Delbecq 1972; Czinkota and Ronkainen 1997; Hsiao 2006), education (de Villiers et al. 2005; Calabor et al. 2019), information systems (Brancheau et al. 1996; Schmidt et al. 2001; Turoff 2002; Akkermans et al. 2003; Rowe and Wright 2011), as well as logistics and SCM (Ecken and Pibernik 2015; Hirschinger et al. 2015; Richardson et al. 2016). For example, in the field of logistics and SCM, Richardson et al. (2016) recently published an original research article in the *Journal of Business Logistics* on factors influencing the repositioning of global inventory. This piece held strong relevance to the authors when designing the study at hand. Richardson et al. (2016) conducted a Delphi survey among various experts. Similarly, we identified subject matter experts in SCM and TM and invited them to take part in our Delphi panel. Finally, 103 experts shared their assessments in the study.

Our manuscript is structured as follows. First, relevant literature regarding TM is presented, and the actor-network theory is described. Next, a detailed description of the research methodology is provided. Subsequently, the quantitative and qualitative results of the real-time Delphi study are discussed, and potential future topic clusters of the role of SCM executives in TM are presented. Finally, the paper closes with a summarizing conclusion and identifies implications, limitations, and potential avenues of future research.

## LITERATURE REVIEW AND THEORY

### Talent management in the area of HR and SCM

Since the concept of TM emerged in the 1990s (Collings 2014), one of the most foremost topics of research has been the debate on definitions (Collings 2014; Thunnissen et al. 2013; Cappelli

and Keller 2014). An analysis of TM definitions developed over the years revealed that the global view of TM is now one of the most frequently used perspectives in the literature (Gallardo-Gallardo and Thunnissen 2016). The driving forces behind this approach includes changes in global demographics leading to talent supply problems (McDonnell et al. 2017) and the increasing internationalization of companies over time (Al Ariss et al. 2014). In this context, Mellahi and Collings (2010) define global TM as "the systematic identification of key positions which differentially contribute to the organization's sustainable competitive advantage on a global scale, the development of a talent pool of high potential and high performing incumbents to fill these roles which reflect the global scope of the multinational enterprise (MNE), and the development of a differentiated human resource architecture to facilitate filling these positions with the best available incumbent and to ensure their continued commitment to the organization" (Mellahi and Collings 2010, p. 143). However, Al Ariss et al. (2014) notice that many corporations fail to fill strategically critical positions due to an inadequate supply of talents (Ready and Conger 2007; Al Ariss et al. 2014). Several researchers highlight difficulties such as filling vacancies due to issues such as the lack of talent possessing the necessary skills (Makarius and Srinivasan 2017; Whysall et al. 2019) or insufficient capabilities of talent to keep pace with technological change (Tatoglu et al. 2016). According to Al Ariss et al. (2014), other scholars argue that companies fail to seize the possibility for strategic success by underestimating the relevance of TM. In this regard, they emphasize the crucial role that executives play in building and sustaining talent in order to realize maximum performance (Joyce and Slocum 2012; Al Ariss et al. 2014).

While digitalization challenges existing SCM principles (Sanders et al. 2019; Klumpp and Zijm 2019), such as the necessity for human involvement as well as interpersonal confidence in any buyer and supplier interaction (Schmidt and Wagner 2019), researchers also assume that several trends will impact the future development of TM (Wiblen et al. 2012; Morgan 2014; Barley et al. 2017; Collings and Isichei 2018). According to Collings and Isichei (2018), these trends include (1) collaboration platforms allowing talent to connect at anytime, anywhere (Morgan 2014); (2) big-data analytics improving talent identification (Wiblen et al. 2012) and decision making (Collings and Isichei 2018) and (3) the growing mobility of work facilitating more project-based work (Barley et al. 2017). In this context, Whysall et al. (2019) examine the transformational changes of digitalization and their impact on TM. They state that in the context of digitalization, it is no longer sufficient to use classical TM methods such as poaching ready-made talent from other companies, as the skills for taking on future roles are not yet sufficiently available in the talent education system (Amankwah-Amoah et al. 2017; Whysall et al. 2019). Consequently, the authors claim that there is a need for more dynamic and evolutionary procedures to address talent development (Whysall et al. 2019).

However, TM is omnipresent not only in the discipline of HR research, but also in specialist research fields such as SCM. The importance of people in SCM and the criticality in the development of SCM talent is highlighted in various research

studies (van Hoek et al. 2002; McCarter et al. 2005; Stank et al. 2011; Sweeney 2013; Thomas 2014). In this context, van Hoek et al. (2002) identify managers in the field of SCM as the crucial factor. Regardless of the economic situation, attracting and training the suitable supply chain managers are regarded as the important issue for achieving most SCM goals. As an essential reason for the decisive influence of people, van Hoek et al. (2002) emphasize the richness of the necessary capabilities to do the job properly, especially in the field of SCM. Accordingly, over the years a significant amount of research has explored the skills and competency requirements necessary for SCM talents (Gammelgaard and Larson 2001; Gibson and Cook 2001; Myers et al. 2004; Mangan and Christopher 2005; Murphy and Poist 2006; Richey et al. 2006; Derwik et al. 2016; Goffnett et al. 2016; Derwik and Hellström 2017; Makarius and Srinivasan 2017; Tatham et al. 2017; Flöthmann et al. 2018; Kotzab et al. 2018).

According to van Hoek et al. (2002), often, only the technical aspects are considered in the training of SCM talents. However, this is insufficient to successfully master the richness of SCM requirements. From the authors' perspective, aside from the technical capabilities, a stronger focus on the human aspects of SCM talents is essential (van Hoek et al. 2002). Stank et al. (2011) focus more on the capabilities required to manage modern supply chain enterprises. In their research, they place the focus on four critical skill dimensions: leadership qualities, cross-functional understanding, technical savviness, and global orientation (Stank et al. 2011). Myers et al. (2004) studied the impact of education, experience, and job skills on talent performance. In their study, they state that education and experience are not irrelevant but that social skills, decision-making skills, problem-solving skills, and time-management skills are more important (Myers et al. 2004). In summary, Goffnett et al. (2016) criticize the fact that the majority of these studies focus on the importance of individual skills. In their study, they therefore argue that it is essential to focus on more factors than just importance in order to avoid inefficiencies and possible oversights in TM programs (Goffnett et al. 2016).

Due to the rapid changes in SCM practice, not only companies, but also lecturers in higher education are challenged to train SCM talents. Therefore, over the years, research contributions have been developed regarding approaches for modern and practice-relevant SCM education (van Hoek 2001; Lutz and Birou 2013; Gibson et al. 2016; Grasas and Ramalhinho 2016; Camps 2017; Sun and Song 2018). In this context, van Hoek (2001) emphasizes the importance of more strongly integrating relevant topics from practice into courses as well as focusing on developing the research skills of talents. In addition, he also presents methods to improve the market relevance of courses and research skill development (van Hoek 2001). Lutz and Birou (2013) provide benchmarking information that allows academics to compare their individual courses to the aggregated results of the study in order to compare the courses to the needs of industry and thereby enhance course format and prepare high-performing alumni. Their research shows that both bachelor's and master's courses in the field of SCM must focus more on problem analysis and tools. Furthermore, they identified the important gap in social skills that must be closed (Lutz and Birou 2013).

## Theoretical lenses

There has been a controversial discourse concerning the identity of the information system area, in which—among others—Allen Lee (2001) expresses himself with his contribution to the “editor's comment” regarding the definition of an information system (Hanseth et al. 2004). In his view, research in the field of information systems (IS) is more than simply investigating the technological system, the social system, or even both systems side by side. Research in the field of IS also increasingly examines the phenomena that arise when technological and social systems interact with each other (Lee 2001). Indeed, this phenomenon also affects actors such as SCM executives and SCM talents and their interaction in increasingly digitized supply chains. The actor-network theory (ANT) deals with this interaction and is focused on investigating the borderline between the social and technical systems (Walsham 1997; Hanseth et al. 2004). Thus, this theory provides the theoretical lens that is necessary in order to analyze and better understand the impact of digitalization on the role of SCM executives in TM. Additionally, in order to ensure high-quality field research, ANT provides the appropriate methodological framework (e.g., type of research questions, type and nature of data collection, etc.) for our research phenomenon and offers a fixed context in which new research can be established (Edmondson and McManus 2007). Since ANT can suggest formal hypotheses but not enough to do them with numbers alone, as well as drawing on earlier work from different literature bodies (e.g., Sage et al. 2011; Lee et al. 2015; Shim and Shin 2016; Burga and Rezanian 2017; Sage et al. 2019), we follow Edmondson and McManus (2007) and classify ANT as an intermediate theory. Therefore, we use the proposed methodological framework of intermedia theory, for example, research questions investigating relationships between new and established constructs or integrate qualitative and quantitative data aiming to shed light on mechanisms between SCM executives and digital technologies (Edmondson and McManus 2007). Our approach is consistent with other studies, in which ANT provides a research framework that enables the examination of phenomena that occur when technological and social systems interact with each other (e.g., Lee et al. 2015; Shim and Shin 2016; Burga and Rezanian 2017; Sage et al. 2019).

Through the theoretical lens of ANT, society is considered as a diverse collective of human beings, albeit together with technology (Doolin and Lowe 2002). These correlations are assumed to be networks of human (e.g., SCM executives) and nonhuman actors (e.g., AI) (Callon 1991; Doolin and Lowe 2002). In this context, an actor is regarded as the origin of an action (e.g., the selection of new SCM talents), irrespective of whether it is a human (SCM executive) or an object (AI) (Doolin and Lowe 2002). As a result, ANT de-emphasizes any consideration of either the human being or the object as an actor but instead combines the conceptual elements of technological and social determinism (Latour 2005; Belliger and Krieger 2006; Faraj et al. 2004). The interplay between the actions of humans and objects is merged into a collective action in the actor network (Belliger and Krieger 2006; Shim and Shin 2016). In ANT, tracking down associations or relationships of, for example, human SCM executives and nonhuman actors such as AI in TM, is a core element

(Latour 2005; Cresswell et al. 2010). ANT suggests that when an actor is either removed from the network or added, as it holds for the application of digital technologies in TM, the performance of the entire network is affected. Nevertheless, it is believed that social reality is fluid, and thus networks are evolving continuously (Cresswell et al. 2010).

## RESEARCH METHODOLOGY

### Delphi method selection

For our foresight study on the role of SCM executives in supply chain TM, we chose a Delphi format for several reasons. First, the Delphi approach is very suitable for studying the effects caused by a specific context of long-term transformation that has been technologically induced (Rowe and Wright 1999; Winkler et al. 2015), as the format engages the thinking of a group of experts independently (Linstone and Turoff 2011) but is able to provide—unlike single predictions—increased group-based forecast accuracy (Dalkey 1969; Landeta 2006). In addition, the approach was chosen because it is suitable for systematically structuring a group-based discussion process among experts (Linstone and Turoff 2011) and may lead to consensus in terms of a projection or question (Diamond et al. 2014). The method has a long tradition in nearly all research disciplines (Gupta and Clarke 1996; Landeta 2006), and Delphi studies have been used to examine phenomena in logistics (Melander et al. 2019; Richardson et al. 2016), information and communication technologies (Keller and von der Gracht 2014), education (Gary and von der Gracht 2015), and other disciplines. In the case of our research, we conducted the Delphi survey online instead of using a paper-and-pencil approach, since it was convenient for participants and to make real-time calculations of the expert panel statistics (Geist 2010; Gnatzy et al. 2011; Aengenheyster et al. 2017; Gossler et al. 2019; Steinert 2009).

### Delphi projection formulation

The creation of future event statements—known as Delphi projections—holds particular importance for insightful results and findings (Loveridge 2002; Warth et al. 2013). Therefore, we followed the systematic and structured procedure presented by Lechler et al. (2019) to create an appropriate set of thirteen projections encompassing the future role of SCM executives in TM in the year 2040. Figure 1 shows the comprehensive procedure to develop the Delphi projections.

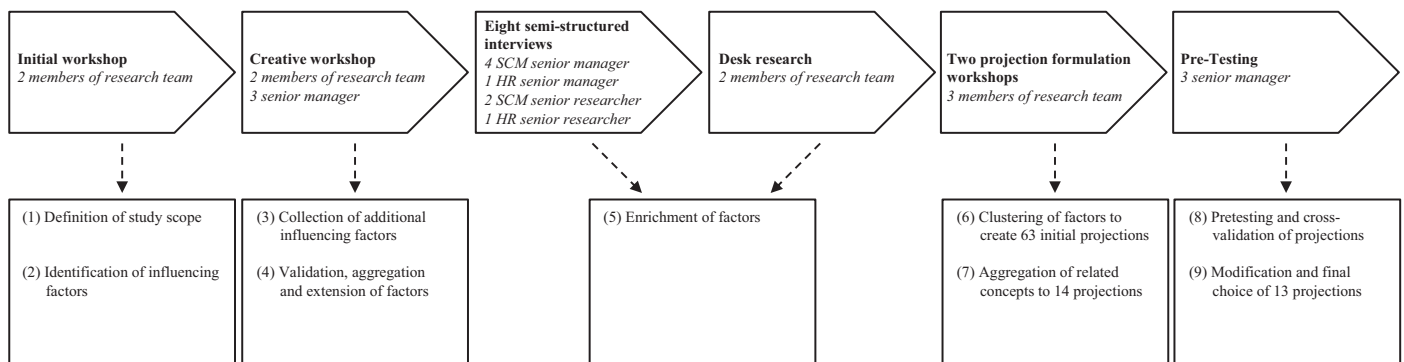
The first step comprised the organization of an initial workshop to specify the study's scope. In addition, special emphasis was placed on the identification of initial influencing factors. Subsequently, a creative workshop with two senior experts in SCM and one senior expert in HR from industry was conducted to further identify and group factors for the elaboration of projections. In order to establish a robust link between the scope of the workshop and the theoretical lens (ANT), we followed the framework of field research by Edmondson and McManus (2007). Accordingly, we focused on topic areas and narrowed

them to a meaningful size by structuring the workshop based on the talent life cycle presented by Schiemann (2014), which encompasses all phases of interaction between an organization and its talents. This spans (1) talent attracting, (2) talent recruiting, (3) talent onboarding, (4) talent developing, (5) talent managing, (6) talent retaining, and (7) talent recovering (Schiemann 2014). Based on the theoretical lens of ANT, workshop questions for each TM phase were additionally prepared to address the necessary theoretical relevance (Edmondson and McManus 2007). In order to lead the workshop toward ANT, the questions focused on the borderline and interaction between SCM executives and digital technologies. Therefore, workshop participants were asked to collect and propose influencing factors of digitalization effecting the future role of SCM executives in each phase of the talent life cycle. Afterward, factors were discussed to cross-validate, and similar factors were aggregated and extended where necessary. Furthermore, eight semi-structured interviews with five senior managers and three senior researchers in the field of SCM and HR were conducted to enrich the database. In order to meet the requirements of the framework to consider prior work and recent literature (Edmondson and McManus 2007), the internal database was further enriched through extensive desk research of academic and practitioner literature. Based on the completion of collecting factors, two further projection formulation workshops were held. The procedure was iterative, involving multiple rewording and reformulation of projections, and modifications in the order of statements. For the final elaboration of projections, generally recognized formulation rules were used (Linstone and Turoff 1975; Markmann et al. 2020; Mitchell 1996; Rowe and Wright 1999; Loveridge 2002). In this regard, further comments on scientific expressions were provided to decrease the ambiguity (Rowe and Wright 1999; Loveridge 2002). Furthermore, attention was paid to compliance with other formulation rules. Subordinate clauses were avoided (Rowe and Wright 1999) or a balance between the wealth of information and sentence length was maintained (Salancik et al. 1971). Finally, a pretest and cross-validation were carried out with three industry experts who did not participate in developing projections (Warth et al. 2013). This step led to the final set of thirteen projections. Detailed information about the experts participating in the projection formulation procedure is attached to the appendix.

### Selection of Delphi experts

The selection of competent and capable panelists is a crucial part of the Delphi approach, as this significantly influences the reliability of the survey results (Spickermann et al. 2014). Thus, we followed a rigorous and systematic three-stage approach that involved the identification, assessment, and recruitment of experts. The initial pool of prospective candidates included 751 experts from various fields, since this survey sought to engage and interview a broad spectrum of experts to assure a multifaceted structure of the panel, reduce biases, and thus increase the information-processing ability of the survey panel (Ecken et al. 2011; Förster and von der Gracht 2014; Roßmann et al. 2018; Winkler and Moser 2016). For each of the expert

**Figure 1:** Procedure of Delphi projection formulation based on Lechler et al. (2019).



**Figure 2:** Data collection process.

Phase	Description
1.) RT Delphi software choice	<ul style="list-style-type: none"> <li>Intense search for RT Delphi software on the internet and consideration of expert references</li> <li>Two different providers tested for usability</li> <li>Decision for one option mainly due to user friendliness, professional reporting of statistics of panel discussion as well as panelists statements</li> </ul>
2.) Access & study introduction	<ul style="list-style-type: none"> <li>Experts were provided with an individual link (ensure anonymity and reduce possible bias)</li> <li>Clear introduction (including background and aim) as well as closure of the study</li> <li>Clear instruction for data collection (quantitative and qualitative) process</li> <li>Definition of study's timeline and iterative procedure</li> </ul>
3.) Feedback to the panelists	<ul style="list-style-type: none"> <li>Immediate feedback to experts after responding to a specific question in form of:                             <ol style="list-style-type: none"> <li>Consensus/dissent in % along with group stability in %</li> <li>Number of invited participants and number of current responses</li> <li>Number of revisions</li> <li>Comments made by other panelists</li> </ol> </li> </ul>
4.) Timeline & iteration of process	<ul style="list-style-type: none"> <li>Timeline of the study: 6 weeks</li> <li>Ø Iteration per panelist: 2.7</li> <li>Revisions in total: 334</li> <li>Written statements in total: 874</li> </ul>

nominees, a score was established reflecting the specific expertise. The scores were based on a number of diversity criteria at both the surface level (age, gender, organizational function, work position) and at the deep level (professional experience,

education level, academic background, scientific contributions) (Spickermann et al. 2014). First, expert candidates with the highest score were asked to contribute to our survey. If these candidates were not interested in participating in the study, the experts

with the next highest score were asked to participate, and so forth. Overall, 103 of the 751 invited experts (13.7%) from 24 countries<sup>1</sup> participated in the study, of which 55 were from industry (53%), 35 came from academics (34%), and 13 were from politics/associations (13%). In addition, 18% of industry panelists are employed at a C-Level, 62% as a head of department, and 20% as senior managers, with an emphasis on a background in SCM (75%), HR (16%) or SCM/digital management (9%). All panelists had at least five years of experience. On average, the experts had 17.85 years of experience.

The total response rate of 13.7% is considered appropriate and justifiable, in view of the level of the selected panelists as well as comparable Delphi studies, which show similar response rates (Hirschinger et al. 2015; Lechler et al. 2019; Roßmann et al. 2018). Furthermore, by using a Kruskal–Wallis rank-sum test, a comparison between the ratings of the early respondents and those of late respondents was generated. The results of the non-response bias test did not reveal any statistically important discrepancies. The latter sample population did not feature characteristics of nonrespondents (Armstrong and Overton 1977; Wagner and Kemmerling 2010), since there was no significant difference ( $p > .05$ ).

### Data collection process

For rigorous data collection in our study, we followed the four classical Delphi characteristics: (1) iteration, (2) anonymity, (3) controlled feedback, and (4) statistical summary of group feedback (Landeta et al. 2011; Belton et al. 2019). Following Kisgen (2017), the first step in the data collection process was to select a suitable real-time (RT) Delphi software tool (Figure 2). Based on an intense search on the internet and the inclusion of expert references, two different RT Delphi tools were examined for usability. After testing the selected systems, one of the two options was chosen based on the criteria proposed by Kisgen (2017), including user-friendliness, professional reporting of statistics and panel discussions, as well as the clear presentation of panelist statements (Kisgen 2017).

For collecting data, panelists received an individual link to ensure that all their entries remained anonymous as well as to reduce bias (Kisgen 2017). As a result, halo and bandwagon effects in group discussions could be avoided (Tersine and Riggs 1976; Winkler and Moser 2016). A concise introduction that included background and purpose next to the closure of the study was provided to create a clear understanding among experts in the data collection process. All experts were asked for their anonymous judgments regarding the expected probability of occurrence (EP) of each of the Delphi projections on a scale from 0 to 100 percent, the impact (I) (if occurred) on the role of SCM executives in TM on a five-point Likert scale as well as the related desirability of occurrence (D) on a five-point Likert scale. Panelists were also asked to provide justifications for their assessments in the appropriate EP, I, and D text boxes, which

contributed to the validity of the analysis (Tapio et al. 2011). The panelists were explicitly told to exclude confidential, personal, or company information in the comments. A far-reaching time horizon of 2040 was chosen for several reasons: (1) Short time horizons (i.e., less than ten years) represent more or less extrapolation of the present and thus produce results that hardly differ from the current situation (von der Gracht 2008; von der Gracht et al. 2015); (2) a long time horizon distances experts from predetermined future events and prevents distortion (Engelke et al. 2015, 2016); (3) the time horizon of 20 years reduces the risk of experts focusing on operational rather than on strategic concerns, which has been identified as one of the prime threats to strategic thinking in SCM (Stank et al., 2005; Förster et al. 2014); (4) the far-reaching time horizon of 2040 can stimulate the expert panel's creativity and outside-the-box thinking on radically new approaches (von der Gracht 2008; Bokrantz et al. 2017; Roßmann et al. 2018; Fritschy and Spinler 2019), especially in the context of digitalization and its impact on the future role of SCM executives in TM. The selected horizon was also consistent with numerous other foresight studies in the logistics context (Liimatainen et al. 2014; Spickermann et al. 2014; von der Gracht and Darkow 2016; Roßmann et al. 2018; Fritschy and Spinler 2019; Melander et al. 2019). Each projection started with the year "2040: [Projection]" to remind participants of the long-term perspective during their participation. Furthermore, a timeline with a definite end date of the study was communicated. During this period, experts were encouraged to return to the portal, review other experts' ratings and comments, and revise their answers at any time.

Feedback to the experts on a projection was only given if an answer was provided. The group opinion was calculated in real time after responding to a question to ensure controlled feedback. The aggregations comprised the group's quantitative results (e.g., consensus/dissent in percentage along with group stability in percentage, the number of invited participants and number of current responses, the number of revisions, etc., in the form of a boxplot) as well as a summary of text arguments made by other panelists.

After completing the first assessment round, experts were able to retrieve and monitor the group's response at any time and as often as desired, as well as revise their quantitative and qualitative text answers. Data acquisition was intended to be completed in six weeks (mid-June to the end of July 2019). Following the invitation e-mail, a total of three reminders were sent to the participants at two-week intervals.

The iterative process led to a structured and multiround debate characterized by experts' reflections and changes in opinion (Rowe and Wright 1999; von der Gracht 2008). In the course of the Delphi study, the iteration and controlled feedback resulted in 334 revisions. In the process, 132 quantitative estimates were convinced upwards and 74 downwards, and 128 comments were revised. In addition, due to the pattern of stability (Erffmeyer et al. 1986), an average iteration per panelist of 2.7 times was considered sufficient. This accorded with the Delphi literature, which suggests that panelists move toward consensus/dissent or a pattern of stability by making two to four iterations (Erffmeyer et al. 1986; Boulkedid et al. 2011). Furthermore, a total of 874 written statements equaling an average of 8.5 qualitative statements per panelist indicated a high level of participation.

<sup>1</sup>Australia, Austria, Belgium, Canada, China, Denmark, Finland, France, Germany, India, Ireland, Italy, Japan, Poland, Portugal, Saudi Arabia, Singapur, Spain, Switzerland, Taiwan, Turkey, United Kingdom, United States of America, Vietnam.

Detailed information about the experts involved in the data collection process is attached in the appendix.

### Qualitative analysis

In order to find patterns and structures from the collected qualitative data, a systematic coding procedure following Strauss and Corbin (1990) was applied. The coding process was carried out independently by two researchers. Therefore, the content of the written statements for each projection was broken down with the aim of identifying and grouping similar content categories and deriving descriptive codes. Afterwards, the data were categorized into subcategories that were eventually consolidated and then transferred to superordinate categories. During the coding process, results were discussed, and any deviations were corrected until a consensus was reached among all codes. The coding process was applied to each projection, and the final set of codes was included in the discussion of the Delphi results.

## RESULTS

### Description of Delphi results

For the analysis of the Delphi results, we followed the approach presented by Roßmann et al. (2018). First, an analysis of the quantitative results was carried out for all thirteen projections of the Delphi survey. The results based on the panel's assessment of the expected probability (EP), the impact on the role of SCM executives in the case of occurrence (I) and desirability (D) are summarized in Table 1. The figures given represent the final accumulated ratings of the experts. In addition, the results are complemented by the interquartile range (IQR) of each projection.

With an impact range of 2.8–4.2, the results show a substantial effect of all thirteen projections on the future role of the SCM executive in TM. It is expected that with an average impact of 4.2, Projection 6 (human aspects) as well as Projection 11 (learning adaptability) have the most significant impact on SCM leaders in TM. In addition, the experts' assessments of the probability of occurrence of each projection show clear trends, such as Projection 13 (recovering role) with 24% or Projection 11 (intense learning adaptability) with 81%, but, on the other hand, the average dissent-marked EP estimates ranged from 40% and 60%. The average dissent-marked estimates result from a bipolar data distribution (Scheibe et al. 1975; Warth et al. 2013), since two opposite groups rated EP as both high (EP larger than 60%) and low (EP less than 40%). Moreover, the average feedback in terms of desirability shows that the experts would like the teaching of human aspects (projection 6) to become much more important than it is today. Finally, with a very low desirability of 2.4 for Projection 12 (retaining role) it can be assumed that SCM executives would like to remain an important reason for SCM talent leaving or staying in a company.

In order to confirm consensus or dissent of a group opinion, the interquartile range (IQR) was used (von der Gracht 2012; Diamond et al. 2014). In this Delphi study, a threshold IQR of less than  $\leq 25$  for EP was determined to confirm consensus, as such a threshold value is comparable with previous Delphi

studies (Warth et al. 2013; Keller and von der Gracht 2014; Roßmann et al. 2018). Based on this threshold, a consensus was reached for three out of thirteen projections. Given the multifaceted nature of the subject, the results reveal a considerable degree of dissent.

In order to identify further in-depth insights from the quantitative data, a group comparison of the final estimations for each projections dimensions of panelists from academics ( $n = 35$ ), industry ( $n = 55$ ) and politics/associations ( $n = 13$ ) was conducted in addition to the panel as a whole. In a first step, a Shapiro–Wilk test was used to check whether a normal distribution is available for all three samples. As the normal distribution could be confirmed, the final expectations with respect to EP, I, and D were compared for each of the samples as well as for all 13 projections. The application of an analysis of variance (ANOVA) test showed that estimates significantly differ in EP for Projection 2 (human caregiver) and Projection 5 (technical aspects), as well as in D for Projection 5 (technical aspects) and Projection 7 (digital network management). In order to identify which of the groups significantly differ, pairwise t-tests were carried out. The comparison revealed that the estimates on the EP for Projection 2 (human caregiver) significantly differ ( $p < .05$ ) between experts from industry and academia, with industry experts rating the expected probability of occurrence higher on average. In case of the EP for Projection 5 (technical aspects), industry experts expect that the teaching of technical aspects can no longer be fully carried out by SCM executives and is more likely to take place at a substantial level ( $p < .05$ ); this expectation is higher than among experts from academia (71% compared to 54%). In addition, for Projection 5 (technical aspects), major discrepancies in the desirability of occurrence could be observed for both industry versus academia ( $p < .05$ ) and industry versus politics/associations ( $p < .05$ ). Experts from industry evaluated the occurrence of Projection 5 (technical aspects) to be significantly more desirable than did the panelists from academia (3.7 compared to 3.0) and experts from politics/associations (3.7 compared to 2.8). Furthermore, industry experts rated the desirability of Projection 7 (digital network management) as more significant ( $p < .01$ ) than experts from academia (3.4 compared to 2.8). Overall, the group comparison indicates that the participants from industry are more optimistic than the experts from academia with regard to the expected probability and desirability of some projections.

Conducting the second group comparison (participants from Europe, North America, and the Asia Pacific region) indicated that the estimates significantly differ ( $p < .05$ ) for I for Projection 1 (digital influencer) between experts of the regions Asia Pacific and Europe (4.0 compared to 3.1). Furthermore, experts from Asia Pacific also expected the impact of digital network management on the SCM executive in TM to be significantly stronger ( $p < .05$ ) than panelists from Europe and North America (4.4 compared to 3.4 and 4.4 compared to 3.3, respectively). In the case of the EP for Projection 2 (human caregiver), it can be said that expectations vary significantly ( $p < .05$ ) between panelists from Europe and North America (66% compared to 47%). In addition, Asia Pacific panelists evaluated the EP the human aspects is the key role of SCM executives in talent development significantly higher compared to experts from Europe (91%



**Table 1:** Quantitative Delphi results

No.	Projections for 2040	Phase	EP	I	D	IQR
1	2040: The role of a digital influencer is an essential part of the SCM executive in attracting SCM talents for a company.	(1)	60%	3.3	3.0	40.0
2	2040: A human caregiver in the form of a SCM executive has become a significant competitive advantage in attracting SCM talents for a company.	(1)	64%	3.8	3.8	30.0
3	2040: Artificial intelligence has completely replaced SCM executives in the SCM talent recruiting process.	(2)	35%	3.3	2.5	40.0
4	2040: Digital onboarding processes for SCM talents without any involvement of SCM executives have become the standard.	(3)	46%	3.0	2.7	55.0
5	2040: The teaching of technical aspects can no longer be fully carried out by SCM executives according to the requirements.	(4)	64%	3.6	3.3	40.0
6	2040: The teaching of human aspects is the key role of SCM executives in talent development.	(4)	77%	4.2	4.2	20.0
7	2040: Digital network management among the SCM talents has replaced the SCM talent development by a SCM mentor.	(5)	58%	3.5	3.1	40.0
8	2040: Daily performance monitoring and initiation of necessary technical development activities for SCM talents is carried out by artificial intelligence.	(5)	69%	3.7	3.6	40.0
9	2040: SCM executives have to take the role of a psychologist reducing the talent burn rate in SCM talent management.	(5)	59%	3.6	3.2	52.5
10	2040: Digital employer platforms offering project-related SCM experts have replaced the need for SCM talent management.	(5)	50%	3.4	2.9	40.0
11	2040: Intense learning adaptability of SCM executives themselves is the key feature for successful SCM talent management.	(5)	81%	4.2	4.0	25.0
12	2040: SCM executives do no longer play a crucial role in retaining SCM talents to a company.	(6)	26%	3.1	2.4	30.0
13	2040: Recovering of educated SCM talents has become irrelevant in SCM talent management.	(7)	24%	2.8	2.3	20.0

EP = expected probability (0 – 100%); I = impact (five-point Likert scale; 5 = very high); D = desirability (five-point Likert scale; 5 = very high); IQR = interquartile range.

compared to 75%). Finally, Asia Pacific experts assess the EP of Projection 7 (digital network management) as more significant than panelists from Europe and North America (78% compared to 57% and 78% compared to 49%, respectively). Overall, this group test shows that there is a trend toward higher estimates by experts from the Asia Pacific region. As a result, this group comparison indicates the presents of cultural differences, with Asian panelists tending to rate the probability of occurrence and the impact of digital technologies on the role of SCM executives in TM higher.

Since the group comparisons did not reveal any further differences in the large number of estimates for EP, I, and D, the results further strengthen the credibility of the findings (Roßmann et al. 2018).

#### Development of topic clusters through fuzzy c-means clustering

In order to guide the quantitative assessments and the interpretation of the qualitative data on how digitalization is influencing the future role of SCM executives (RQ1), as well as to give decision makers' orientation on how to prepare SCM leaders for the future (RQ2), a cluster analysis was performed. Following Roßmann et al. (2018), the cluster analysis was carried out to assign the quantitative statements for each individual projection according to EP, I, and D. This approach contributed a systematic procedure according to which to

structure and discuss qualitative comments to gain insights into the quantitative data (Nowack et al. 2011; Tapio et al. 2011). Furthermore, it produced for decision makers a clear overview of the different topic clusters as well as provided guidance, for example, on prioritizing clusters according to a high probability of occurrence and high impact on the future role of SCM executives in TM.

In order to define the pertinent content of the topic clusters, the fuzzy clustering technique was used for each Delphi survey dimension. This approach is appropriate for small sample sizes (Josien and Liao 2000) and enables detecting potential intersections of objects with other clusters (see Projection 8) (De Oliveira and Pedrycz 2007). In order to indicate the degree of cluster affiliation of each projection, the fuzzy clustering algorithm was applied. The degree of membership of a projection to a cluster was expressed by a value between 0 and 1. The closer the value to 1, the higher the degree of membership (Bezdek 1981; Bezdek et al. 1999). Table 2 lists the individual membership values of each projection to the clusters. The algorithm's formulas and a methodological description of fuzzy clustering can be obtained from Bezdek (1981).

#### DISCUSSION OF TOPIC CLUSTERS

Our research uses four clusters of two, six, two, and three projections (see Figure 3) to illustrate the different ways in which

**Table 2:** Results from fuzzy c-means clustering

No.	Projection	Degrees of membership				Projection assignment			
		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 1	Cluster 2	Cluster 3	Cluster 4
1	Digital influencer	0.010	0.966	0.021	0.003		X		
2	Human caregiver	0.035	0.937	0.023	0.005		X		
3	AI in recruiting	0.022	0.058	0.264	0.655				X
4	Digital onboarding	0.003	0.011	0.979	0.008			X	
5	Technical aspects	0.037	0.933	0.024	0.005		X		
6	Human aspects	0.990	0.007	0.002	0.001	X			
7	Digital network management	0.027	0.868	0.094	0.011		X		
8	Performance monitoring	0.401	0.519	0.064	0.017		X		
9	Psychologist role	0.019	0.924	0.051	0.007		X		
10	Digital employer platforms	0.008	0.045	0.935	0.012			X	
11	Intense learning adaptability	0.967	0.022	0.007	0.003	X			
12	Retaining role	0.000	0.001	0.002	0.996				X
13	Recovering role	0.002	0.004	0.011	0.982				X

digitalization influences the role of SCM executives in the various phases of TM.

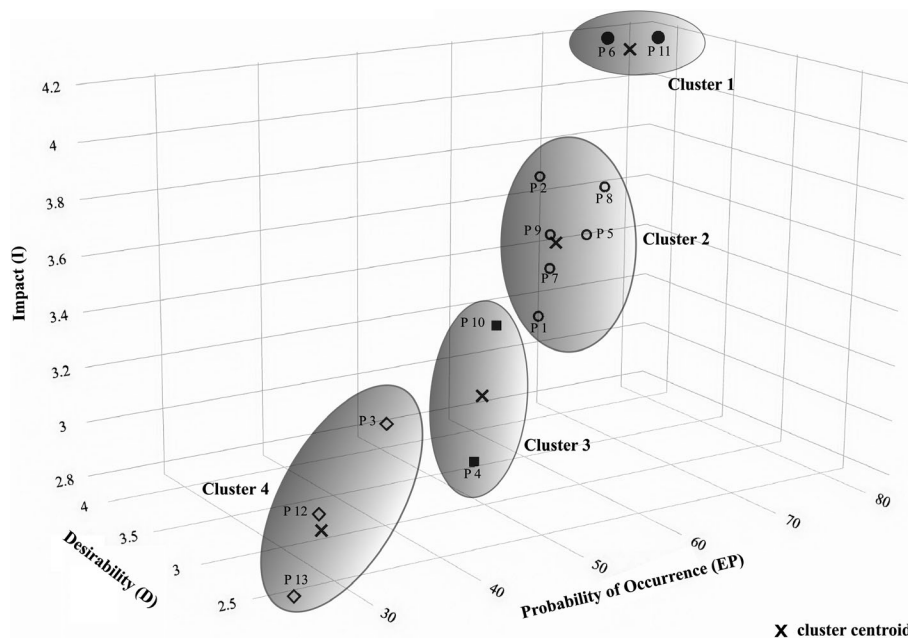
**Cluster 1: SCM executive dominance**

The first cluster consists of Projection 6 (human aspects) as well as Projection 11 (intense learning adaptability) and is characterized by a very high probability of occurrence ( $\geq 77\%$ ) as well as a very high influence on the role of SCM leaders in TM ( $\geq 4.2$ ). It is therefore a cluster on which decision makers should focus when developing strategies to prepare SCM executives for the future.

*Development of human aspects (CI.1)*

The experts assume that the development and promotion of the human aspects (see Projection 6) of SCM talents in the course of progressive digitization will hold increasing importance. Additionally, experts believe that with a higher probability of AI and economies of scale, the human factor will remain the differentiating element, which is why the human aspect must be further developed in the case of SCM talents. Moreover, due to further digitalization, national borders will no longer be an obstacle, which—especially in the context of SCM—makes it much more necessary to interact with other people from countries around the world. The ability to, for example, interculturally communicate,

**Figure 3:** Classification of projections into clusters.



negotiate, manage relationships, and create empathy toward each other is therefore indispensable and an essential component of SCM talent development. A recent study of Langer et al. (2016) assumes that, for example, interpersonal skills can be trained to some extent by AI. By contrast, experts in our study see the development of human aspects, with SCM executives fulfilling this important role in the future, since it is assumed that exactly these aspects cannot be adequately taught by any digital technology, but rather only by human SCM executives. A clear focus on the further development of the human aspects among the talents will provide the opportunity to finally adopt the actual role of an SCM executive in TM, namely, being a leader (managing people) instead of a manager (managing things).

The findings of other studies show that human aspects are important in supply chain TM but are still not sufficiently focused on (van Hoek et al. 2002; Sweeney 2013; Thomas 2014; Wieland et al. 2016). Despite procedural advancements and technological innovations (Mangan and Christopher 2005), studies assume that human talents, not technologies, remain the core of supply chains (Kirby 2003; Mangan and Christopher 2005; McCarter et al. 2005). Like us, Wieland et al. (2016) note that supply chains are complex socio-technical systems, not soulless machines, and are therefore influenced by personal communications. Therefore, SCM talents must be empowered not merely with the technical skills to manage the supply chain (van Hoek et al. 2002), but also with human aspects (van Hoek et al. 2002; Mangan and Christopher 2005; Ketchen and Hult 2007; Shub and Stonebraker 2009).

#### *Intense learning adaptability (C1.2)*

In general, the SCM executive will continue to be attributed strong importance for successful TM. However, the experts argue that this is essentially dependent on the respective learning adaptability (see Projection 11) of the SCM executive. This learning adaptability is already a central aspect today. In an increasingly fast-moving digital world in which experts assume that the half-life of knowledge is dramatically reduced, intense learning adaptability is the distinctive feature of an SCM leader. An SCM executive who tries to achieve a lot by referencing experiences and routines will experience difficulty in this environment because many of the new requirements are not anchored in their existing experiences. In addition, it is assumed that new generations of SCM talents will increasingly ask for this intensive learning adaptability (Table 3).

Several studies have shown that SCM has always faced increasing turbulence in the business environment, competing markets, ever-faster cycle times, and complex supply chains (Makarius and Srinivasan 2017; Tatham et al. 2017). Considering these circumstances and the cross-disciplinary character of SCM (Derwik and Hellström 2017), our findings support available studies in the sense that people in the SCM field are also subject to intense learning adaptability (Kotzab et al. 2018; Wrobel-Lachowska 2018). Additionally, our findings support a recent study by Wrobel-Lachowska (2018) that found that digital technologies increase the requirement of intense learning adaptability. This study also found that logistics managers in the digital age should not rely solely on their experience; if they do, the skills gap between newly trained managers and managers who

completed their training many years earlier will create an insurmountable hurdle (Wrobel-Lachowska 2018).

#### **Cluster 2: SCM executives and digital technologies - hand in hand**

Six projections are encompassed within Cluster 2. While the panelists assume that these projections will be realized by the year 2040, an average EP range of 58% to 69% shows that the experts are overall divided (Roßmann et al. 2018). Taking into account the impact of all six projections on the role of SCM executives ( $\geq 3.3$ ), this cluster should also be taken seriously for the future role preparation of SCM executives in TM.

#### *Development of technical aspects (C2.1)*

Delphi panelists expect that the technical aspects (see Projection 5) of talent will no longer be developed by the executive him-/herself. They argue that as a result of increasing digitalization, the complexity of the influencing factors can no longer be learned, applied, and passed on to talent by the SCM executive quickly enough. This leads to a high degree of specialization in the field of training technical aspects. Since this change requires more targeted training and additional education of SCM talents, experts assume that the training of the technical aspects will be carried out by specialists or AI. According to these experts, the influence of AI increases in this field, since logical causal chains can be learned through machine-supported processes. However, there is disagreement about the intensity of the AI influence: Some experts believe that technical skills will be completely taught by AI while others expect that AI and SCM executives will complement each other (i.e., the training of the basics will be undertaken by AI, but in practical application and fine-tuning skills, the SCM executives will play a greater role). Other experts are actually convinced that AI is not ready to take on this role and that the SCM leader will remain in the lead.

Our research findings support extant research indicating that the teaching of technical aspects is increasingly moving toward digital technologies. SCM lecturers of universities, for example, are confronted with different challenges when teaching technical aspects (Camps 2017). The primary challenge is the increasing SCM complexity. Furthermore, the challenge to teaching technical aspects is to bridge the existing gap between science and industry. The third, and in our case, fundamental, challenge is related to SCM teaching methods (Camps 2017). According to Camps (2017), classroom teaching remains the dominant form of teaching content but is less stimulating. In this context, several studies, such as those of Sweeney et al. (2010) and Camps (2017), reveal that talents are more interested in the use of technology in SCM education since multimedia illustrations are considered as pleasant and improve understanding of supply chain issues (Sweeney et al. 2010; Camps 2017). It is therefore hardly surprising that SCM simulations and games have increasingly been used in teaching in recent years (Grasas and Ramalhinho 2016; Sweeney et al. 2010; Camps 2017). However, not only at universities, but also in other fields, research projects in the area of machine learning (Silver et al. 2018), deep learning (LeCun et al. 2015), and the gamification of production and logistic processes (Warmelink et al. 2020) reveal that the influence of AI is increasing.

**Table 3:** Overview of major/sub-issues for each topic cluster based on Sauer and Seuring (2019).

No.	Major Issue	Subissue	Exemplary Representative Quotes
C1	<i>SCM executives dominance</i>		
C1.1	Development of human aspects	<ul style="list-style-type: none"> <li>• With the increasing use of AI, the human factor will remain the differentiating element</li> <li>• National borders will no longer be an obstacle, which makes it much more necessary e.g., to interculturally communicate, negotiate, manage relationships and create empathy toward other people from countries all over the world</li> <li>• Human aspects cannot be adequately taught by any digital technology</li> <li>• Stronger focus on human aspects identifies someone as an SCM leader instead of an SCM manager</li> </ul>	<ul style="list-style-type: none"> <li>• “With a greater probability of robotization and economies of scale, the human factor is likely to be the differentiating element.”</li> <li>• “Human aspects can only be developed by humans. No robot or digital medium can do that (...). In a digital world the importance of human aspects will increase dramatically (...). thinking of needed communication and multicultural skills, as distance in a digital world is no longer a problem.”</li> <li>• “Human aspects cannot be taught adequately by machines in their full complexity. SCM has to manage interfaces with many different roles with humans involved.”</li> <li>• “In the future, the world will become much more complex and complicated, as well as more fast-paced, it will primarily need other skills than a technical understanding, which can also be covered by a cleverly programmed algorithm.”</li> </ul>
C1.2	Intense Learning adaptability	<ul style="list-style-type: none"> <li>• Learning adaptability is the distinctive feature of an SCM leader in a fast-moving digital world</li> <li>• The half-life of knowledge is dramatically reduced</li> <li>• SCM executives who try to do a lot by referencing their experiences and routines have a hard time in this environment</li> </ul>	<ul style="list-style-type: none"> <li>• “In a faster-paced world, adaptability will play an increasingly important role.”</li> <li>• “(...) with faster and faster cycles of knowledge roll-over, this is going to even increase in importance over the future.”</li> <li>• “(...) importance of experiential knowledge will decrease tremendously due to half-life of knowledge in a digital world.”</li> </ul>
C2	<i>SCM executives and digital technologies - hand in hand</i>		
C2.1	Development of technical aspects	<ul style="list-style-type: none"> <li>• Technical aspects can no longer be learned, applied, and passed on to talent quickly enough by the SCM executive</li> <li>• Training of the technical aspects carried out by specialists or AI</li> </ul>	<ul style="list-style-type: none"> <li>• “Advancing specialization will make it impossible for executives to cover all areas.”</li> <li>• “(...) SCM executives will not be able to build their knowledge quickly enough to pass it on to their talents.”</li> <li>• “Logical causal chains and things in which physical principles in the background are in control can also be controlled and supported by machine-supported processes.”</li> </ul>
C2.2	AI performance monitoring	<ul style="list-style-type: none"> <li>• AI will play an important role, as algorithms are unbiased in the evaluation of employee performance</li> <li>• AI is an opportunity to more efficiently promote talent in the technical field with tailored development measures at short intervals</li> <li>• Not all performance dimensions can be monitored by AI, as they are too versatile</li> </ul>	<ul style="list-style-type: none"> <li>• “Assuming we have a clear KPI or performance review mechanism, automation will replace performance review.”</li> <li>• “(...) AI could measure agreed upon goals in a much shorter time frame.”</li> <li>• “Performance monitoring and AI linkage to auto improvement will be a significant driver in the future.”</li> <li>• “Performance is multi-faceted and not all performance dimensions can be assessed by AI. Think of communicative performance/ social interactions (...).”</li> </ul>

Continued.

Table 3: (Continued)

No.	Major Issue	Subissue	Exemplary Representative Quotes
C2.3	Psychologist role	<ul style="list-style-type: none"> <li>• Due to the fast pace of digitalization, information surplus, short change cycles, etc., the pressure on SCM talent will massively increase</li> <li>• Certain psychological skills of an SCM leader are necessary, but there is disagreement over the extent</li> </ul>	<ul style="list-style-type: none"> <li>• “Competitive pressure will grow due to increasing transparency. Burnout and pressure to perform are a logical consequence here.”</li> <li>• “(...) pressure in the digital world (through fast pace, absolute transparency in terms of performance, etc.) for SCM talents will actually increase.”</li> <li>• “SCM executives are already invested in the psychological development of their talents. With ongoing digitalization, the human factor in this equation will only increase.”</li> <li>• “The role of a psychologist is overstated, but the role will change towards that.”</li> </ul>
C2.4	Human caregiver	<ul style="list-style-type: none"> <li>• By increasing de-personalization in TM, this role will actually represent a competitive advantage</li> <li>• As long as there are human talents there will in some way be a demand for human SCM leaders</li> <li>• Cultural differences can be decisive (human vs. AI)</li> </ul>	<ul style="list-style-type: none"> <li>• “As digitization de-personalizes more and more areas of society, a human caregiver may become a competitive advantage.”</li> <li>• “As long as there are people employed within an organization, there will be a need for mentors (...)”</li> <li>• “Such an executive could be a role model especially in a super-aged-society like Japan, Korea, China (...)”</li> </ul>
C2.5	Digital influencer role	<ul style="list-style-type: none"> <li>• The role of digital influencer will be increasingly demanded by companies in various forms</li> <li>• The handling of the role varies according to the size of the company or industrial sectors</li> <li>• Executives represent the human face of companies in social networks with direct contact, maintaining relationships and building a network of potential talents</li> <li>• Some experts are critical of the role, since this role takes a lot of time and professional training</li> </ul>	<ul style="list-style-type: none"> <li>• “SCM executives have to sell the SCM function which is not recognized enough today compared to other functions. To attract qualified associates the SCM function has to gain visibility in the future and one has therefore to also use social media.”</li> <li>• “As digitization already is an essential part of our lives, future generations of SCM executives will further embrace it to connect with internal staff as well as attract new talent.”</li> <li>• “Very few big companies will have such people in place that in their private time are also influencers (...)”</li> <li>• “Becoming a digital personal influencer is not easy, and it can be time consuming. Some professionals love this kind of interaction, many don’t have enough time.”</li> <li>• “(...) more and more companies will have a person who is responsible for digital communication. And this person is going to be the influencer not SCM executives.”</li> </ul>
C2.6	Digital network management	<ul style="list-style-type: none"> <li>• Expert opinions are divided: digital network management will replace SCM executives vs. the mentor-mentee principle will remain, albeit complemented by digital network management</li> <li>• The possibilities of digitalization in easily exchanging and spreading information with this type of model are promoted in TM</li> <li>• However, the quality of the information is partially questioned</li> </ul>	<ul style="list-style-type: none"> <li>• “With the advancement of specialization, the transfer of knowledge by the executive becomes more and more difficult and already today knowledge networks play a very strong role. This trend will continue in the future as knowledge becomes more and more freely available.”</li> <li>• “It will not replace SCM executives, but it will be a good addition.”</li> <li>• “(...) I find much of the information shared in high level and many times inaccurate (...)”</li> </ul>

Continued.

Table 3: (Continued)

No.	Major Issue	Subissue	Exemplary Representative Quotes
C3	<i>The uncertain outcome</i>		
C3.1	Digital employer platforms	<ul style="list-style-type: none"> <li>Expert opinions are divided: trend of freelancer, gig worker etc. will continue in the course of digitalization, since it represents an attractive alternative to the classical in-house SCM talent vs. in order to achieve a long-term strategy it is essential to have SCM talents in-house</li> <li>Project-related model is an attractive way for companies to cover capacity peaks, in case of missing in-house knowledge, as well as in flexibilization of personnel costs</li> </ul>	<ul style="list-style-type: none"> <li>“Digital employer platforms will play a crucial role in completing project-related tasks in the future. Of course, the promotion of young talent will continue to be of great importance, since the development of a long-term strategy cannot be implemented via digital employer platforms.”</li> <li>“We will have more gig workers with very deep expertise instead of people working permanently for only one company.”</li> <li>“No full replacement of all employees but it will surely be used more project-related or also to cover capacity peaks.”</li> </ul>
C3.2	Digital onboarding	<ul style="list-style-type: none"> <li>Onboarding is an important socialization process in which the SCM executive continues to play an important role</li> <li>However, an increased combination of social and technological determinism is expected whereby some parts of onboarding are not carried out by SCM leaders but rather by digital technologies</li> </ul>	<ul style="list-style-type: none"> <li>“Basic information can already be transformed by e-learning platforms. But the cultural aspect can't be transformed without any human interaction.”</li> <li>“Digitization will automate large parts of the onboarding process, but as long as people are involved, personal contact will continue to be important.”</li> </ul>
C4	<i>No AI revolution</i>		
C4.1	AI in recruiting	<ul style="list-style-type: none"> <li>AI does not to completely replace the SCM executive in the talent recruitment process, but rather acts in an assistant role (e.g., identifying and selecting potential SCM talents)</li> <li>The final recruiting decision remains a highly personal decision</li> </ul>	<ul style="list-style-type: none"> <li>“The screening process will certainly be supported by AI, final hiring decisions will continue to be highly personal decisions involving an active role of the executive.”</li> <li>“AI will be highly relevant in the recruiting process but in the next 20 years more as a recruiting assistant than a decision-maker.”</li> <li>“AI will suggest but SCM executives will still decide.”</li> </ul>
C4.2	Retaining role	<ul style="list-style-type: none"> <li>SCM executives remain one of the main reasons SCM talents leave or stay in a company</li> <li>Other retaining factors such as working time regulations, workplace, etc. will gain in importance compared with today</li> </ul>	<ul style="list-style-type: none"> <li>“Employees stay or leave the company because of the leader in most of the cases. I still believe in this statement in the future.”</li> <li>“SCM executive will play a crucial role in retaining SCM Talents (...) but other areas will become much more important than today (e.g., working time regulation, workplace, etc.)”</li> </ul>

Continued.

Table Table 3: (Continued)

No.	Major Issue	Subissue	Exemplary Representative Quotes
C4.3	Recovering role	<ul style="list-style-type: none"> <li>The war for SCM talent will be exacerbated by factors such as rising demand, demographic development, disruptive HR models, and changes in talent behavior in relation to the average length of service in a company</li> <li>An important task for an SCM executive is to keep in touch with former talents and cultivate relationships via digital networks</li> </ul>	<ul style="list-style-type: none"> <li>“Opportunities for future talents will increase rapidly through a more interconnected world. Therefore, it will be normal for a talent to leave the company and the more important it will be to recapture those talents who could expand their wealth of experience elsewhere.”</li> <li>“Recovering SCM talent will remain important, just look at our demographic development!”</li> <li>“(…) maintaining good connections to company alumni will continue to be important.”</li> <li>“(…) SCM leaders will benefit by staying connected with past talent for future challenges.”</li> </ul>

*AI performance monitoring (C2.2)*

In order to follow the development of the technical aspects and initiate measures for improvement (see Projection 8), the Delphi participants assume that AI will play an important role. An algorithm is unbiased in the evaluation of employee performance. This eliminates the risk of SCM managers dismissing talents due to biases. Moreover, according to the experts, today’s staff appraisals often occur far too seldom. For example, talking once a year about performance and the initiation of development activities in employee appraisals does not lead to efficient talent development. The experts see AI as an opportunity to more efficiently promote talent in the technical field with tailored development measures at short intervals, thus supporting the expectation that digital technologies could proactively offer solutions to potential SCM issues (Büyüközkan and Göçer 2018). This is also because AI has much greater access to possible technical training activities and measures of its effects in the global digital network. However, experts doubt that in general all performance dimensions can be monitored by AI because they are too versatile. Therefore, the manager must continue to play a role in this area, especially when it comes to finding out why certain performance characteristics of the talent are not achieved since the reasons for this occurrence are deeper than pure AI logic. Moreover, according to some experts, it is not good to exercise too much control over SCM talents because it hinders creativity and innovation. Even in times of many digital opportunities, trust is an essential part of managing SCM talents.

Performance monitoring and initiation of the necessary technical development activities are part of the research of people analytics. Similar to the present study, the existing research indicates that most executives are trapped in their daily business and do not spend enough time on performance feedback, which often makes talented employees feel dissatisfied and undervalued, leading to withdrawal and a direct impact on performance (Buck and Morrow 2018). It is assumed, as we do, that increasing digitalization changes performance management processes from standard appraisals to continuous monitoring, feedback, and coaching and therefore transforms the role of executives (Buck and Morrow 2018; Pape 2016; Shrivastava et al. 2018; Tursunbayeva et al. 2018). There are already pioneer research projects, for example, from Google (Shrivastava et al. 2018) or McKinsey (Fecheyr-Lippens et al. 2015) with first successes in this field of research. However, there are also critical studies that consider the topic more of a hype due to the modest progress made in recent years (Angrave et al. 2016; Leonardi and Contractor 2018).

*Psychologist role (C2.3)*

An SCM leader must also play a psychologist-like role in TM (see Projection 9). Recent studies indicate that a good executive offers protection to safeguard talent in situations in which there is a high risk of failure, thereby limiting professional advancement or, worse, resulting in potential burnout (Johennesse and Chou 2017; Naim and Lenka 2018). Psychological support in the form of social support, counseling and role modeling is therefore already a part of the SCM leadership role (Naim and Lenka 2018). In our study, experts agree that certain psychological skills of an SCM leader are already a necessity in managing talents. However, there is disagreement over the extent of the role

to be played by the SCM executive. Some Delphi participants state that especially in the framework conditions in 2040, such as the permanent monitoring of performance (see Projection 8), fast pace of digitization, information surplus, short change cycles, and so on, the pressure on SCM talent will massively increase. As a result, they expect SCM managers to need to more strongly develop their psychological skills and thus be forced to provide more psychological support to their talents. By contrast, others doubt that SCM managers will play a stronger role than today and rather suspect that companies will be obligated to offer, for example, stress management programs for their talents.

#### *Human caregiver (C2.4)*

In terms of whether a human caregiver in the form of an SCM executive represents a significant competitive advantage (see Projection 2) in the war for SCM talents in an increasingly digital world, the experts are also divided. Some argue that by increasing de-personalization in TM, this role will actually represent a competitive advantage in the opposite sense as it does today. The Delphi panelists also assume that the SCM executives are evaluated in social networks and that companies actively use these rankings to their advantage in attracting talents. Others expect that as long as there are human talents, there will in some way be a demand for human SCM leaders. Some panelists also point out the cultural differences, since in some countries a human caregiver is anchored in the culture and is indispensable, whereas other cultures are more accessible for AI or assign more importance to other attributes such as the reputation of the company.

The concept and importance of a human mentor in the promotion of talent are duly considered in the scientific literature (Naim and Lenka 2016; Małgorzata 2017; van Vianen et al. 2017; Naim and Lenka 2018). Thus, it is not surprising that even in the early 1990s, CEOs of Fortune 500 companies considered mentoring - after personal characteristics and their own value system - to be the third most important contribution to their professional success (Frances 1995). Our results support recent studies suggesting that the mentoring principle continues to be used successfully in TM (Małgorzata 2017; Naim and Lenka 2018; van Vianen et al. 2017). For example, Naim and Lenka (2018) reveal that a human mentor facilitates the development and the retention of Generation Y, even if mentoring is extended by social media.

#### *Digital influencer role (C2.5)*

Another attribute that influences the attracting of SCM talent is the active role of a digital influencer (see Projection 1). Aside from our study, there is no research showing that executives become more active in talent attracting through social media. There are rather studies that suggest that HR units of companies increasingly use social media in attracting talent since it serves as a powerful tool to reach talents whom companies would otherwise not reach (Sharma and Nagendra 2017; Pongratz 2018; Pandita 2019). By contrast, experts of our study are already seeing initial movement toward this more active role and predict that the digital influencer role will be increasingly demanded by companies in various forms. In large companies, they assume that this will be regarded as a basic requirement, even if there is still a central unit for this topic. For smaller companies, they argue that this role will be an opportunity and a necessity in the war for SCM talent, as smaller companies are mostly unknown, do not have the necessary

structures, and have very limited financial resources. Moreover, the Delphi panelists assume that the intensity and extent of the role will vary in different industrial sectors, depending on the availability of talent. Others believe that through the worldwide digital expansion of social platforms, the executives will represent the human face of companies in network, and that having direct contact, maintaining relationships, and building a network of potential talents will represent a significant competitive advantage. However, some of the experts are critical of the role, since this role takes a lot of time. In addition, experts argue that there are professional influencers who are better suited to the role and that the impact of a single person is insufficient.

Other recent studies, for example, that by Walford-Wright and Scott-Jackson (2018), assume that such a role in the attracting process could be filled by digital technologies. From their point of view, digital technologies are already able to enter into a dialogue with potential candidates and in future will take them on an interactive preview of the job and the company (Walford-Wright and Scott-Jackson 2018).

#### *Digital network management (C2.6)*

While some Delphi panelists believe that digital network management among SCM talent will replace SCM mentors in talent development (see Projection 7), others tend to believe that the human aspects cannot be replaced by digital technologies and therefore the mentor-mentee principle will remain, albeit complemented by digital network management. According to the Delphi panelists, the need for digital learning groups on social platforms is already evident. With the possibilities of digitalization in easily exchanging and spreading information as well as the increasing specialization in the technical aspects (see Projection 5), this type of model is promoted in TM (but both for talents and for SCM executives). However, experts assume that the information in the networks is partly on a very abstract level, torn out of context, as well as partly incorrect. They therefore argue that SCM leaders will play an important guiding role in the sense of guiding where information is validly available and putting what has been learned from the networks together into the company-specific context.

Our findings support current studies in the field of higher education, since the use of social networks to support collaborative learning has significantly increased in recent years (Alkhathlan and Al-Daraiseh 2017; Raspopovic et al. 2017; Sun et al. 2017; Al-Samarraie and Saeed 2018; Jan and Vlachopoulos 2018). Social networking sites are popular with the digital natives (Alkhathlan and Al-Daraiseh 2017; Raspopovic et al. 2017) as well as used as a complementary learning path or as an enhancement of conventional classrooms (Alkhathlan and Al-Daraiseh 2017). Thus, our findings reflect the developments of studies in higher education, namely, that the mentor-mentee principle remains and is complemented by digital network management. In addition, such collaborative systems are used not only by students (talents) but also by lecturers (executives) themselves (Raspopovic et al. 2017).

### **Cluster 3: The uncertain outcome**

Cluster 3 contains two projections: While the estimated average impact values for all projections are displayed with a relevant effect on the role of SCM executives in TM ( $\geq 3.0$ ), the expected



probabilities are between 46% and 50%. Therefore, it can be assumed that the projections are less likely to occur by 2040. This is therefore a cluster that decision makers should keep in mind but not place at the center of action plans developed for the future SCM executive role in TM.

#### *Digital employer platforms (C3.1)*

The panelists' assessments concerning whether digital employer platforms with project-related SCM experts will replace the need for supply chain TM (see Projection 10) are balanced. Some experts see digitalization as an opportunity to make such a concept easier to put into practice and thus follow the assumption that digital technologies could promote more short-term and ad hoc partnerships in SCM (Schmidt and Wagner 2019). The hurdle to being an SCM freelancer or gig worker is as seen lower than today, since, for example, the necessity to work on site in a company will no longer be a given. Furthermore, the experts assume that simple, repetitive tasks will be taken over by AI and more complex tasks by SCM specialists. In addition, forms of project-related work in SCM already exist in practice today. According to the panelists, this trend will continue in the course of digitalization, since it represents an attractive alternative to the classical in-house SCM talent for both companies and SCM talents. In addition, the project-related model is an attractive way for companies to cover capacity peaks, in case of missing in-house knowledge, as well as the flexibility of personnel costs. In addition, SCM executives will have a more coordinating role and will not have to invest a lot of time and effort into talents who may only remain in the company for a short time. Others argue that in order to achieve a long-term strategy it is essential to have SCM talents in house. From their perspective, the risk of only becoming dependent on external SCM talents is too high, and SCM knowledge must be anchored in the company and only enriched by project-related SCM experts. In addition, some of the Delphi panelists believe that the majority of SCM talents would not want to work in such a model.

Several studies underline our results of the increasing trend of employer platforms due to the rapidly changing connectivity. In Malaysia, for example, the idea of creating digital jobs evolved with the launch of the "Digital Malaysia" strategic program in 2012. Likewise, in spring 2013, the Nigerian Ministry initiated the campaign "Microwork for Job Creation – Naijacloud" (Graham et al. 2017). An index that measures the use of digital work platforms from 2016 to 2018 additionally confirms our study results, indicating a growth of roughly 20% worldwide (Kässi and Lehdonvirta 2018). However, Graham et al. (2017) point out that while digital work is a worldwide topic, it is defined by different regions of geography. The majority of requirement comes from the geographical North, but most of the work is conducted in low-wage nations (Graham et al. 2017). Contrary to our results, the main argument currently for digital employer platforms seems not to be flexibility or the lack of in-house knowledge, but the cost factor (Graham et al. 2017).

#### *Digital Onboarding (C3.2)*

Moreover, panelists expect the majority of the onboarding of SCM talents to remain in the area of SCM executives (see Projection 4). According to the experts, onboarding is an important process in which a talent should feel comfortable right from the

start. The human component—and thus the SCM manager—will continue to play an important role. However, experts expect an increased combination of social and technological determinism, whereby some parts of onboarding are not carried out by SCM leaders but rather by digital technologies such as e-learning platforms. In addition, Delphi panelists assume that the intensity of man and/or machine in the onboarding process will vary among different SCM talent pools; for example, entry-level SCM talents are likely to have less intensive contact with the SCM executive than SCM talents for the managerial level.

Existing studies are divided on the issue of the increasing digitalization of the onboarding process. Therefore, our expert discussions reflect the extant research. Nalband et al. (2017) discuss in their study that many of the existing onboarding processes are manual, monotonous, and very time-consuming. Therefore, their study proposes a system of onboarding that uses a robot to optimize the time frame and efficiency and also helps in building relationships between the company and other employees (Nalband et al. 2017). Similarly, Depura and Garg (2012), who studied the use of online social tools and gamification in the successful onboarding of new employees of a worldwide leading Fortune 100 organization, also conclude that the digital natives are asking for new methods. The quantitative and qualitative results from their survey suggest that the use of interactive methods, such as online social interaction, can help foster the engagement of talent as well as lead to lower costs and higher productivity in the onboarding process (Depura and Garg 2012). Our findings support other studies that differentiate more strongly, such as that of Snell (2006), concluding that technologies have their place in onboarding (e.g., when it comes to turning a paper checklist into an automated workflow), but cannot perform the important socialization activities like a human being.

#### **Cluster 4: No AI revolution**

The fourth cluster contains a total of three projections. The predicted average impact values for all projections have a considerable effect ( $\geq 2.8$ ). However, the expected probabilities are between 24% and 35%, and thus, the projections are assessed as not going to occur by 2040. This cluster shows that there will be no AI revolution in which the SCM executives are completely replaced. It is therefore a cluster that decision makers should be interested in but not one into which they should invest a great deal of effort in creating new action plans to prepare SCM leaders for the future.

#### *AI in recruiting (C4.1)*

Panelists expect AI not to completely replace the SCM leaders in the SCM talent recruitment process (see Projection 3), but rather to act in an assistant role. Thus, experts follow the assumption that digital technologies could prepare or recommend an increasing number of future decisions in SCM (Preindl et al. 2020) and support SCM executives as an actor in terms of identifying and selecting potential SCM talents, since these processes can be standardized and verified by algorithms. However, the final recruiting decision will remain highly personal, since the experts do not assume that AI will be able to evaluate, for example, a cultural fit on an emotional level.

Our findings confirm those of other recent studies, since, especially in the recruiting process, digital technologies enable companies to work more easily and cost-effectively in a supportive manner (Stone et al. 2013; Langer et al. 2017). A recent LinkedIn survey, conducted by Spar et al. (2018), indicates that the impact of AI in recruiting is on the rise. Due to the increasing volume of data available in combination with AI, it is expected that digital technologies will increasingly do the grunt work (e.g., sourcing, screening, analyzing candidates resumes, and scheduling interviews). Our results additionally strengthen the findings of this study insofar as it is also assumed that the complex aspects of recruiting (e.g., engaging, interviewing candidates) cannot be replaced by digital technologies (Spar et al. 2018).

#### *Retaining and recovering role (C4.2 and C4.3)*

In the field of talent retention (see Projection 12), there is strong agreement among experts that SCM executives will remain one of the main reasons that SCM talent will leave or stay in a company. Experts therefore do not expect increasing digitalization to make a major difference compared with today's standards. However, the panelists note that other retaining factors such as working time regulations, workplace, compensation, and so on will increase in importance compared with today. Finally, panelists doubt that the recovering of educated SCM talents will be irrelevant in supply chain TM due to the influence of digitalization (Projection 13). The experts assume that there will still be a war for SCM talent and that the situation will be exacerbated by factors such as rising demand, demographic development, disruptive HR models, changes in talent behavior in relation to the average length of service in a company, and so on. Experts therefore assume that it will be important for an SCM executive to keep in touch with former talents and cultivate relationships via digital networks. Moreover, according to these experts, AI cannot replace SCM executives but can help keep in contact with talents with less effort, for example, via intelligent chat bots.

Our findings support extant literature in attributing a decisive role to the executive in talent retention (Johennesse and Chou 2017; Wong et al. 2017; Ott et al. 2018; Pandita and Ray 2018). According to these studies, there are many factors, such as training and coaching (Johennesse and Chou 2017; Ott et al. 2018; Pandita and Ray 2018), career succession planning (Ott et al. 2018; Pandita and Ray 2018; Wong et al. 2017), appraisal and feedback (Johennesse and Chou 2017; Pandita and Ray 2018), and empowerment (Johennesse and Chou 2017) that have a direct impact on talent retention and are influenced by the executive (Johennesse and Chou 2017; Wong et al. 2017; Ott et al. 2018; Pandita and Ray 2018).

## CONCLUSION

Spurred by the rapid technological developments of the fourth industrial revolution and their effect on SCM (Dash et al. 2019; White et al. 2008; Goldsby and Zinn 2016; Min et al. 2019), the study at hand applied strategic foresight techniques to provide insights into the impact of digitalization on the future role of SCM executives in TM. In order to investigate this evolution, a web-based Delphi study among 103 selected experts from academia, industry and associations/politics was conducted. Thirteen

provocative projections for the year 2040 were elaborated to maximize the real-time panel discussion and to identify fields of conflict (Turoff 1970). In order to gain insights from the quantitative and qualitative expert discussion, we applied descriptive statistics, qualitative data analysis, and fuzzy c-means clustering. Based on those applications, four topic clusters were created in order to provide valuable orientation and guidance for decision makers to derive robust and promising strategies and an action plan to prepare SCM leaders for the future role in TM.

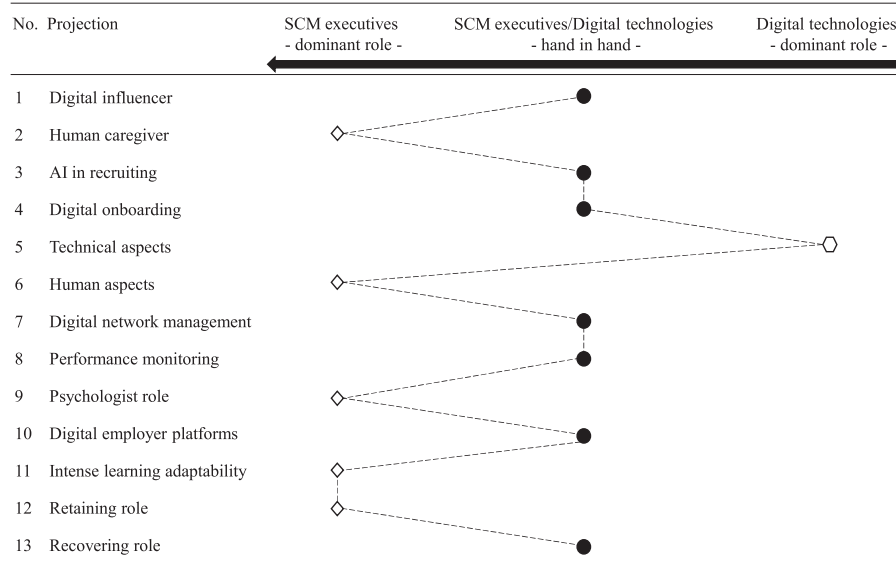
## Implications for the role of SCM executives in TM

By applying ANT, we were able to provide the appropriate methodological fit (e.g., type of research questions, type and nature of data collection, etc.) in order to ensure high-quality field research. In addition, this theory built the foundation on which we derived our projections as a basis for the panel discussion. Due to the nature of the theory in combining the one-sided views of technological determinism and social determinism (Latour 2005; Belliger and Krieger 2006), ANT also served as an enabler to focus our expert discussion on changings of the borderline and complex web of relations between SCM executives (human actor) and digital technologies (nonhuman actors) (Hanseth et al. 2004; Walsham 1997). Thus, this theory provided the theoretical lens necessary to analyze and better understand the extent to which the role of the SCM executive changes when an actor—as is the case with the use of digital technologies—is added to the TM network. In this context, our results show that in some areas of TM, digitalization is leading to a strong fusion of SCM executives and digital technologies as well as to a clear division of roles, in which either SCM leaders or technology will dominate in the future (see Figure 4).

#### *SCM executives and digital technologies hand in hand*

In general, the SCM executive undergoes a substantial transformation as a result of digitalization but is still considered to be of strong importance for successful TM. In tracking the associations or relationships between human SCM executives and nonhuman actors such as AI (Latour 2005; Cresswell et al. 2010), it becomes apparent that the influence of digitalization will lead to a shift of the border between the social and the technical system in many phases of TM. The interaction and relationship between SCM executives and technology become much more fluid. SCM executives and objects will work together and combine to create collective action in the actor network (Belliger and Krieger 2006). In seven of the 13 projections (see Projections 1, 3, 4, 7, 8, 10, 13) in our study, this fact is evident and clearly shows the future digital influence on the SCM executive in TM, but in different ways and intensities. In line with existing literature, this can be seen, for example, in the recruiting of new talent (see Projection 3), in which AI performs future processes such as pre-selection, but the final recruiting decision is still made by the SCM executive (Spar et al. 2018). In this case, digitalization has a supportive effect on SCM leaders without changing their current role too much. However, in other areas such as performance monitoring and the initiation of necessary technical development activities (see Projection 8), the digital influence is more intense and more fundamentally changes the role of the SCM manager. In this case, digital technologies already automatically initiate a development activity and thus intervene more strongly in the

**Figure 4:** Implications for the role of SCM executives in TM.



current competencies of the SCM executive. The role of the manager is shifting toward success control and finding out why certain performance characteristics of the talent are not achieved, as the reasons for those aspects are deeper than pure logic. Therefore, our work indicates that the combination of digital technologies and the new role of SCM executives can build the foundation of an increasing efficiency in TM. In line with extant literature, IT technologies have already automated certain processes in the SCM environment (Dash et al. 2019; Sanders and Premus 2002; Klumpp and Zijm 2019; Min et al. 2019) and are becoming more powerful in TM, thus giving SCM executives the opportunity to focus on strategic aspects (Sanders and Premus 2002).

*SCM executives versus digital technologies*

In addition to the changes of a stronger fusion between the SCM executives and digital technologies, there is also a clear separation of roles, in which either SCM leaders or technology dominates. The human dimension has often been emphasized for technology deployment in SCM and remains a critical success factor in TM. With the increasing use of AI, the insufficient capabilities in teaching human aspects through digital technologies, and the fact that national borders will no longer be an obstacle, the SCM executive plays a dominant role as a teacher of human aspects (see Projection 6), and as a human caregiver (see Projection 2). In addition, the SCM executive takes on an even more important, psychologist-like role (see Projection 9), as it is assumed that in a fast-moving digital world, the pressure on SCM talents increase. Finally, SCM executives continue to play the critical role in retaining talent (see Projection 12), as they remain one of the main actors in whether SCM talent leaves or stays in a company.

In other areas, however, such as the teaching of technical aspects (see Projection 5), it can be clearly seen that due to the appearance of new digital elements, SCM executives decrease in importance. This role tends to be taken over by digital technologies, as technical aspects can no longer be learned, applied, and

passed on to talent quickly enough by the SCM executive. In the context of ANT, however, these roles in no way mean a turning away in the sense that there is a strict separation between social and technical determinism. Rather, it becomes clear that networks are different and that the roles played by technological artifacts and people can vary. Thus, it means that the SCM executive of the future receives the opportunity to finally adopt the role of leading people instead of managing things.

*Future challenges*

Increasing digitalization offers a wealth of opportunities but is also associated with risks for SCM executives in TM. The separation of focal points, as well as the increasing overlap of man and machine, requires a significantly higher learning adaptability (see Projection 11) of SCM executives and a shift of the mindset toward collaboration with digital technologies. Not every executive will want to accept that digital technologies will simply be better in certain areas or even take on current roles. In addition, not every SCM executive will necessarily prefer to focus primarily on the human aspects of talent development. Aside from the new role associations and distributions, SCM executives make active use of the possibilities of digitalization and at the same time create new roles in TM. This includes, for example, the role of the digital influencer (see Projection 1), in which a SCM manager uses digital technologies to change from a passive to an active role in the talent-attracting phase. However, as digital influence is expected to create further new roles, new capabilities and skills need to be developed in order to handle digital technologies.

**Limitations and further research**

As with any research, our study has some limitations that need to be considered when interpreting the results, but that, in turn, offer opportunities for future research. First, the number of topics was somewhat limited. Certainly, the future role of SCM executives in TM is influenced by more factors than we discussed. Although we followed a systematic process in developing our

projections, we had to limit the number of projections to 13 in order to ensure adequate survey processing time and reduce drop-off rates. This leaves possibilities for future research, allowing other aspects that were not explicitly considered in our Delphi study to be evaluated. Second, like any other study design our methodology has constraints. We chose the Delphi-based approach for the development of future topic clusters, which is valuable due to the triangulation perspective. However, other techniques such as roadmapping and back-casting are also reliable for drawing conclusions about future developments. Based on a comparison of different study results, future studies could evaluate the concurrent validity. Furthermore, by using a Kruskal–Wallis rank-sum test, we compared the ratings between early respondents with those of late respondents to test for the characteristics of nonrespondents (Armstrong and Overton 1977; Wagner and Kemmerling 2010). Since this has been a standard procedure for testing for nonresponse bias for many years, future research could be conducted to overcome this simple approach. Moreover, our group comparison between experts from the Asia Pacific region, North America, and Europe revealed the presence of cultural differences, but based on a small sample only. Future research in this field might place more emphasis on a larger sample size and advance our understanding of why Asian experts tend to rate the impact of digital technologies on the role of SCM leaders in TM more highly. Finally, since our research results reveal a substantial transformation of the SCM executive in TM, future research could focus on deriving strategies to support SCM executives for their future role in TM.

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**APPENDIX A: DETAILED INFORMATION ABOUT THE EXPERTS INVOLVED IN THE PROJECTION FORMULATION PROCEDURE**

<b>Phase in projection formulation</b>	<b>Age categorization</b>	<b>Field of expertise</b>	<b>Position in organization</b>	<b>Type of organization</b>	<b>Expertise categorization</b>
Creative workshop	50–59 years	SCM	Head of department	Industry	>25 years
Creative workshop	40–49 years	SCM	Head of department	Industry	>15 years
Creative workshop	40–49 years	HR	Head of department	Industry	>15 years
Expert interview	50–59 years	HR	Professor	Academia	>15 years
Expert interview	50–59 years	HR	Head of department	Industry	>25 years
Expert interview	50–59 years	SCM	Professor	Academia	>25 years
Expert interview	50–59 years	SCM	Professor	Academia	>20 years
Expert interview	30–39 years	SCM	Senior manager	Industry	> 5 years
Expert interview	30–39 years	SCM	Head of department	Industry	>10 years
Expert interview	30–39 years	SCM	Senior manager	Industry	>10 years
Expert interview	40–49 years	SCM	Head of department	Industry	>15 years
Pretesting	30–39 years	SCM	Head of department	Industry	> 5 years
Pretesting	30–39 years	SCM	Head of department	Industry	>10 years
Pretesting	40–49 years	SCM	Head of department	Industry	>10 years

**APPENDIX B: DETAILED INFORMATION ABOUT THE EXPERTS INVOLVED IN THE DATA COLLECTION PROCESS**

<b>Field of expertise</b>	<b>Age categorization</b>	<b>Position in organization</b>	<b>Type of organization</b>	<b>Country</b>	<b>Expertise categorization</b>
SCM	50–59 years	Chief Operations Officer	Industry	Germany	>30 years
SCM	50–59 years	Chief Operations Officer	Industry	Switzerland	>30 years
SCM	50–59 years	Senior manager	Industry	Germany	>30 years
SCM	50–59 years	Head of department	Industry	Canada	>30 years
SCM	50–59 years	Senior manager	Industry	USA	>30 years
SCM	50–59 years	Head of department	Industry	Australia	>30 years
SCM	50–59 years	Professor	Academia	Germany	>30 years
SCM	50–59 years	Professor	Academia	USA	>30 years
SCM	50–59 years	Board member	Politics/Association	Austria	>30 years
SCM	50–59 years	Professor	Academia	USA	>30 years
SCM	50–59 years	Head of department	Industry	USA	>30 years
SCM	50–59 years	Head of department	Industry	USA	>30 years
SCM	50–59 years	Head of department	Industry	Spain	>30 years
SCM	50–59 years	Senior manager	Industry	Germany	>25 years
SCM	50–59 years	Chief Operations Officer	Industry	Germany	>25 years
SCM	50–59 years	Professor	Academia	Germany	>25 years
SCM	50–59 years	Professor	Academia	Germany	>25 years
SCM	50–59 years	Board member	Politics/Association	Ireland	>25 years
SCM	50–59 years	Professor	Academia	USA	>25 years
SCM	50–59 years	Head of department	Industry	Taiwan	>20 years
SCM	50–59 years	Professor	Academia	Germany	>20 years
SCM	50–59 years	Head of department	Politics/Association	Germany	>20 years
SCM	50–59 years	Professor	Academia	Germany	>20 years
SCM	40–49 years	Head of department	Industry	UK	>30 years
SCM	40–49 years	Professor	Academia	Germany	>25 years

Continued.

## Appendix B (Continued)

Field of expertise	Age categorization	Position in organization	Type of organization	Country	Expertise categorization
SCM	40–49 years	Professor	Academia	Poland	>25 years
SCM	40–49 years	Professor	Academia	USA	>25 years
SCM	40–49 years	Head of department	Industry	Italy	>20 years
SCM	40–49 years	Head of department	Industry	Japan	>20 years
SCM	40–49 years	Head of department	Industry	Singapore	>20 years
SCM	40–49 years	Head of department	Industry	China	>20 years
SCM	40–49 years	Head of department	Industry	Denmark	>20 years
SCM	40–49 years	Professor	Academia	Canada	>20 years
SCM	40–49 years	President	Politics/Association	USA	>20 years
SCM	40–49 years	Chief Operations Officer	Industry	Germany	>15 years
SCM	40–49 years	Chief Operations Officer	Industry	Poland	>15 years
SCM	40–49 years	Senior manager	Industry	UK	>15 years
SCM	40–49 years	Head of department	Industry	India	>15 years
SCM	40–49 years	Professor	Academia	Germany	>15 years
SCM	40–49 years	Assistant Professor	Academia	Finland	>15 years
SCM	40–49 years	Professor	Academia	USA	>15 years
SCM	40–49 years	President	Politics/Association	Germany	>15 years
SCM	40–49 years	Senior manager	Industry	Germany	>15 years
SCM	40–49 years	Chief Operations Officer	Industry	Germany	>10 years
SCM	40–49 years	Head of department	Industry	Germany	>10 years
SCM	40–49 years	Senior manager	Industry	Germany	>10 years
SCM	40–49 years	Professor	Academia	Denmark	>10 years
SCM	40–49 years	Professor	Academia	Germany	>10 years
SCM	40–49 years	Professor	Academia	Germany	> 5 years
SCM	30–39 years	Head of department	Industry	Germany	>15 years
SCM	30–39 years	Head of department	Industry	France	>15 years
SCM	30–39 years	Head of department	Industry	Vietnam	>15 years
SCM	30–39 years	Assistant Professor	Academia	Portugal	>15 years
SCM	30–39 years	Assistant Professor	Academia	UK	>15 years
SCM	30–39 years	Professor	Academia	Turkey	>15 years
SCM	30–39 years	Professor	Academia	UK	>15 years
SCM	30–39 years	Head of department	Industry	Germany	>10 years
SCM	30–39 years	Chief Operations Officer	Industry	Germany	>10 years
SCM	30–39 years	Head of department	Industry	Germany	>10 years
SCM	30–39 years	Head of department	Industry	Germany	>10 years
SCM	30–39 years	Head of department	Industry	Germany	>10 years
SCM	30–39 years	Head of department	Industry	Germany	>10 years
SCM	30–39 years	Chief Operations Officer	Industry	Germany	>10 years
SCM	30–39 years	Head of department	Industry	Vietnam	>10 years
SCM	30–39 years	Head of department	Industry	Switzerland	>10 years
SCM	30–39 years	Head of department	Industry	Germany	>10 years
SCM	30–39 years	Head of department	Industry	Germany	>10 years
SCM	30–39 years	Chief Operations Officer	Industry	Germany	> 5 years
SCM	30–39 years	Head of department	Industry	Germany	> 5 years
SCM	30–39 years	Head of department	Industry	Germany	> 5 years
SCM	30–39 years	Senior manager	Industry	Germany	> 5 years
SCM	30–39 years	Chief Operations Officer	Industry	Belgium	> 5 years
SCM	30–39 years	Senior manager	Industry	Germany	> 5 years
SCM	30–39 years	Professor	Academia	Germany	> 5 years
SCM	30–39 years	Director	Politics/Association	USA	> 5 years
SCM	30–39 years	Professor	Academia	India	> 5 years
SCM	30–39 years	Head of department	Industry	Italy	> 5 years

Continued.

## Appendix B (Continued)

Field of expertise	Age categorization	Position in organization	Type of organization	Country	Expertise categorization
SCM	Not stated	Professor	Academia	Germany	> 25 years
HR	50–59 years	Head of department	Industry	Germany	>30 years
HR	50–59 years	Director	Politics/Association	USA	>30 years
HR	50–59 years	Head of department	Industry	Germany	>25 years
HR	50–59 years	Professor	Academia	Germany	>15 years
HR	50–59 years	Senior manager	Politics/Association	Germany	> 5 years
HR	40–49 years	Head of department	Industry	Germany	>20 years
HR	40–49 years	Professor	Academia	France	>20 years
HR	40–49 years	Senior researcher	Academia	Germany	>10 years
HR	40–49 years	Professor	Academia	Germany	>10 years
HR	30–39 years	Head of department	Industry	Germany	>15 years
HR	30–39 years	Head of department	Industry	Germany	>15 years
HR	30–39 years	Professor	Academia	Saudi Arabia	>10 years
HR	30–39 years	Head of department	Industry	Germany	>10 years
HR	30–39 years	Senior manager	Politics/Association	Germany	> 5 years
HR	30–39 years	Senior manager	Politics/Association	USA	> 5 years
HR	30–39 years	Senior manager	Politics/Association	Germany	> 5 years
Digital Mgt./SCM	50–59 years	Professor	Academia	Germany	>25 years
Digital Mgt./SCM	50–59 years	Senior manager	Politics/Association	Germany	>25 years
Digital Mgt./SCM	50–59 years	Professor	Academia	Germany	>20 years
Digital Mgt./SCM	50–59 years	Professor	Academia	Germany	>15 years
Digital Mgt./SCM	30–39 years	Senior manager	Industry	Germany	>10 years
Digital Mgt./SCM	30–39 years	Professor	Academia	Germany	>10 years
Digital Mgt./SCM	30–39 years	Senior manager	Industry	Germany	> 5 years
Digital Mgt./SCM	30–39 years	Senior manager	Industry	Germany	> 5 years
Digital Mgt./SCM	30–39 years	Senior manager	Politics/Association	Germany	> 5 years

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