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Economic Research-Ekonomska Istraživanja

ISSN: 1331-677X (Print) 1848-9664 (Online) Journal homepage: https://www.tandfonline.com/loi/rero20

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To cite this article: J. Erjavec, A. Popovič & P. Trkman (2019) The effect of personality traits and knowledge on the quality of decisions in supply chains, Economic Research-Ekonomska Istraživanja, 32:1, 2269-2292, DOI: 10.1080/1331677X.2019.1642788

To link to this article: https://doi.org/10.1080/1331677X.2019.1642788

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Published online: 13 Aug 2019.

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ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA
2019, VOL. 32, NO. 1, 2269–2292
https://doi.org/10.1080/1331677X.2019.1642788

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The effect of personality traits and knowledge on the quality of decisions in supply chains

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ABSTRACT

Supply chain and operations management requires frequent decision making, and decisions are importantly influenced by the personality traits and knowledge of the decision maker. Thus, we analyse the effect of those factors on the confidence and quality of decisions taken in the context of supply chain management. The data were gathered via an online supply chain simulation game where subjects needed to make several decisions. Personality traits of the participants were tested using the Big Five model. The structural model was estimated using the partial least squares structural equation modelling approach. We found that decision-makers with lower levels of extraversion and agreeableness and higher levels of conscientiousness and openness make better decisions. On the other hand, neuroticism and agreeableness negatively affect confidence in decisions. Tested knowledge positively influences both decision-makers' confidence in and the quality of their decisions while self-reported knowledge has no significant effect. Therefore, the companies should carefully consider how an individual's personality matches the type of job at hand and rely on tested instead of self-reported knowledge.

ARTICLE HISTORY
Received 7 August 2018
Accepted 21 January 2019

KEYWORDS
Behavioural supply chain management; individual decision making; knowledge; big five personality traits; quality of decisions; simulation game; structural equation modelling

JEL CLASSIFICATION
D91; D80; M10

1. Introduction

Decision-making plays a significant role in operations and supply chain management (SCM) and uses large amounts of organisational resources (Roehrich, Grosvold, & Hoejmose, 2014). Management of operations calls for frequent decision-making where employees need to make decisions in conditions of uncertainty (Wu & Pagell, 2011). Historically, researchers have sought to understand how firms make decisions on strategic and operational levels (Steckel, Gupta, & Banerji, 2004). This paradigm has led to underemphasising individuals' dispositional characteristics as an important factor in the quality of individuals' decisions.

People are critical for the functioning of the majority of supply chains, influencing both the way these chains work and how they perform (Rodney, 2014). Making

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superior decisions (that in turn positively affect organisational performance) is regarded as a key issue (Cantor & Macdonald, 2009). However, decision-making in practice is not done by the firms themselves but by various individuals who utilise their knowledge and time available to make decisions.

Human behaviour in operations and supply chain decision-making is insufficiently explored, especially in complex decision situations. Wieland, Handfield, and Durach (2016) found out that there is insufficient research that explores individual actors in supply chain and thus call for additional research that involves what they call the people dimension. As evidenced by the growing interest in behavioural operations/SCM research (Croson, Schultz, Siemsen, & Yeo, 2013; Donohue & Schultz, 2018; Erjavec & Trkman, 2018; Schorsch, Wallenburg, & Wieland, 2017; Tokar, 2010), this is a topic of escalating importance. A deeper understanding of behavioural issues should enable firms to make better decisions and operate more efficiently (Croson et al., 2013).

The way an individual makes SCM-related decisions depends on dispositional characteristics such as personality traits and level of domain knowledge (Tokar, 2010). Thus, the paper attempts to analyse the impact of these dispositional characteristics on the quality of decisions and the confidence in those decisions. Decision quality refers to both the process of decision-making and the number of successful outcomes that may affect business activities, while confidence in the decision is the level of a decision-maker's belief that the outcome will be achieved (Oz, Fedorowicz, & Stapleton, 1993).

Past research has suggested the quality of decisions in SCM is importantly influenced by the personality traits of the decision-maker (Strohhecker & Größler, 2013). Recruiting employees who possess enduring personality traits that stimulate certain behaviour is crucial (Periatt, Chakrabarty, & Lemay, 2007), and personality traits explain a considerable part of the variance in employees' performance (Rothmann & Coetzer, 2003). While the effects of cultural and demographical traits on decision making in supply chain management have been researched (Bragge, Kallio, Seppälä, Lainema, & Malo, 2017), the extent to which employees' personality traits may affect decision-making environments and supply chain performance has not been subjected to rigorous empirical examination. Extant research remains largely anecdotal and disjointed (Chen, Lee, & Paulraj, 2014). Further, if we are to truly understand the relationship between personality and employee performance, we must move beyond the relationship between them and toward identifying the intervening variables that link these domains (Hurtz & Donovan, 2000).

Nevertheless, relying solely on personality traits to explain employee performance is insufficient (Adamides, Papachristos, & Pomonis, 2012). Supply chain managers may underperform because they lack the specific knowledge for a particular type of work (Dotson, Davè, & Miller, 2015; Roehrich et al., 2014). Since cognitive ability plays an important role in work behaviour independent of the role played by personality traits (Hurtz & Donovan, 2000), knowledge deserves separate consideration when analysing a behavioural aspect of decision-making in SCM.

We use a computer simulation game to explore the effects of decision-makers' personality traits and domain knowledge on their confidence in and quality of decisions

made in SCM tasks. Our work extends previous work on the role of various factors such as information technology (Ho, Wang, Pauleen, & Ting, 2011), education levels (e.g., Ali & Kumar, 2011), experience, time to make a decision (Fisher, Chengalur-Smith, & Ballou, 2003), data quality (e.g., Hazen, Boone, Ezell, & Jones-Farmer, 2014), and accessibility (O'Reilly, 1982) on decision quality. We combine decision-making and personality traits by introducing decision-makers' internal characteristics as important predictors of the quality of decisions in the context of SCM.

The remainder of this paper is organised as follows. First, the importance of decision-makers' personality traits and knowledge in supply chain decision-making is outlined. Next, the research model and hypotheses are presented. Furthermore, the research approach followed in this study, the sources of data, and data analysis procedure are explained. This is followed by the findings on how different personality traits, along with self-reported and test-evaluated supply chain domain knowledge, influence the quality of and confidence in decisions. In the discussion section, the paper sheds light on the theoretical contributions and managerial implications of the findings. The paper concludes with avenues for future research.

2. Literature review

Managers make decisions, and the results of their decision-making process impact firm performance (Amason, 1996). The decision-making process is dynamic and changeable and the quality of decisions is importantly influenced by internal and external factors (Bonner, 1999). Among internal factors, the most notable include personality traits (Davis, Patte, Tweed, & Curtis, 2007), domain knowledge (Dietrich, 2010), cognitive biases (Stanovich & West, 2008), and experience (Juliusson, Karlsson, & Garling, 2005). Besides these internal variables, external factors, including economic, specific sector-related issues, governmental regulation, and political events (Dean & Sharfman, 1996), have also been discussed.

Managerial decision-making depends on the context and on the individual performing it (Solomon, 2005). Some people may plan and structure their decisions, whereas others make decisions in a more flexible and spontaneous way. While the reasons behind different decision-making approaches may lie in the context, such as the relationship between supply chain and top manager (Villena, Lu, Gomez-Mejia, & Revilla, 2018), even more important are individuals' dispositional characteristics (Finkelstein & Hambrick, 1990). Two often considered dispositional characteristics in managerial decision-making milieu are decision-makers' domain knowledge and personality traits.

Knowledge importantly influences decision-making (Wowak, Craighead, Ketchen, & Hult, 2013) as it can impact a person's judgment and choice (Alba & Marmorstein, 1987). This is particularly important in supply chain setting where managers need a vast array of cross-functional knowledge (Flöthmann & Hoberg, 2017). The personal estimation of one's level of knowledge can be misleading when assessing confidence in decisions. It is, therefore, important to assess individuals' knowledge to better understand their overall capability to decide.

Similarly, prior studies have explored how personality traits influence decision-making processes and outcomes (e.g., Lauriola, Panno, Levin, & Lejuez, 2014; Davis et al., 2007) also in games with uncertain outcomes (Kang & Morin, 2016). Furthermore, Haines, Hough, and Haines (2017) report that supply chain decision making is a behavioural rather than a deterministic process. Some offer mixed results about the effect of personality traits on the quality of decisions (Moutafi, Furnham, & Crump, 2003; Hough & Ogilvie, 2005; Davis et al., 2007). A personality trait is defined as a dispositional characteristic of an individual that exerts a pervasive influence on a broad range of trait-relevant responses (Ajzen & Fishbein, 2005). Different types of personality traits are suitable for different managerial decision roles, depending on the context of decisions and various other factors, such as the management level or the extent or urgency of decisions.

The taxonomies for classifying personality traits have suffered from a lack of unification (Eysenck, 1991), thereby posing a problem regarding the comparability or repeatability of different studies (Barrick & Mount, 1991). An influential taxonomy that emerged to organise the vast variety of personality traits into small personality constructs is the Big Five classification (Goldberg, 1990). The Big Five factor structure offers five robust personality factors that serve as a meaningful taxonomy for classifying personality attributes (Barrick & Mount, 1991). Research in this area suggests that any personality can be viewed as a combination of five major factors: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience (Goldberg, 1990). Judge, Higgins, Thoresen, and Barrick (1999) argue that the Big Five factor model may be generalised across cultures and remains stable over time. Thus, the five-factor conceptualisation of personality has been used and promoted as an all-embracing approach to understanding personality traits (Block, 2010). Seibert and DeGeest (2017) also identify the Big Five model as predominant model for conceptualising and researching the relationship of personality to workplace outcomes. The Big Five model has been successfully applied in studies closely related to the managerial decision-making context. For example, Barrick and Mount (1991) used the Big Five model to examine personality dimensions for different job performance criteria, Judge et al. (1999) investigated the relationship of Big Five factors and general mental ability with career success, whereas Oh and Berry (2009) applied the Big Five model to assess managerial performance. Based on the above we use the Big Five model in our research.

3. Research model and hypotheses development

3.1. Effects of personality traits on quality and confidence of decisions

Extraversion. Extraversion implies an energetic approach to the social and material world. It is distinguished by sociability, activity, assertiveness, and positive emotionality (John, Naumann, & Soto, 2008). Extraverted individuals are predisposed to positive effect, prefer interpersonal interaction (Mooradian & Swan, 2006), and enjoy leadership roles (Depue & Collins, 1999). They tend to be socially oriented but are also dominant, ambitious, and active (Watson & Clark, 1997). Together with

neuroticism and conscientiousness, extraversion appears to be the most relevant to career success and is generalised across studies (Judge et al., 1999).

At first glance, extraversion is positively related to both rational and intuitive decision-making styles (Dalal & Brooks, 2013). However, this is often an exaggeration as an 'extravert ideal' dominates, and introversion is mistakenly viewed as inferior or even pathological (Cain, 2012). In fact, extraversion is unrelated to long-term performance (Ciavarella, Buchholtz, Riordan, Gatewood, & Stokes, 2004) and is not a predictor of better multitasking performance either (Konig, Buhner, & Murling, 2005). Contrary to expectations, extraversion is not even related to a seemingly typical job for extraverts: the sales volume achieved by sales persons (Barrick, Mount, & Strauss, 1993).

What is more, in continuous tasks, extraverted subjects show increasing lapses of attention (Thackray, Jones, & Touchstone, 1974). Introverts appear to more easily regulate their behaviour (Coplan & Bowker, 2014) and are careful, reflective thinkers who can work in solitude where they enjoy privacy and freedom (Cain, 2012). Further, introverts do better with problem-solving tasks requiring insight and reflection (Moutafi et al., 2003). This leads to our first hypothesis:

H1a: The personality trait extraversion is negatively associated with the quality of a decision.

Some previous studies have shown that extravert managers have higher confidence in their decisions (Cheng & Furnham, 2002; White, Varadarajan, & Dacin, 2003). However, extraverts need considerable external stimulation. Thus, extraverted individuals suffer cognitive and emotional deficits when asked to act introvertedly (Coplan & Bowker, 2014) as their mental processes are directed at the external world (Moutafi et al., 2003). For extraverts, interacting with others produces robust increases in decision confidence with positive emotions (Heath & Gonzalez, 1995), while behaviour inconsistent with the sociable interactive style of extraverts (Canli, Sivers, Whitfield, Gotlib, & Gabrieli, 2002) leads to lower confidence. For tasks that are mainly individual it is assumed that

H1b: The personality trait extraversion is negatively associated with confidence in a decision.

Agreeableness. Agreeableness is a prosocial trait that differentiates how people form interpersonal relationships and refers to individuals who cooperate (John et al., 2008). People with a high level of agreeableness are described by others as kind, considerate, and warm (Graziano & Tobin, 2002). People who are less agreeable tend to have interpersonal problems (John et al., 2008) and might be quarrelsome (Antoncic, Bratkovic Kregar, Singh, & Denoble, 2015). Agreeableness, along with openness, is the least robust of the five personality traits since its theoretical structure is less consistently replicated (Meyer & Purvanova, 2013).

Individuals with high agreeableness prefer working and perform better in workgroups or teams (John et al., 2008) since their characteristics facilitate interpersonal attraction, cooperation, smooth conflict resolution, open communication, information-seeking, and compliance with team goals. As a result, these people elevate the overall team performance (Peeters, Van Tuijl, Rutte, & Reymen, 2006). For tasks that are mainly individual it is assumed that

H2a: The personality trait agreeableness is negatively associated with the quality of a decision.

Another characteristic of agreeableness is tender-mindedness (John et al., 2008). A decision-maker who is tender-minded tends to be influenced by others and can doubt his or her decisions. This tendency may lead to known decision biases and rationality shown by supply chain decision-makers (Carter, Kaufmann, & Michel, 2007). All these biases can affect the rationality of the decision and may erode confidence in the decision. People who score highly in agreeableness will appreciate assistance from others (Dalal & Brooks, 2013) and, in turn, without communication with other team members will have lower confidence in the decision. Therefore, it is posited that

H2b: The personality trait agreeableness is negatively associated with confidence in a decision.

Conscientiousness. Conscientiousness is a well-developed construct grounded in the personality and individual differences literature (Li, Tangpong, Hung, & Johns, 2013). It describes a socially prescribed impulse control that facilitates task- and goal-directed behaviour, such as thinking before acting, delaying gratification, and following norms (John et al., 2008). Conscientious individuals are self-disciplined, orderly, and hard-working (Jackson et al., 2010). Conscientiousness is thus the best predictor of individual job performance across occupations (Meyer & Purvanova, 2013) as well as other individual performance outcomes (e.g., contextual performance and customer service orientation) (Li et al., 2013; Strohhecker & Größler, 2013; Ellershaw, Fullarton, Rodwell, & Mcwilliams, 2016; Judge & Ilies, 2002; Hurtz & Donovan, 2000). Further, conscientiousness significantly affects decision accuracy (Lepine, Hollenbeck, Ilgen, & Hedlund, 1997). The literature thus provides vast support for the positive impact of conscientiousness on the quality of a decision. In only one experimental study the participants with low levels of conscientiousness made better decisions, but this entailed a laboratory experiment where the rules used were changed unbeknownst to the participants (Lepine, Colquitt, & Erez, 2000). Hence, it is suggested that

H3a: The personality trait conscientiousness is positively associated with the quality of a decision.

On the other hand, the effect of conscientiousness on confidence is less clear. Conscientious people prefer to make important decisions and participate in deliberation (Flynn & Smith, 2007). Conscientiousness positively predicts higher confidence in reading and writing and time management skills (Pulford & Sohal, 2006), which are, however, quite different activities than decision-making. Conscientiousness is not always good for well-being; although conscientious people tend to achieve more, they experience a bigger drop in satisfaction in the case of failure (Boyce, Wood, & Brown, 2010). It has been found that conscientiousness is negatively associated with risk-taking (Lev, Hershkovitz, & Yechiam, 2008). Overall, a significant negative correlation was found between conscientiousness and confidence (Burgess, Irvine, & Wallymahmed, 2010), especially in complex situations that imply uncertainty about future outcomes (Werner, Jung, Duschek, & Schandry, 2009). Therefore, it is proposed that

H3b: The personality trait conscientiousness is negatively associated with confidence in a decision.

Neuroticism. Neuroticism is the tendency to show poor emotional adjustment in the form of stress, anxiety, and depression (Judge & Ilies, 2002). Neuroticism is one of the most stable and replicable personality traits across contexts (Meyer & Purvanova, 2013). Individuals scoring highly on neuroticism are mostly regarded as anxious, depressed, angry, worried, insecure, and emotional (De Vries, De Koster, & Stam, 2016).

A previous inventory management study from an SCM setting showed that neuroticism consistently negatively predicts work-related performance to a comparatively large extent (Strohhecker & Größler, 2013). Individuals with high levels of neuroticism (i.e., the highest quintile) make twice as many errors compared to individuals in the lower quintiles (De Vries et al., 2016). Still, highly neurotic individuals outperform their stable counterparts in a busy work environment or if they are expending a high level of effort (Smillie, Yeo, Furnham, & Jackson, 2006).

This discrepancy can be attributed to the type of work. For example, neuroticism does not affect the performance of customer-oriented supply chain personnel (Periatt et al., 2007), and inventory specialists are more likely to be neurotic than the general population (McMahon, Lemay, Periatt, & Opengart, 2013). Another study finds that neuroticism is most strongly and most consistently negatively correlated with performance motivation (Judge & Ilies, 2002), yet additional evidence suggests it only has a weak connection with procrastination (Steel, 2007). These sometimes-conflicting results in previous studies show that the impact of neuroticism on the quality of decisions in the supply chain setting is somewhat mixed. Still, most studies show a negative impact, therefore,

H4a: The personality trait neuroticism is negatively associated with the quality of a decision.

Individuals high in neuroticism are more likely to increase their level of worry, as indicated by self-reported preferences and by behavioural choices in experimental settings (Tamir, 2005). These individuals are also more hesitant to make important decisions; overall risk-taking is negatively associated with neuroticism (Lauriola et al., 2014).

People who are more neurotic are more likely to avoid engaging in decision-making tasks because they doubt their abilities and feel vulnerable to stress (Wang, Jome, Haase, & Bruch, 2006) and may be afraid of the consequences of their decisions (Hirsh & Peterson, 2009). Neuroticism has been associated with heightened stress responses to daily stressors and other physiological changes; on the other hand, those who report low levels of neuroticism tend to be emotionally stable and feel self-assured (Denburg et al., 2009). This leads to

H4b: The personality trait neuroticism is negatively associated with confidence in a decision.

Openness. Openness assesses an individual's proactive seeking and appreciation of experience for its own sake and toleration for and exploration of the unfamiliar. The higher scorers tend to be curious, creative, original, imaginative, and untraditional

(Lin, 2010). Individuals who exhibit openness are considered innovative, adventurous, and unusual in their ways. They show high levels of intellect and creativity and become bored of the same routine (John et al., 2008).

People who score higher on openness are better suited to adapt to more dynamic environments and should be more flexible and adaptable, more creative, and innovative (Colbert, Barrick, & Bradley, 2014), and they should make good business decisions (Antoncic et al., 2015). An individual highly open to experience should be constantly intellectually challenged. If the challenge is sufficient, the performance of the person scoring highly on openness will improve (Hurtz & Donovan, 2000). Such an individual should be making better decisions since high openness promotes higher performance in decision-making (Lepine et al., 2000). The above puts forward the following:

H5a: The personality trait openness is positively associated with the quality of a decision.

Openness significantly predicts confidence and accuracy. Individuals with high openness scores possess elevated confidence levels that accurately reflect their elevated performance (Schaefer, Williams, Goodie, & Campbell, 2004). These individuals will also try to have an active role in decision-making (Gosling, Rentfrow, & Swann, 2003). On the other hand, people with low levels of openness are less adaptable to change, less confident, and highly likely to act recklessly (Duberstein, 1995). Finally, participants highly open to experience are significantly more influenced by cues for anchoring (the adjustment of one's assessment, higher or lower, based on previously presented external information) (McElroy & Dowd, 2007). It is thus hypothesised that

H5b: The personality trait openness is positively associated with confidence in a decision.

3.2. Effects of domain knowledge on quality and confidence of decisions

Supply chain managers come from different backgrounds, such as transportation, procurement, information technology, and finance (Mangan & Christopher, 2005) and follow different cross-functional career paths (Flöthmann & Hoberg, 2017). As SCM is considered an interdisciplinary field, supply chain managers should be experts in a wide variety of areas pertaining to general knowledge and supply chain knowledge (Mangan & Christopher, 2005), for example, transportation and logistics, business ethics, and production management (Murphy & Poist, 2007).

The quality of decision is affected by the prior knowledge of the decision-maker. The distinction between self-reported knowledge (subjective knowledge) and test-evaluated knowledge (objective knowledge) of decision-makers has been emphasised in this research as both types of knowledge can affect the entire decision process and are likely to have different effects on the decision process (Raju, Lonial, & Mangold, 1995). It is, therefore, important to assess an individual's self-reported knowledge and test-evaluated knowledge to better understand their overall capability to decide.

People differ widely on how they apply knowledge to solve a problem. Those who are more knowledgeable in a certain domain become more confident (Hall, Ariss, & Todorov, 2007). Knowledge about a specific topic can create a cognitive bias toward

overdependence on prior knowledge in arriving at decisions (Dietrich, 2010) and can, therefore, negatively affect the quality of a decision. High domain knowledge can provide a biased first solution attempt and can fixate the high-knowledge subject and decrease the chances of finding an appropriate solution (Wiley, 1998). Therefore, we hypothesise the following:

H6a: Self-reported supply chain knowledge negatively affects the quality of a decision.

While specific managerial skills are more important for sound decision making among supply chain managers, factual SCM knowledge provides a solid basis (Tatham, Wu, Kovács, & Butcher, 2017). Furthermore, it has been shown by a meta-analysis that the possession of supply chain knowledge is positively related to performance (Wowak et al., 2013). Therefore, we hypothesise the following:

H6b: Test-evaluated supply chain knowledge positively affects the quality of a decision.

People with the lowest level of knowledge usually overestimate their abilities, while people with the greatest knowledge are typically meta-aware of the limits of their abilities, which also reduces their confidence in their own decisions (Kruger & Dunning, 1999). However, there is a lack of relevant research in decision confidence related to prior knowledge specifically in the field of SCM. Therefore, there is a genuine need to explore the effect of self-reported and test-evaluated knowledge on confidence in a decision. As such, the following hypotheses are proposed:

H7a: Self-reported supply chain knowledge positively affects confidence in a decision.

H7b: Test-evaluated supply chain knowledge positively affects confidence in a decision.

4. Methodology

Simulation games have often been used in behaviour operations and supply chain research (Amaral & Tsay, 2009; Bragge et al., 2017). The research participants played the Supply Chain Game (Responsive-Learning-Technologies, 2015). The game simulates decision-making in the supply chain operations of a firm. Such an approach is well suited when trying to understand how and why supply chain managers make their decisions (Rungtusanatham, Wallin, & Eckerd, 2011).

This game has four parameters that participants could freely decide to change: (1) capacity additions to the existing factory; (2) reorder point; (3) the factory's production batch size; and (4) type of transport. Five days before starting the simulation, the participants were provided with a detailed case that included a market analysis, information on the company's operations, and two years of historical data (demand, satisfied demand, lost demand, all transportation activities, start/end of batch production, and capacity changes in the factory). The simulation was accessible online via a web browser and ran continuously for seven days without pause (the simulated time was two years). The leader board was shown throughout the entire simulation so the participants could see their scores relative to others'. After the game had ended, the participants submitted their reports, which included a description, justification, and self-assessed confidence for each decision. The evaluated reports and final scores were part of the grade for the course.

The participants could change the four parameters at any given time and any number of times. The game itself ran in a controlled environment; however, the decisions were made in a real-life setting amidst other activities of the participants, which reflects well how those decisions are made in real professional life (Frey & Meier, 2004). Qualitative and quantitative data from 29 participants (15 male and 14 female students) relating to 370 decisions were collected and analysed. Qualitative data included the participants' explanation for each decision which was a basis for evaluation of the quality of each decision. Quantitative data included the timestamp for each decision, the old and new value of the changed parameter in the game and the self-assessed confidence score for each decision. The game was completed by a group of full-time SCM master's students during the same course. All the participants played the same iteration of the simulation.

Before the game, the personality traits of participants and SCM knowledge were measured. Personality traits were tested using the Big Five model (John et al., 2008). Dochy, Segers, and Buehl (1999) identified six types of assessment methods for assessing specific knowledge, out of which a recognition measure such as a paper-and-pencil test of topical knowledge is sufficient (Valencia, Stallman, Commeyras, Pearson, & Hartman, 1991). Participants estimated their self-reported SCM knowledge using a 1–5 Likert scale with four questions. Test-evaluated SCM knowledge was measured with written questions that were graded by the authors. Each answer was evaluated on a scale from 0 to 3. They were tested for specific SCM knowledge that related directly to the game's contents, such as demand planning, economic order quantity model, inventory costs, marginal costs, stock out, and lead times.

During the game, two variables were measured: (1) the quality of a decision; and (2) the self-assessed confidence in that decision. The quality of each decision was evaluated on a Likert scale from 1 to 5, with 1 being the lowest and 5 the highest. Since the final position on the leader board was the result of all decisions, the base scores for the quality of decisions were based on the final leader board, i.e., if a participant was in the first quintile on the final leader board, all decisions were initially evaluated as 5; if a participant was in the second quintile, all decisions were evaluated as 4; and so on. Lastly, each decision was evaluated by one of the authors and could vary by up to 2 points from the base score based on the quality of the specific decision in relation to the current state of the simulation.

The structural model consists of nine latent variables (see Figure 1). The model was estimated using the partial least squares structural equation modelling (PLS-SEM) approach. This option is mainly motivated by the data characteristics and the model's properties. In fact, PLS-SEM works efficiently with small sample sizes and complex models and practically makes no assumptions about the underlying data (Hair, Sarstedt, Ringle, & Mena, 2012). All data analyses were carried out using SmartPLS (Ringle, Wende, & Will, 2007) and SPSS.

5. Results of testing the hypotheses

5.1. Descriptive analysis

Table 1 shows the means and standard deviations of the original variables. The means vary between 1.78 for TEK2 and 4.29 for PTC3. The highest means are found in the

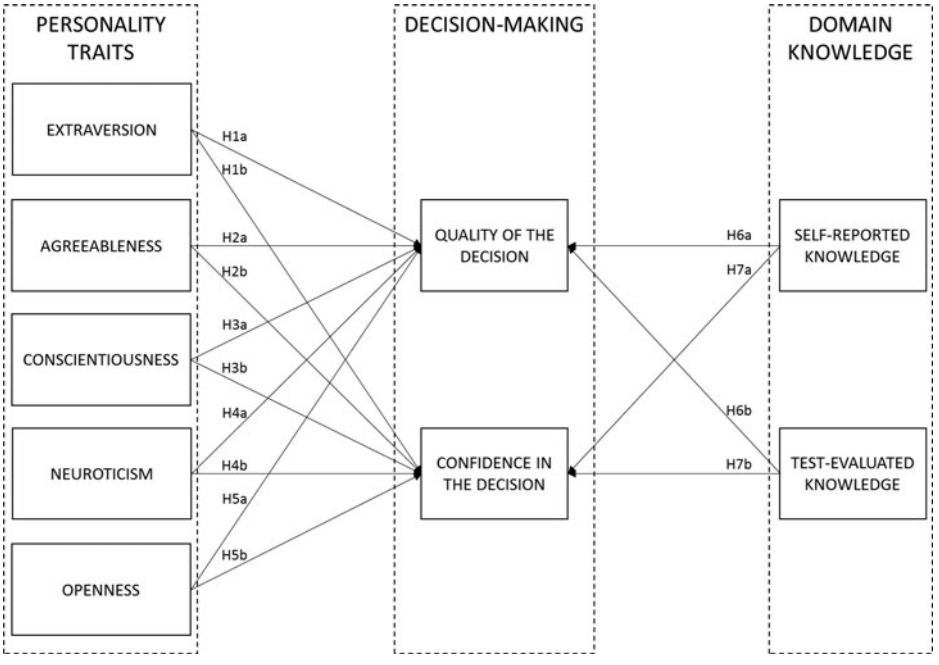

Figure 1. Research model. Source: Authors' work.

Table 1. Means, standard deviations, and standardised loadings of latent variables.

Construct	Indicator	Mean	Std. Dev.	Loading
Personality trait extraversion (PTE)	PTE1	3.90	0.816	0.691*
	PTE2	3.63	0.690	0.796*
	PTE3	3.89	0.857	0.901*
Personality trait agreeableness (PTA)	PTA1	3.75	1.086	0.663*
	PTA2	3.96	0.859	0.857*
	PTA3	4.01	0.775	0.687*
Personality trait conscientiousness (PTC)	PTC1	3.75	0.774	0.716*
	PTC2	3.15	1.088	0.859*
	PTC3	4.29	0.680	0.687*
Personality trait neuroticism (PTN)	PTN1	2.74	0.868	0.810*
	PTN2	2.54	0.949	0.980*
Personality trait openness (PTO)	PTO1	3.58	0.664	0.788*
	PTO2	4.18	0.647	0.656*
	PTO3	3.79	0.767	0.835*
Self-reported knowledge (SRK)	SRK1	2.31	1.103	0.843*
	SRK2	2.30	1.273	0.775*
	SRK3	2.36	1.075	0.894*
	SRK4	2.33	1.328	0.823*
Tested knowledge (TEK)	TEK1**	1.91	1.218	0.797*
	TEK2**	1.78	1.204	0.910*

Note: *Significant at the $<$ 0.001 level (two-tailed test); **different measurement scale was used (see above). Source: Authors' calculations.

PTA indicators and the lowest in the TEK construct. The means for most measures (except for those of the SRK and TEK constructs) are around one scale point to the right of the centre of the scale, suggesting a slightly left (negative) skewed distribution. Standard deviations vary between 0.647 for PTO2 and 1.328 for SRK4. The TEK indicators are those that globally show the highest standard deviations, and the indicators of the PTO construct are those with the lowest variability.

5.2. Measurement of reliability and validity

First, the reliability and validity measures for the model's multi-item constructs were examined (Table 2). All Cronbach's Alphas exceed the 0.7 threshold (Nunnally, 1978). All latent variable composite reliabilities (Fornell & Larcker, 1981) are higher than 0.7, showing the high internal consistency of the indicators measuring each construct and thus confirming construct reliability. The average variance extracted (AVE) (Fornell & Larcker, 1981) is also always higher than 0.5, indicating the variance captured by each latent variable is significantly larger than the variance due to measurement error, thus demonstrating unidimensionality and the high convergent validity of the constructs. The reliability and convergent validity of the measurement model was also confirmed by computing standardised loadings for the indicators (Table 1) and bootstrap t-statistics for their significance (Anderson & Gerbing, 1988). Indicators with standardised loadings that were not close to the 0.7 threshold were dropped from the final analysis. The remaining indicators were significant at the 1% significance level.

Discriminant validity is assessed by determining whether each latent variable shares more variance with its own measurement variables or with other constructs (Fornell & Larcker, 1981, Chin, 1998). The square root of the AVE for each construct was compared with the correlations with all other constructs in the model (Table 3). A correlation between constructs exceeding the square roots of their AVE would indicate that they may not be sufficiently discriminable. In this case, the square roots of AVE (shown in bold on the diagonal) are always higher than the absolute correlations between constructs. Thus, all constructs have acceptable validity.

5.3. Model estimation results

Table 4 shows the explanatory power (through the determination coefficient R^2) of the equations explaining the endogenous constructs: confidence in the decision

Table 2. Reliability and validity measures for multi-item constructs.

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
PTE	0.756	0.813	0.598
PTA	0.705	0.750	0.508
PTC	0.749	0.795	0.566
PTN	0.807	0.893	0.808
PTO	0.734	0.806	0.583
SRK	0.888	0.902	0.697
TEK	0.744	0.845	0.732

Source: Authors' calculations.

Table 3. Correlations between the latent variables and square roots of average variance.

	PTE	PTA	PTC	PTN	PTO	SRK	TEK
PTE	**0.773**	0.700	0.020	0.021	0.278	0.043	0.158
PTA		**0.713**	0.292	0.036	0.144	0.043	0.089
PTC			**0.752**	0.009	0.282	0.020	0.145
PTN				**0.899**	0.129	0.045	0.043
PTO					**0.764**	0.106	0.036
SRK						**0.835**	0.638
TEK							**0.856**

Note: Numbers shown in bold denote the square root of the average variance extracted. Source: Authors' calculations.

Table 4. Structural model results and effects sizes (f^2).

Criterion	Predictors	R^2	Path Coefficient	f^2
DQU	PTA	0.347	−0.180***	0.031
	PTC		0.246***	0.177
	PTE		−0.211***	0.041
	PTN		−0.093*	0.010
	PTO		0.386***	0.398
	SRK		0.053(ns)	0.020
	TEK		0.240***	0.118
DCO	PTA	0.101	−0.173**	0.054
	PTC		0.020(ns)	0.000
	PTE		−0.026(ns)	0.021
	PTN		−0.118**	0.025
	PTO		0.106**	0.011
	SRK		−0.039(ns)	0.000
	TEK		0.234***	0.133

Notes: (ns) non-significant; *significant at the 0.05 level (one-tailed test); **significant at the 0.01 level (one-tailed test), ***significant at the 0.001 level (one-tailed test). Source: Authors' calculations.

(DCO) and quality of the decision (DQU). The proposed model reveals relevant explanatory power for the quality of the decision (0.347) and lower explanatory power for confidence in the decision (0.101). Further, Table 4 presents the estimates of the path coefficients of the proposed model and the respective significances. Table 4 also shows the effect sizes for evaluating the predictive importance of each determinant.

The effect of personal trait extraversion (PTE) on DQU was found to be significant (−0.211; $p < 0.001$) and small whereas the effect of PTE on DCO was non-significant. Thus, hypothesis H1a is confirmed whereas H1b is not.

The effect of personal trait agreeableness (PTA) on DQU was significant (−0.180; $p < 0.01$) and small, thereby confirming hypothesis H2a. Moreover, the effect of PTA on DCO was also significant (−0.173; $p < 0.01$) and small, thus confirming hypothesis H2b. Accordingly, it can be argued that PTA has a negative influence on both the quality of and the confidence in decisions.

The effect of personal trait conscientiousness (PTC) on DQU was significant (0.246; $p < 0.001$) and of medium size, thus confirming hypothesis H3a. On the other hand, the effect of PTC on DCO was found non-significant, thereby rejecting hypothesis H3b.

The negative effect of personal trait neuroticism (PTN) on both DQU (−0.093; $p < 0.05$) and DCO (−0.118; $p < 0.01$) was significant (although small), thus confirming hypotheses H4a and H4b.

The effect of personal trait openness (PTO) on DQU was significant (0.386; $p < 0.001$) and large, thereby confirming hypothesis H5a. Moreover, the effect of PTO on DCO was also significant (0.106; $p < 0.01$), thus confirming hypothesis H5b. Therefore, sufficient evidence exists to support PTO's having a positive influence on the quality of the decisions and confidence in the decisions.

Finally, partial support for the set of hypotheses H6a–H6b and H7a–H7b was found. The effects of test-evaluated knowledge (TEK) on DQU (0.240; $p < 0.001$) and DCO (0.234; $p < 0.001$) were found significant. The effects show a medium effect size in both instances, confirming suitable predictive relevance. Hypotheses H6b and H7b are thus confirmed. On the contrary, the effect of self-reported knowledge (SRK) on

DQU and DCO was found to be non-significant, thus rejecting hypotheses H6a and H7a.

6. Discussion

Decision making is a vital aspect in supply chain and operations management. This study explored how the personality traits and knowledge of the decision maker influence the quality of decisions in the context of supply chain management. It showed that personality traits can significantly affect the confidence in and also the quality of their decisions. Also, an easy-to-administer test can identify candidates' level of knowledge, which importantly influences the quality of and confidence in their decisions whereas self-perceived knowledge does not exert such an influence.

6.1. Implications for theory

The presented work shows the solid explanatory power of the impact of personality traits and domain knowledge on the quality of decisions and to a slightly smaller extent on the confidence in decisions. Even small incremental explained variance can make a significant contribution to predictive efficiency in one's job (Hurtz & Donovan, 2000). Collectively, the personality traits and knowledge more strongly affect how good decisions are and less so how confident the decision-maker is in his or her decisions.

This study makes three theoretical contributions. First, a decision-maker's conscientiousness and openness were the two personality traits that contributed the most to the better quality of decisions. While the large effect of conscientiousness is not surprising, the even stronger effect of openness is both unexpected and important. Obviously, in this case, the way in which the game was played (a computer-based simulation environment) was new to the participants. This shows that openness is important for employees who are dealing with novel tasks in a novel environment.

Extraversion importantly (negatively) affects the quality of decisions. This adds new insights to the previous finding that extraversion (along with agreeableness) relates more strongly to voice and cooperative behaviour than to task performance (LePine & Van Dyne, 2001). As hypothesised, the more agreeable participants perform worse in solitude tasks and, therefore, made decisions of worse quality in our game, which was played individually.

Second, this paper argues that the effect of personality traits on confidence in the decision is less significant and generally weaker than on decision quality, although 3 out of 5 hypotheses are still confirmed. More extraverted individuals do not show any greater confidence in their decisions, a finding that is in line with previous work of Heath and Gonzalez (1995). As expected, due to the nature of the game where decisions had to be made sequentially, individuals who are agreeable in nature had less confidence in their decisions as they might become indecisive and tend to doubt their decisions. Neurotic individuals have less confidence, which is contrary to the findings of Periatt et al. (2007) that neuroticism does not affect the confidence of customer-oriented SCM personnel. However, as hypothesised, this can be attributed to

the mental state of stress that hampers confidence in these decisions. While conscientious people perform significantly better, they are not more confident in their decisions. As expected, people who are open to experience are also more confident in their decisions.

Third, somewhat surprisingly, the knowledge as perceived by an individual does not affect either their confidence or the decision quality. It should be emphasised that the tested subjects did not have any incentive to overinflate their perceived knowledge, which usually happens in job interviews (Weiss & Feldman, 2006). Thus, it can be assumed that their self-reported knowledge adequately reflects their perceived knowledge.

Self-reported knowledge about SCM also does not help to boost the confidence of the decision-maker. This is slightly counterintuitive because when a person perceives they have the knowledge it should help to improve their confidence. On the other hand, test-based knowledge positively affects both confidence and decision quality. The more the participant really knows about SCM, the more confident he or she is. The effect of tested knowledge on both confidence and quality is high; this indicates that already a relatively small investment in training improves both confidence in and quality of decisions.

6.2. Implications for practice

Firms should carefully consider how an individual's personality matches the type of job at hand. This is even more important in the SCM setting where the available jobs are very diverse; some jobs (e.g., inventory management or procure-to-pay process) may be quite standard while others are very specific to a certain company. In a typical job type, previous knowledge may be more important; in specific jobs, personality (especially openness and conscientiousness) can matter more. As job interviews are often biased toward more extraverted employees (Kristof-Brown, Barrick, & Franke, 2002), negative effect of extraversion on quality of decisions can lead to the selection of wrong individuals for a certain decision-making position.

Next, appropriate motivation mechanisms should be devised for less conscientious individuals as the productivity-enhancing effects of pay-for-performance are especially pronounced for employees who score low on this trait (Fulmer & Walker, 2015). It should also be noted that while conscientious people do make better decisions, their level of confidence in those decisions is not significantly higher. Therefore, an individual's confidence in a certain decision is not a good proxy for the quality of such a decision.

Finally, since supply chains nowadays operate in turbulent environments (Trkman & McCormack, 2009) while constantly innovating their business models in response to yet unknown changes (Trkman, Budler, & Groznik, 2015), it is crucial that the core supply chain experts score highly on openness as they will need this trait to adapt to new circumstances.

The paper also has informs other audiences in addition to practicing managers (Busse, 2014). For example, it can help career advisors at universities to recruit

appropriate students for the SCM major or to better guide existing students in their specific career choices.

6.3. Limitations and future research

The study has several limitations while it also opens opportunities for future research. To begin with, the conclusions should be considered with caution due to the setup of our game. The game was a particular type of problem with individual decision-making. Further, the impact of knowledge and personality traits is likely different in a different kind of game.

Second, the sample was relatively small and included solely full-time master's students who made several individual decisions throughout the game. The way in which decisions are made in a fictional (game) setting can be very different from the real world since the consequences of decisions in real life hold much greater weight. Still, the fact that feedback was provided and that the participation was graded indicates this was a solid proxy. A further limitation is that the quality of a decision was evaluated by one of the authors and presents a partly subjective evaluation of the quality of a decision in a particular situation.

An important question is the generalisability of the findings – to what extent can the impact of personality traits on quality of decisions in supply chains be generalised to all decision makers.

Caution is needed in generalisation as the more specifically one delineates a situation in which personality predicts job performance, the more difficult it is to know whether that specific context works in similar contexts (Judge & Zapata, 2015). Still, the personality traits that are generally believed to show stability across different contexts (Müller, Beutel, Egloff, & Wölfling, 2014). The traits are replicable and generalisable, can be identified empirically, and the unique constellation of individuals' traits has important consequences for a wide range of outcomes (Robins, John, Caspi, Moffitt, & Stouthamer-Loeber, 1996). The general view is that that the impact of personality on decision making can be generalised and the variability across studies can mainly be explained by methodological factors (Lord, De Vader, & Alliger, 1986). Thus, interpreting differences in personality as predispositions is reasonable (Müller et al., 2014).

Although a group of supply chain professionals would be preferable, the described group of students is an appropriate approximation for real-world decision-makers regarding personality and education/knowledge, except for the experience that real-world managers have (Knemeyer & Naylor, 2011; Stevens, 2011; Strohhecker & Größler, 2013). Given the fact that the intended population for the study was explicitly identified and the goal of the researchers with respect to generalisation from student subjects is explicitly presented the use of students for our particular purpose is justified (Compeau, Marcolin, Kelley, & Higgins, 2012).

Still, additional research will be necessary to more thoroughly test the generalisability of the findings across a more diverse range of samples and future studies that incorporate informant report are needed (see Allen et al, 2018).

In this respect, game's availability in a standard form allows a direct replication of our study (Simons, 2014). Assuring replicability is crucial to improving scientific exploration (Pashler & Harris, 2012) as more than 70% of researchers have tried and failed to reproduce another peer's experiments, and more than half have failed to reproduce their own experiments (Baker, 2016). On the other hand, the game could also be modified. A thought-provoking option is to repeat the same game in a time-pressured lab environment where the effect of external influences (e.g., the busyness of individuals and whether individuals are allowed to communicate with each other) could be controlled while the effect of other factors (e.g., the amount of time available, the monetary incentives for doing well, the learning effect, or interruptions during the game) could be tested. The alternative modification would be to let the subjects play the game at their own pace as decisional procrastination strongly correlates with personality traits (Fabio, 2006).

Lastly, the most interesting (although also challenging) future research could use real-life observations or even action research of supply chain experts' decision-making during their everyday work. Such investigations might further improve our understanding of the factors that affect the quality of decisions in supply chains and help firms to hire employees suited to a particular task.

Funding

Slovenian Research Agency (grant number: J5-6816)

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