

INVESTIGATING INFLUENCE OF PRACTICAL SUPPLY CHAIN CONSTRAINTS ON DECISION-MAKING OF SCM AGENTS OF DIFFERENT PERSONALITY TYPES

Paraschos Maniatis*

Abstract: Purpose: This research is an investigation of the influence of practical supply chain constraints on sustainable SCM decision-making orientations by SCM agents of different personality types under the influence of supply chain integration, information availability, and multi-supplier availability acting as SCM moderators, **Design/methodology/approach:** SCM decision-making orientations were mapped with SCM decision constraints through exploratory factor analysis and scale reliability tests based on structured data collection from 104 research participants pertaining to demand-supply uncertainty scenarios. An online personality test has been used to map these 104 research participants with Big-5 personality traits. The influence of their personality traits on SCM decision-making orientations (mapped with real world SCM constraints) under chosen SCM moderators (supply chain integration, information availability, and multi-supplier availability) have been tested using confirmatory factor analysis. Finally, structural equation modeling tests have been conducted to test the initial and alternate models, and derive the best-fit model. **Findings:** It has been found that cultural constraints of SCM decision-making are linked with extraversion and neuroticism personality traits, and profitability, environmental, and sustainability constraints of SCM decision-making are linked with openness, agreeableness, and conscientiousness personality traits. Most importantly, it has been found that SCM capabilities (acting as SCM moderators) have a high influence on SCM decision-making irrespective of the personality type. **Research limitations/implications:** The research is based on a small and uneven sample taken from four countries. The final model of this research may be validated by future researchers taking much larger and even samples (typically >500) from more countries (typically >10), and using similar statistical modeling methodology. **Practical implications:** Organizations could invest in most effective SCM capabilities (acting as SCM moderators) under difficult and conflicting SCM decision constraints knowing how they can be used as effective tools to reduce the risks caused by personality-driven (individual-dependent) decision-making and their impacts on organizational business. **Original value:** There have been few studies on the merits of SCM moderators in influencing decision-making behaviors by SCM agents of different personality types. This emerging knowledge can help in reducing business risks caused by SCM agents by virtue of their personality-driven decision-making behaviors.

Keywords: sustainable SCM decision constraints, sustainable SCM decision behaviors, sustainable SCM agent personalities, sustainable SCM moderators, sustainable decision-making under risks and uncertainties, Big-5 personality traits

* Business School, Athens University of Economics and Business, E-mail: pman@aueb.gr

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Decision-making in supply chain management has been one of the primary concerns given that it is directly linked with supply chain efficiency and hence with business performance. There is lack of theories and practice pertaining to behavioral influences and resulting biases on complex decision-making in SCM amidst risks and uncertainties. Decisions are taken by individual supply chain agents that often face practical uncertainties and risks at both supply and demand sides. Erroneous decisions cause erroneous demand information flowing upstream in the form of tidal demand waves (Forrester effect). In absence of any support from organizational SCM capabilities, the supply chain agents make decisions by virtue of their personalities and experience. This research showed that relationships between personalities of SCM agents and their decision-making orientations are existent. However, a significant finding by this research is that the influence of personalities reduces if the organization has invested in relevant and effective SCM capabilities, like supply chain integration, information availability, and multi-supplier availability, acting as SCM moderators. These moderators help in reducing decision-making errors caused by personality traits of SCM decision-makers. These findings may encourage organizations for investing in relevant and effective SCM moderators such that dependence on individual SCM agents and their respective personalities could be reduced thus reducing the chances of people-made risks.

1. INTRODUCTION

The key SCM question addressed in this research is the following:

How do the real world supply chain constraints influence the decision-making by SCM agents of different personality types under supply chain integration, information availability, and multi-supplier availability acting as SCM moderators?

Decision-making in supply chain has been one of the prominent research interests of scholars in the past decade. Significant emphasis has been given on models of decision-making especially under uncertainties, and conflicting multi-objective scenarios. However, there is little evidence on how SCM capabilities (acting as SCM moderators) support SCM agents with different personality types while making decisions under practical SCM decision constraints, especially when the SCM agents are exposed to real world settings having demand and supply uncertainties. Roles of personality types in constrained decision-making amidst risks and uncertainties have attracted significant research interest recently (Bellman, 2012; Deck *et al.*, 2008; Soane, Dewberry, & Narendran, 2010; Frechette, Schotter, & Trevino, 2011, 2013; Lauriola *et al.*, 2013; Caliendo, Fossen, & Kritikos, 2011, 2013). These researchers have found prominent effects of Big-5 personality traits on information usage, risk aversion, reasoning and analysis, and impulsivity while making decisions amidst risks and uncertainties. SCM decision-making amidst demand and supply uncertainties is one such prominent field. SCM under demand-supply risks has been researched significantly for deriving decision-making models. However, human behaviors in supply chain decision-making have not been researched adequately.

Brauner *et al.* (2013), Carter, Kaufmann, and Michel (2007), and Tokar (2010) have emphasized the need for studying effects of human behavior in complex decision-making in the fields of logistics, purchasing, and SCM. Tokar (2010) highlighted the lack of theory and practice of behavioral research in these fields resulting in inadequate knowledge of human biases in such sophisticated decision-making fields. Personality types have a role in sophisticated decision-making events in SCM, like dealing with suppliers during complex scenarios, negotiating, analyzing risks and benefits in purchasing decisions, persuasive communication with suppliers and customers for managing risks, and evaluating economics (Brauner *et al.*, 2013; Carter, Kaufmann, and Michel, 2007). However, the recommendations by Brauner *et al.* (2013), Carter, Kaufmann, and Michel (2007), and Tokar (2010) reveal that these roles have not been studied adequately in supply chain literatures. SCM is among those management disciplines having very little tolerance for judgmental errors. In SCM with demand and supply uncertainties, judgment errors cause the threat of Forrester effect (commonly known as Bullwhip effect) (Geary, Disney, & Towill, 2003). Jay Forrester modeled SCM using systems dynamics theories and found that “rougue fluctuations” caused by judgmental errors result in false demand waveforms propagating upstream with amplitudes increasing at each echelon (Geary, Disney, & Towill, 2003). This effect causes significantly larger shipments downstream than the actual consumptions causing inventories piling up at each echelon (Geary, Disney, & Towill, 2003). For businesses dealing with limited shelf-life products, there can be enormous wastage (Geary, Disney, & Towill, 2003). This phenomenon happens in almost all the industries having multi-echelon supply chains (Geary, Disney, & Towill, 2003). Lee, Padmanabhan, & Whang (1997) presented that distortions in information sharing and inter-echelon coordination and lack of information integration are primary causes of Forrester effects. A number of decision models have evolved for solving the Forrester effect problem. However, there is little evidence of research on influence of personalities causing erroneous decisions in supply chains and thus the Forrester effect (Brauner *et al.*, 2013). This gap is the motivation for conducting this research.

This research is a multivariate analysis of relationship of SCM decision-making orientations with Big 5 personality types of SCM agents in an experimental construct for testing supply chain decision-making behaviors under environmental, profitability, reputational, trust, market share, and risk minimization constraints in real world settings (having demand and supply uncertainties), and with integration, information availability, and multi-supplier availability acting as SCM moderators. The supply chain decision behaviors tested are profit orientation, ecological orientation, cultural orientation, and sustainability orientation. The research comprises a controlled experimentation on 104 research participations having 51 members from Greece, 23 members from Germany, 12 members from UAE, and 18 members from India. The chosen participants are working in multi-

echelon supply chains in inventory management, logistics, procurement, and production roles. The techniques used for testing the structural framework and its hypotheses are confirmatory factor analysis and structured equation modeling.

2. REVIEW OF LITERATURES

2.1. Personality and decision-making

The decision-making behaviors of individuals do not depend only upon their cognitive abilities but also depend upon their cognitive reflections (Frederick, 2005). Frederick's (2005) experiment found that there are unexplained differences in decision-making behaviors among high aptitude people subjected to a cognitive reflection test comprising elementary questions. The relationship between cognitive styles and decision-making was diagnosed as affirmative in older studies, as well (Hunt et al., 1989; Haley and Stumpf, 1989). Employing Myers-Brigg type indicators and Jung type tests, Haley and Stumpf (1989) found evidences of influence of personality on cognitive styles. However, Blass (1991) found that individual cognitive styles vary under different situations given that situational moderators interact with personalities of people depending upon whether the situation was chosen or imposed. Furnham and Stringfield (1993) found that culture has a role to play when people of different personalities are exposed to different decision-making situations. However, they cautioned that personality type should not be viewed as the predictor of job performance given that their test (based on Myers-Brigg type indicators) did not reflect any correlations with training and job proficiency. In fact, they found culture playing more significant role than Myers-Brigg type indicators in predicting job performance. This is because culture can influence development of strategies and decision-making given that problems occur within the frame of socio-cultural settings (Guss and Dornier, 2011). Guss and Dornier (2011) emphasized that under difficult problem scenarios, values, ethics, norms, and standards serve as guiding principles for choosing certain strategies against others. They identified values, ethics, norms, and standards as traits of a cultural framework. In addition, emotions and discourse come into play under difficult situations, like an organizational change management (Garrety *et al.*, 2003).

The interaction of personality types with cultural traits can be modeled using Hofstede's cultural typology (Rawwas, 2001). Ethics, beliefs, and morality are traits of culture but their influence on individuals differ by their personality types (Rawwas, 2001; Raja, Johns, and Ntalianis, 2004). The differences can be measured by how individuals of different personality types perform in psychological contracts (perceptions and expectations of an employee about his/her obligations within an organization) (Raja, Johns, and Ntalianis, 2004). The performance of an individual in psychological contracts influences his/her decision-making behavior and work performance (Raja, Johns, and Ntalianis, 2004).

The key personality tests used in majority of research studies reviewed in this research are Myers-Brigg type indicators (MBTI) and Big 5. A detailed comparison of these personality tests is out of the scope of this research and this discussion is limited to choosing an appropriate test for this research. It is learnt that MBTI assigns a single personality type per individual out of 16 types without a numerical score (UOK, 2002). The 16 personality types are formed by combining four preferences of individuals - extraversion (E) versus introversion (I), sensing (S) versus intuition (N), thinking (T) versus feeling (F), and judging (J) versus perceiving (P) (UOK, 2002). The Big 5 assesses each individual based on five personality dimensions named as extraversion, neuroticism, openness, agreeableness, and conscientiousness (John and Srivastava, 1999). Each dimension is measured using structured questions with Likert scale (John and Srivastava, 1999). This test is interpreted as suitable for this research because the decision-making attributes in supply chain are measured using Likert-type scales. Some prominent Big 5-based research studies are reviewed in the next paragraph.

Personality scales are associated with decision-making competence (Dewberry, Juanchich, and Narendran, 2013). Dewberry, Juanchich, and Narendran (2013) found that extraversion and neuroticism are negatively associated with decision-making competence whereas openness, agreeableness, and conscientiousness are positively associated with decision-making competence. Germeijs and Verschueren (2011) found a significant positive correlation between decision-making competence (measured through an indecisiveness scale) and neuroticism personality type. However, in another research by Di Fabio and Palazzeschi (2012), it was found that self-evaluation construct (formed by motivation, self-confidence, and level of dysfunctional belief) causes significant variance in decision-making competence (measured through an indecisiveness scale) irrespective of how the Big 5 personality traits are linked with intelligence and cognitive abilities. These results tend to favor openness, agreeableness, and conscientiousness against extraversion and neuroticism. However, based on the research by Lauriola and Levin (2001), one should be cautious in accepting indecisiveness scale as the determiner for decision-making competence. Their research used another scale for measuring risky decision-making under arousal, aggressive, and impulsive tendencies and found that openness, agreeableness, and conscientiousness combined with age and gender (mostly youth) tend to take riskier decisions under those tendencies. Similar results were obtained in the research by Soane and Chmiel (2005). These research studies have indicated that Big 5 personality traits should be mapped with demographics, knowledge, experience, and such other moderators for determining decision-making competence.

For determining decision-making, personality does play a key role. However, personality type is not the sole determiner of decision-making competence. Situational and environmental moderators and other moderators like knowledge,

experience, demographics, culture (values, ethics, norms, standards), and emotions interact with personality types in determining decision-making competence. Keeping these findings in view, the theoretical construct for determining role of personality in supply chain decision-making behaviors with profit, ecology, culture, and sustainability orientation under supply chain environmental uncertainties (in demand and supply) is designed in Section 2.4.

2.2. Linking Big-5 personality traits with decision-making under risky scenarios and its significance in the context of SCM

The influence of Big-5 personality traits (and similar models) on decision-making under risky scenarios has been researched considerably in the recent past (Bellman, 2012; Deck *et al.*, 2008; Soane, Dewberry, & Narendran, 2010; Frechette, Schotter, & Trevino, 2011, 2013; Lauriola *et al.*, 2013; Caliendo, Fossen, & Kritikos, 2011, 2013). Some of the key areas of research in this context have been social and recreational decision-making, health and safety decision-making, gambling, ethical decision-making, and making investment decisions (Deck *et al.*, 2008; Soane, Dewberry, & Narendran, 2010). The research by Soane, Dewberry, & Narendran (2010) found that personality has prominent effects on decision-making under risks and uncertainties in the fields of social and recreational, health and safety, gambling, investments, and ethical decision-making. Frechette, Schotter, & Trevino (2011, 2013) recognized that the personality of a decision maker plays a role when the probability distribution of certainties within an uncertain environment is not clear. Such an uncertainty looms because of sparse and ambiguous information and lack of decision-support models (Frechette, Schotter, & Trevino, 2011, 2013). In such scenarios, the decision-makers' personalities enact the risk preferences made under a priority ranking defined by level of information availability, advises available, profile of advisors (by age and experience), and maturity of systems offering advises (Frechette, Schotter, & Trevino, 2011, 2012). Their research studies found that extraversion and neuroticism increases riskiness of choices positively whereas agreeableness reduces it. On the other hand, agreeableness follows advises more prominently instead of jumping to risky decisions. Openness and conscientiousness prefers to club their thoughts on information and advises before making a choice. Hence, neither they will jump to a choice based on gut feelings nor will follow an advice blindly. Further, Frechette, Schotter, & Trevino (2012) also found that personalities have no roles to play when the decision-makers receive complete and relevant information about the probability distributions facing them. Hence, personality is important when ambiguity in a risky environment is present. Personality is also important when the contexts of decision-making and personal motivation factors vary by individual (Deck *et al.*, 2008). The magnitude of outcomes and expected values determine the risk sensitivity of individuals (Bellman, 2012). The role of affect, cognition, and motivated reasoning are linked with risk sensitivity, which is diluted by increase in ambiguity thus fueling impulsivity of

decision-making (Bellman, 2012). Bellman (2012) found that impulsivity is inversely linked with decision-avoidance under ambiguous scenarios.

Personality has a great role to play when individuals face alternate opportunities with varying risk and uncertainty profiles. Caliendo, Fossen, & Kritikos (2011) researched the influence of Big-5 personality traits on chances of success of individuals after entering self-employment ventures. They mapped personality types with willingness to enter entrepreneurial ventures and later stay in them fruitfully. They found that extraversion and openness help in entrepreneurial development and conscientiousness, openness, and agreeableness helps in sustaining the entrepreneurial ventures in the longer terms. Bean (2010) added further that conscientiousness and openness are related positively to causal analysis of alternate scenarios such that appropriate decision logic could be derived depending upon the level of uncertainty. Bean (2010) found that causal analysis and resulting decision logic are positively related to revenue growth in entrepreneurial ventures thus making them sustainable. These findings are in line with the theory of risk propensity by Nicholson *et al* (2001) stating that risk propensity comprises high extraversion and neuroticism, and low openness, agreeableness, and conscientiousness.

In SCM, decision-making is interlinked along all the echelons of a supply-chain (Brauner *et al.*, 2013). Wrong decisions can affect not only the performance of the decision-maker but can affect the performance of the entire supply chain (Brauner *et al.*, 2013). Small errors in decision-making can cause an amplification effect across the chain resulting in significant tidal wave like fluctuations in the errors of estimating demands (Geary, Disney, & Towill, 2003). The result of Forrester effect is an inventory overhead causing losses to the business (Geary, Disney, & Towill, 2003). This phenomenon is called Forrester effect or Bullwhip effect (Geary, Disney, & Towill, 2003). Information distortion, lack of co-ordination, and lack of information integration are primary factors causing Forrester effect (Lee, Padmanabhan, & Whang, 1997). These are linked with human decision errors as well as systemic errors (Fransoo & Wouters, 2000). The theory of personalities and risk propensity can be highly effective in causing such decision errors. There are multiple orientations used by SCM decision-makers influencing decision accuracy (or errors) in SCM scenarios with uncertainties. The SCM moderators help in reducing such errors (Xia and Chen, 2011). The next section presents a review of SCM decision-making orientations under supply chain uncertainties with SCM capabilities acting as moderators.

2.3. SCM decision-making orientations under supply chain uncertainties and the role of SCM moderators

Mantel, Tatikonda, and Liao (2006) found that decisions in uncertain supply chain environments are influenced by the perception of supply risk (strategic

vulnerability) developed by the decision-makers. However, they also found that core competencies and information availability acts as moderators in reducing the supply risk perception. Information on risks, their chances of occurrence, and their impacts help decision-makers in right sizing their risk perceptions based on quantitative modeling (Xia and Chen, 2011). In absence of timely and accurate information, decision-making becomes decentralized and distributed in various echelons of a supply chain, similar to a beer distribution game (Cantor and Macdonald, 2009; Schneeweiss, 2003). Other moderators in action are supplier behavior and competencies, multiple supplier sources, integrated supply chain operations, market integrated distribution, market share, and supply network design (Narasimhan and Mahapatra, 2004).

The decision tradeoffs depend upon seasonal demand fluctuations, perceived quality of demand forecasting, and perceived flexibility of ordering and replenishment decisions (Crnkovic, Tayi, and Ballou, 2008). The key decision tradeoffs are short-term profitability, risk minimization, company reputation, customers' trust, and long-term sustainability, environmental protection, and community well-being (Wu and Pagell, 2011; Nagurney and Matsypura, 2005; Chang *et al.*, 2013; Cruz, 2009). Some representative scenarios of decision-making are reviewed in the next paragraph.

Under stochastic demand scenarios, a decision maker with profitability orientation will focus on controlled inventory holding with the help of forecasting models whereas a decision maker with reputational and trust orientation will try to maximize inventory holding (Seliaman and Ahmad, 2008; Ancarani, Mauro, and D'Urso, 2013). In absence of key moderators like integration, multiple supplier sources, and information availability the decision-making may be distributed following dysfunctional strategies like beer game and rationing, which in turn cause Forrester (bullwhip) effect (Ancarani, Mauro, and D'Urso, 2013). Profit orientation and risk averseness may also influence dual sourcing (or multi sourcing) decisions, pricing decisions, and product quality decisions (Xie *et al.*, 2011; Yu, Zeng, and Zhao, 2009). Again, in absence of integration and information availability, distributed decision-making takes over resulting in compromise of quality and price escalations (Xie *et al.*, 2011).

Overall, under risky supply and demand scenarios and lack of key moderators (like, integration and information availability), decision-makers tend to hedge the forecasting errors through their judgmental adjustments (Fildes *et al.*, 2009), which may be based on short-term profitability, long-term sustainability, risk minimization, company reputation, and customers' trust orientations (Wu and Pagell, 2011; Nagurney and Matsypura, 2005; Chang *et al.*, 2013; Cruz, 2009). The gap in the existing theories is that the influence of personality on supply chain decision-making under ecological constraints, cultural settings, and bounded ethics especially when supply chain managers are exposed to real world settings having

demand and supply uncertainties is not researched. This research is a contribution to bridging this gap by including the Big 5 personality traits in the experimental construct for testing supply chain decision-making behaviors under environmental, profitability, reputational, trust, market share, and risk minimization constraints in real world settings (having demand and supply uncertainties) with integration, information availability, and multi-supplier availability as moderators. The supply chain decision behaviors tested are profit orientation, ecological orientation, cultural orientation, and sustainability orientation.

Before finalizing the initial theoretical construct, it is important to review the risks that SCM agents may cause to business under SCM constraints in absence of support of effective SCM capabilities (acting as moderators). This review will establish the significance of this research and its linkage with the key SCM question.

2.4. Why SCM agents cause risks to business under SCM constraints in absence of effective SCM capabilities?

SCM agents like purchasing managers make multiple decisions in a day (Guinpero and Dawley, 1999). If the SCM agents are forced to use their tacit knowledge more than support from structured databases and such other SCM capabilities, there is a risk of bounded rationality causing conflicts between individual and firm choices under difficult supply and demand scenarios (Guinpero and Dawley, 1999). For example, McNally and Griffin (2004) presented that there can be conflicts between individual SCM agents and the firm management in make or buy decisions if the organization lacks predictive ability (systems and knowledge) in determining the transaction cost economics of both the decision scenarios. Modern organizations have introduced multiple codes of conduct for governing decision behaviors of SCM agents, like ethics, conflicts of interest, and legal, environmental, and social responsibilities (Eltantawy, Fox, and Guinpero, 2009; Handfield and Baumer, 2006; Svensson and Baath, 2008; Svensson, 2009). However, the research studies by Svensson and Baath (2008) and Svensson (2009) invoked a critical thinking on accurate visibility of dysfunctional decisions by SCM agents and accurate differentiation about whether the decision was an unethical act or lack of decision competence because of inadequate support by the organizational SCM capabilities. For example, a poor supplier performance in spite of adequate compensation with a premium does not essentially reveal an unethical collusion. This decision may have been made because of lack of adequate supplier evaluation and supplier performance measurement systems in the organization.

Under SCM constraints, supply and demand uncertainties, lead-time pressures, and delivery pressures the SCM agents need support from organizational SCM capabilities, like supplier knowledge management, strategic supplier partnerships, effective communication structures, and agility (Thomas, Fugate, and Koukova, 2011; Meier, Humphreys, and Williams, 1998; McHugh, Humphreys, and McIvor,

2003). It is reviewed in the previous section that lack of support from SCM capabilities leads to person-dependent decision-making, which can be dysfunctional at times. For example, Oosterhuis, van der Vaart, and Molleman (2012) conducted a factor analysis and structural equation modeling study on variables influencing supplier performance and found that lack of operational communication of upstream supply chain goals could significantly affect supplier performance causing a question mark on supplier selection and management by SCM agents. Their research showed that the cause of the problem is lack of corporate framework for operational communication with suppliers, which is a key SCM capability and hence is expected to act as a SCM moderator.

In addition to code of conduct compliance, there are sustainability constraints implied on SCM agents as reported by Cantor, Morrow, and Montabon (2012), Reuter *et al.* (2010), and Thornton *et al.* (2013). However, these scholars referred to dynamic SCM capabilities in the organization for supporting sustainable SCM decision-making. These reviews have indicated that SCM agents are bound to make self-driven decisions in absence of SCM moderators such that their personality types become key influencers of decision choices and their consequences. Such decisions may or may not be favorable because SCM agents with different personality traits may exhibit different decision-making orientation and choices. Hence, there is a finite probability of people-made SCM risks induced into the supply chain.

It is important for organizations to invest in SCM capabilities that most effectively influence SCM agents' decision-making abilities. This research is focused on influence of integration, information availability, and multi-supplier availability on decision-making by SCM agents of different personalities. As analyzed in chapters 4 and 5, it is found that these SCM capabilities (acting as moderators) have a high influence on SCM decision-making irrespective of the personality type of SCM agents. The theoretical construct tested in the research is discussed in the next section.

2.5. The theoretical construct

The theoretical construct of the research is presented in Figure 1. This construct is employed as the initial measurement model. The double-sided arrows indicate many-to-many relationships among all variables shown in the boxes. The results of confirmatory factor analysis and structured equation modeling, however, has eliminated many relationships and retained only the ones indicating good model fitment.

The key SCM question addressed by this research is the following:

How do the real world supply chain constraints influence the decision-making by SCM agents of different personality types under supply chain integration, information availability, and multi-supplier availability acting as SCM moderators?

The key SCM question is divided into the following research questions related to the research topic:

- (a) How the Big 5 personality types of SCM agents influence SCM decision-making orientations under real world uncertainties in supply and demand?
- (b) What role do the SCM moderators play in decision-makers' choices of SCM decisions under real world uncertainties in supply and demand?

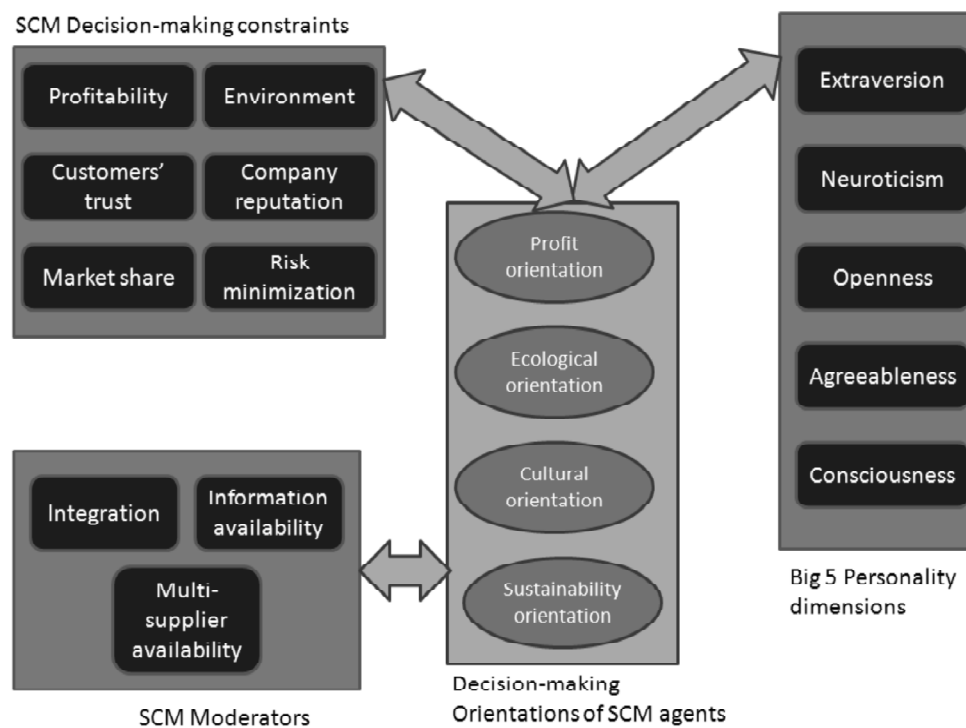


Figure 1: Theoretical construct of the research

The model in Figure 1 has been used as an initial measurement model for running the Exploratory Factor Analysis (EFA) test. The model is reduced after conducting Cronbach Alpha scale reliability tests. The reduced model comprises the hypotheses of this research that are tested using the Confirmatory Factor Analysis (CFA) tests and Structural Equation Modeling (SEM).

This research is a contribution to bring together four different sets of variables – SCM decision-making constraints, SCM moderators, Decision-making of SCM agents, and Big-5 personality traits (as presented in Figure 1). The initial measurement model (Figure 1) has been formed with the help of variables and

their relationships evolved from theoretical reviews in Sections 2.1 through 2.4. However, the model is significantly large (18 variables with 56 relationships). This means there are 56 core hypotheses plus additional 56 alternate hypotheses. Such a complex model needs to be reduced using an appropriate way. Because of limited research conducted in this field, it was not feasible to reduce the model with the help of theories only (this can reduce the scale reliability scores). Hence, Exploratory Factor Analysis (EFA) using Principal Component Analysis and Varimax rotation has been used to reduce the model. This approach is recommended by Hair et al. (2009) and Hooper, Coughlan, and Mullen (2008). The reduced model has been tested for scale reliabilities using Cronbach Alpha test. This entire process reduced the number of relationships to 14, as shown in Figure 2. The 14 relationships (after reduction) are the hypotheses of this research mentioned and described immediately after Figure 2.

The research methods and techniques used in this research are explained in the next chapter.

3. RESEARCH DESIGN

This research is a quantitative phenomenological study (Bryman, 2004). The research has been conducted by approaching supply chain decision-makers in various roles in different countries. The respondents were approached through social networking connections on LinkedIn of the researcher and his accomplices. The sample size achieved is 104 comprising 51 members from Greece, 23 members from Germany, 12 members from UAE, and 18 members from India (Appendix B). There were 68 male members and 36 female members. There were 30 respondents with less than 5 years of SCM experience, 47 respondents with 5 years to less than 10 years of SCM experience, 20 respondents with 10 years to less than 15 years of SCM experience, 6 respondents with 15 to less than 20 years of experience, and 1 respondent with 20 or more years of SCM experience.

The respondents were requested to undertake an online Big 5 test and send the scores to the researcher. The reflections of the test results are taken as the following (John and Srivastava, 1999):

- a) Extraversion is a reflection of the individual getting oriented beyond self and derives self-satisfaction through social networking and interactions.
- b) Consciousness is a reflection of carefulness of an individual about rules, policies, procedures, regulations, and compliances.
- c) Neuroticism is a reflection that the individual experiences negative emotions under pressure.
- d) Agreeableness is a reflection that the individual likes to discuss and agree with others.

- e) Openness is a reflection that the individual likes to accept new ideas and experiment with new things and ways.

In addition, they were sent a questionnaire comprising structure questions on SCM decision-making and SCM moderators as presented in Appendix A. The respondents were requested to answer the questions keeping in view the description of a realistic supply chain environment and the SCM moderators in their respective countries.

The initial measurement model presented in Figure 1 is tested using the exploratory factor analysis technique (Hair *et al.*, 2009). The method used was principal factor analysis using VARIMAX orthogonal rotation, which helped in reducing the factors per latent variable and define the scales for each latent variable such that the scale reliability tests could be conducted (Hair *et al.*, 2009; Hooper, Coughlan, and Mullen, 2008).

The reliability testing of scales was done using Cronbach Alpha split-half testing method. The scale reliability threshold is taken as " $\alpha = 6$ ", which is the recommended value for phenomenological studies involving collection of data from human experiences (Beins and McCarthy, 2012; Howitt and Cramer, 2011). Given that this research is based on an online personality test based on Big-5, it is decided that the threshold for reliability is reduced further to " $\alpha = 5$ ". This assumption is made because the personality indicators based on just one test should not be treated as highly reliable, but running multiple tests for each respondent may not be feasible. In practice, the respondents were not asked to undertake multiple personality tests because multiple tests may take much longer time than stipulated per respondent in this research (not more than 15 minutes).

It is important that the scale should neither be under-loaded nor be overloaded (Beins and McCarthy, 2012). Hence, scale items have been deleted wherever an overloading is evident. This has resulted in reduction in the number of relationships in the measurement model. The normality test has been conducted using Kolmogorov-Smirnov test given that the sample size is greater than 50 (Johnson and Bhattacharya, 2010). The outcomes of EFA and Cronbach Alpha tests are the hypotheses of this research. Given that

The Cronbach Alpha and Kolmogorov-Smirnov tests have been conducted in SPSS. The model fitment tests (CFA and SEM) are conducted in LISREL 8.8 academic edition. The test statistics used in this research are the following (Hooper, Coughlan, and Mullen, 2008; Hair *et al.*, 2009):

- a) Chi-Square to degrees of freedom ratio (acceptable value is ≤ 3)
- b) Root mean square error of approximation (RMSEA) (acceptable value is ≤ 0.08)

- c) Root mean square residual (RMR) (acceptable value is ≤ 0.07)
- d) Standardized root mean square residual (SRMR) (acceptable value is ≤ 0.07)
- e) Goodness of fit index (GFI) (acceptable value is ≥ 0.9)
- f) Adjusted goodness of fit index (AGFI) (acceptable value is ≥ 0.9)
- g) Normed fit index (NFI) (acceptable value is ≥ 0.9)
- h) Non-normed fit index (NNFI) (acceptable value is ≥ 0.9)
- i) Comparative fit index (CFI) (acceptable value is ≥ 0.9)
- j) Incremental fit index (IFI) (acceptable value is ≥ 0.9)

The last four indices are related to structural equation modeling which are comparative indices against an absolute fit model estimated by LISREL (automatically). The correlations obtained may be perceived as valid once the model fitment is ascertained through these tests.

4. EXPLORATORY FACTOR ANALYSIS, SCALE RELIABILITY TESTING, AND FORMATION OF HYPOTHESES

The responses from the 104 participants were entered in SPSS and the principal component analysis (exploratory factor analysis) test using VARIMAX orthogonal rotation with Kaiser Normalization was conducted on the two groups of factors – SCM decision-making, and Big-5 personality traits. The results are presented in Appendix C. The rotated component matrix presents four components having correlations with the factors. Profitability and environment converged under a single component, and the factors related to organizational culture are split between components 2 and 3. The component 4 is highly correlated with market share, which is one of the indicators of long-term sustainability. Ideally, risk minimization and customer trust should have been included in component 4 but they have been kept out due to low correlation values in this sample (merely 0.149 and 0.049, respectively). The results indicate that there should be three latent variables instead of four named as profit and environment orientation (component 1), cultural orientation (combining components 2 and 3), and sustainability orientation (component 4). Reducing the number of latent variables has ensured that all Eigen-values are greater than unity after factor rotation.

Before arriving at the modified model, the scale reliability tests have been conducted using Cronbach Alpha testing. The scale reliability tests were conducted after combining the variables of SCM decision-making factors and Big-5 personality traits under each component returned by the exploratory factor analysis (principal component analysis). The test results are presented in Appendix D. The scale reliabilities (Cronbach Alpha values) of profit and environment, and sustainability orientations are 0.805 and 0.674 respectively. However, the scale reliability of

cultural orientation is 0.436, which is slightly less than the threshold value of “ $\alpha = 5$ ”. This value has been accepted because adding or deleting variables in the scale did not return substantial improvements in the value of Cronbach Alpha.

The scales of profit and environment, and sustainability orientations appear to be balanced because deleting or adding variables did not return substantial improvements in their Cronbach Alpha values. The scale of cultural orientation appears to be unbalanced because deleting the variable “market share” can increase the Cronbach Alpha value from 0.674 to 0.954. However, this variable cannot be deleted because it is the only one from the SCM decision-making factors and the remaining three variables are Big-5 personality traits.

After confirming the scale reliability levels, the normality tests were conducted using Kolmogorov-Smirnov method. This method is suitable for sample sizes greater than 50 and hence is suitable for this research. The normality test results are presented in Appendix E. None of the data sets is normally distributed because P value is less than 0.005 in all of them (De Sa, 2007). Hence, only non-parametric tests can be conducted in the CFA and SEM tests for verifying model fitment.

The modified measurement model after principal component analysis and scale reliability testing is presented in Figure 2. The double-headed arrows indicate many-to-many relationships and the single headed arrows indicate one-to-one relationships between observable factors (SCM moderators and Big-5 personality traits) and the latent variables (SCM decision-making behaviors).

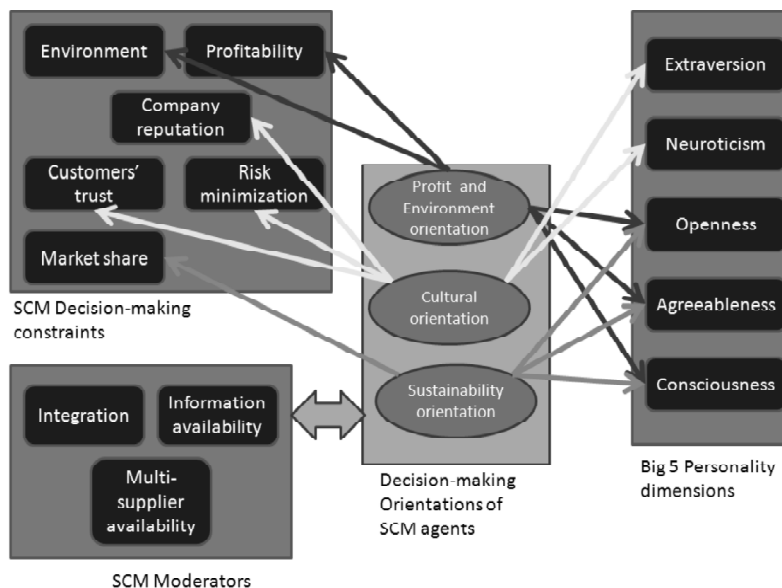


Figure 2: Modified measurement model after Principal Component Analysis and scale reliability testing

The modified measurement model derives the hypotheses of this research stated as the following:

Under integration, information availability, and multi-supplier availability acting as SCM moderators;

- H1: Environment constraint is related significantly with profit and environmental orientation.
- H2: Profitability constraint is related significantly with profit and environmental orientation.
- H3: Company reputation constraint is related significantly with cultural orientation.
- H4: Customer's trust constraint is related significantly with cultural orientation.
- H5: Risk minimization constraint is related significantly with cultural orientation.
- H6: Market share constraint is related significantly with sustainability orientation.

Referring to reviews in Section 2.3, profit and environment constraints are two separate decision-making orientations. However, after factor rotation, they merged under a single component (in the quest for ensuring that Eigen-values are equal to or greater than one after factor rotation). Thus, the environment and profitability constraints are hypothesized as highly correlated, separately with a common decision-making orientation named "profit and environmental orientation". These relationships are straightforward and hence will be validated.

SCM decision makers adopting cultural orientation of decision-making consider company reputation, customers trust, and risk minimization as their constraints. This is clear from the first scenario reviewed in Section 2.3 (Seliaman and Ahmad, 2008; Ancarani, Mauro, and D'Urso, 2013). As per the scenario, SCM decision-makers with cultural orientation will focus on inventory maximization under uncertain demand and supplies scenarios for ensuring risk reduction, and protecting customer's trust and company reputation. This is a case of decision trade-off amidst high uncertainties. However, cultural orientation alone may prove to be risky because inventory maximization at intermediate echelons of the supply chain (through dysfunctional decisions, like beer game or rationing) may cause Forrester's effect (Ancarani, Mauro, and D'Urso, 2013). On the other hand, if the SCM moderators (integration, information availability, and multi-supplier availability) may reduce this risk if the decision-makers prefer the route of informed and rational decision-making (Xie *et al.*, 2011). In such a case, even dysfunctional personality types may not be harmful.

Market share constraint is related with sustainability orientation. This is the result of model reduction and is feasible because market share itself is a secondary variable caused by multiple inputs (like, reputation and customer's trust). In the reduced model, market share is treated as a primary factor linked with decision-makers focused on long-term sustainability. Factors influencing market share are out of the focus domain of this research.

The hypotheses H7 to H14 present the relationships between personality types and decision-making orientations.

H7: Extraversion is related significantly with cultural orientation.

H8: Neuroticism is related significantly with cultural orientation.

H9: Openness is related significantly with profit and environmental orientation.

H10: Agreeableness is related significantly with profit and environmental orientation.

H11: Consciousness is related significantly with profit and environmental orientation.

H12: Openness is related significantly with sustainability orientation.

H13: Agreeableness is related significantly with sustainability orientation.

H14: Consciousness is related significantly with sustainability orientation.

As reviewed in Section 2.2, extraversion and neuroticism increase the riskiness of decision-making (Frechette, Schotter, & Trevino, 2011, 2012). Matching with the presentation by Ancarani, Mauro, and D'Urso (2013) pertaining to the first scenario discussed in Section 2.3, the SCM decision-makers having cultural orientation may tend to maximize inventory thus increasing the risk of Forrester's effect. Hence, extraversion and neuroticism are hypothesized as related with cultural orientation. On the other hand, as reviewed in Section 2.2, consciousness, openness, and agreeableness are linked with long-term sustainability (Caliendo, Fossen, & Kritikos, 2011). As further added by, Bean (2010), consciousness and openness relate with causal analysis of alternate scenarios such that appropriate risk-aware decision logic could be derived. Bean (2010) further discovered that causal analysis and resulting risk-aware decision logic link positively to profitability and revenue growth. Based on these findings, it is hypothesized that consciousness, openness, and agreeableness are related with profit and environmental orientation and sustainability orientation. Given that consciousness, openness, and agreeableness relate with causal and risk-aware decision-making, it is safe to hypothesize that they will be linked with environmental orientation, as well. This is anyways enforced by the reduced model because profitability and environmental orientations are merged after factor rotation.

5. RESULTS OF CONFIRMATORY FACTOR ANALYSIS AND STRUCTURAL EQUATION MODELING

The next level of testing comprises CFA and SEM tests. The tests have been conducted on two alternate structures of the model:

- (a) The modified measurement model as shown in Figure 2 – Model A presented in Appendix F
- (b) The modified measurement model with all SCM moderators removed – Model B in Appendix G

The model A converged successfully, but model B failed to converge even after 500 iterations returning errors shown in Appendix G. This indicates that SCM moderators are essential for influencing decision-making behaviors and mere personalities are not sufficient. This is an original finding because past studies have not included functional moderators as influencers of decision-making behaviors acting as a catalyst to the personalities.

The Model A has achieved good model fitment test results. The Chi square to degrees of freedom ratio has reduced even further to 1.35. In the CFA tests, RMSEA has improved to 0.058, RMR and SRMR have improved to 0.066 and 0.091 respectively, and GFI and AGFI have improved to 0.88 and 0.83 respectively. Similarly, in the SEM statistics NFI has improved to 0.85, NNFI has improved to 0.94, CFI has improved to 0.95, and IFI has improved to 0.95. In CFA, chi square to degrees of freedom ratio, RMSEA, and RMR are within goodness of fitment limits and SRMR, GFI, and AGFI are closer to the goodness of fitment limits. In SEM, except NFI all other test statistics are within the limits of goodness of fitment. Hence, Model A can be accepted as the good fit structural framework. The fitment statistics of Model A validates hypotheses H1 through H14 as none of the relationships needed to be eliminated or modified for achieving acceptable model fitment (validity) scores. LISREL provides recommendations on adding, deleting, and modifying relationships based on internal validation for improving model fitment scores if they are unacceptable.

There are a few Heywood cases in both the Model A. Heywood cases refer to relationships in a model having negative error variance with positive loading and positive error variance with negative loading that is mostly caused by a factor loading (correlation) more than unity (Chen *et al.*, 2001). In model A, Heywood cases can be solved by either modifying the model, introducing additional error covariances (positive or negative), introducing a non-linear constraint, or fixing the loading at unity (Chen *et al.*, 2001). In this research, the loadings have been fixed at unity in the finalized model (Model B). The Model A is good for fitment and Model B could not converge in LISREL thus failing completely.

6. DISCUSSIONS

The results present interesting revelations about role of personality, role of SCM moderators in SCM decision-making. The key influencers are SCM moderators and personalities of the decision-makers. An interesting revelation in this research is that SCM moderators are mandatory influencers of decision-making even if people of multiple personalities are involved. The Model B failed completely when SCM moderators were eliminated and only personalities were related with decision orientations. Hence, SCM integration, information availability, and multi-supplier availability are key enablers influencing decision-making behaviors by people irrespective of their personalities.

The discussion is now focused on the key SCM question and the research questions addressed in this research. Referring to the Model A (keeping in mind that the factor loadings more than unity have been fixed to unity as a solution to the Heywood cases), profit and environmental orientation, and sustainability orientation are positively linked with agreeableness, openness, and consciousness. On the other hand, cultural orientation is positively linked with extraversion and neuroticism. These results indicate that people with extraversion and neuroticism personalities tend to be more oriented towards emotional aspects of decision-making that is linked with organizational culture. People with such personalities will be highly concerned about company reputation, customers' trust, and risk minimization. Such decisions may be at times at the cost of reduced profits, environmental commitment, and long-term sustainability. It may be possible that such people will be highly concerned about fulfilling orders from regular customers even if there is a high cost of meeting the demands or some environmental compliance level is bypassed. Decisions made under the influence of emotions may be focused more on keeping customers delighted, maintaining a good company reputation, minimizing risks to business (Seliaman and Ahmad, 2008; Ancarani, Mauro, and D'Urso, 2013). These orientations are desirable provided they do not dilute profitability, long-term sustainability, and environmental protection considerably. If the decision-makers simply focus on cultural orientation, there is a chance of Forrester's effect cropping into the system (Ancarani, Mauro, and D'Urso, 2013).

On the other hand, people with openness, agreeableness, and consciousness personality traits avoid making decisions under emotional influence (Caliendo, Fossen, & Kritikos, 2011; Bean, 2010). As per the results of this research, their focus may be more on profitability, environmental protection, and long-term sustainability through a sustained and sizeable market share. Such people may prefer to reject some of the demands in the interest of profitability and environmental compliance. These decision-making behaviors are desirable, as well, provided they do not get to such extremes that the company may lose significant number of customers and face significant level of dilution of reputation in the market.

Some of the existing studies have preferred openness, agreeableness, and conscientiousness against extraversion and neuroticism (Dewberry, Juanchich, and Narendran, 2013; Di Fabio and Palazzeschi, 2012). However, Germeijs and Verschueren (2011) preferred neuroticism when assessing decision-making on an indecisiveness scale. This research is unable to take any side given the risks involved in SCM decision-making. Taking an emotional extreme in decision-making is dangerous for the business. However, taking an extreme of profitability orientation is also dangerous for the business if the company starts losing customers. Similarly, getting too much concerned about environmental issues may hamper business because the constraint may prove to be too strong to run the show. There needs to be a balance between either of approaches and hence, dependence on individual personality traits for SCM decision-making outcomes is highly risky.

Scholars like Soane and Chmiel (2005), Lauriola and Levin (2001), Xia and Chen (2011), Cantor and Macdonald (2009), Schneeweiss (2003), and Narasimhan and Mahapatra (2004) have discussed about SCM moderators influencing decision-making irrespective of the personality types. Their findings have been found to be applicable in this research, as well. Model A could not have converged with good fitment if SCM moderators were not present. Hence, personality types do not influence decision-making if the decision-makers get support from SCM moderators. There should be moderators in the work environment helping the decision-makers. For example, integration and information availability can help a decision-maker to gain better profitability and customer orientations under stochastic demand and supply scenarios.

There are prominent practical implications of these findings. The results indicate that personality traits of SCM agents are related with different SCM decision-making orientations. Hence, different personality traits may be influencers of dysfunctional decisions as well as good decisions if the scenario faced by the SCM agents needs to be tackled through individual decision-making only. This could be a cause of people-made risks in the supply chain. The scenarios faced by SCM agents may comprise of SCM constraints and real world demand and supply uncertainties. Under lead-time and delivery pressures, SCM agents may make decisions based on the most suitable orientation matching their personality traits. The results indicate that some personality traits may be focused on firm profitability while others may be focused on fulfillment of commitment to customers. It is highly risky for the organization to depend solely on the personality traits of SCM agents in influencing decision-making given the uncertainty of outcomes. On the other hand, it is impractical to assign SCM roles based on scores of personality tests of SCM agents.

The most significant result of this research is that SCM capabilities (acting as moderators) influence decision-making by people of multiple personalities. This means that the SCM moderators can potentially mitigate the people-made supply

chain risks by virtue of their personalities and resulting variations in SCM decision-making orientations. In this research, the SCM capabilities (acting as moderators) studied are SCM integration, information availability, and multi-supplier availability that are found to be effective in reducing the influence of personality traits in SCM decision-making. In practical scenarios, these capabilities ensure process-guided, controls-driven, and information-driven decision-making for SCM agents. In such an environment, the decision-making by SCM agents is not personality-driven albeit is system-driven. Hence, organizations should invest in such effective SCM capabilities for influencing SCM decision-making irrespective of the personality type of the SCM agents. If such SCM capabilities are in place, it does not matter if the individual involved in decision-making are of a particular personality type. All individuals simply follow the system. The constraints of code of conduct and sustainable decision-making discussed by Eltantawy, Fox, and Guinipero (2009), Handfield and Baumer (2006), Svensson and Baath (2008), and Svensson (2009) can be effectively managed by SCM agents if empowered with relevant and effective SCM capabilities acting as moderators. This role of SCM moderators is supported by Xia and Chen (2011), Cantor and Macdonald (2009), Schneeweiss (2003), and Narasimhan and Mahapatra (2004). Overall, the results of this research indicate that if the relevant and effective SCM capabilities are in place, an organization can employ a SCM agent of any personality in any SCM role.

These results need to be tested for larger sample sizes (typically >500) and respondents from more countries (typically >10). Based on further research efforts, these practical implications can become empirical theories followed by organizations in future.

Future researchers may also like to test the influence of age, SCM experience, and gender in SCM decision-making. These tests have been avoided in this research because they are not the focus of this study. Moreover, the sample distribution in this research is significantly tapered when assessed as per age, SCM experience, and gender. For example, there is only one respondent having 20 or more years of SCM experience and there are no female respondents from UAE.

6. CONCLUSIONS AND RECOMMENDATIONS

This research started with a key SCM question and three research questions. The key SCM question is about influence of supply chain constraints on decision-making by SCM agents of different personalities under supply chain integration, information availability, and multi-supplier availability acting as moderators. It is positive that different personality traits influence different SCM decision-making orientations. Hence, an organization may face people-made risks in the supply chain due to uncertainty in their SCM decision-making orientations. It is impractical to assign SCM roles as per their personality test results. However, if the organization

invests in appropriate and effective SCM capabilities, the influence of personality traits on SCM decision-making orientation can be reduced because it will be system-driven and not personality-driven.

The first research question is pertaining to role of personality in SCM decision-making. The results reflect that profit and environmental orientation, and sustainability orientation are positively linked with agreeableness, openness, and consciousness, and cultural orientation is positively linked with extraversion and neuroticism. As per the good fit model obtained in this research, this means that individuals with extraversion and neuroticism possess a high focus on company reputation, customer trust, and risk minimization. On the other hand, individuals with openness, agreeableness, and consciousness possess a high focus on profitability, environment protection, and long-term sustainability (market share). However, these variations in SCM decision-making orientations driven by different personality traits could cause people-made risks in the supply chain. It is risky for an organization to be solely dependent upon people-driven SCM decision-making.

The second question is related to role of SCM moderators included in the good fit model obtained in this research. It has been found that SCM moderators (integration, information availability, and multi-supplier availability) are highly significant for decision-making behaviors of different personalities. In absence of the moderators, the best fit model crashes indicating invalid relationships between personalities and decision-making behaviors in absence of the SCM moderators. This indicates that the SCM moderators can be used as effective tools for reducing influence of personality on SCM decision-making.

It is recommended that the influences of nationality, age, gender, and SCM experience on decision-making behaviors of different personalities be studied. The influences should be studied by maintaining uniform distribution of all levels decided in the scales of these variables. For example, there should be nearly equal proportion of male and female members of all nationalities studied in a research. Future studies may involve appropriate modeling of national cultures (like Hofstede's cultural dimensions) for studying their influence on SCM decision-making under risks and uncertainties.

References

- Ancarani, A., Mauro, C. D., and D'Urso, D. (2013), "A human experiment on inventory decisions under supply uncertainty", *International Journal of Production Economics*, Vol. 142, 61-73.
- Bean, M. (2010), "The effects of personality and uncertainty on the decision-making process and new venture outcomes of South African entrepreneurs", Published Master Thesis, Gordon Institute of business Science, University of Pretoria, 3-121.
- Beins, B. C. and McCarthy, M. A. (2012). "Research Methods and Statistics", Global: Pearson Education.

- Bellman, S. B. (2012), "I would rather be happy than right consumer impulsivity, risky decision making, and accountability", Published Doctoral Thesis, The University of Iowa, 2-136.
- Blass, T. (1991), "Understanding behavior in the Milgram Obedience Experiment: The role of personality, situations, and their interactions", *Journal of Personality and Social Psychology*, Vol. 65 (3), 398-413.
- Brauner, P., Runge, S., Groten, M., Schuh, G., & Ziefle, M. (2013), "Human Factors in Supply Chain Management", *Lecture Notes in Computer Science (LNCS)*, Vol. 8018: 423-432.
- Bryman, A. (2004). "Social Research Methods". London: Oxford University Press.
- Caliendo, M., Fossen, F., & Kritikos, A. (2011), "Personality Characteristics and the Decision to Become and Stay Self-Employed", Discussion Paper No. 5566, The Institute for Study of Labor, Deutsche Post Foundation, 4-64.
- Caliendo, M., Fossen, F., & Kritikos, A. S. (2013), "Personality characteristics and the decisions to become and stay self-employed", *Small Business Economics*, Vol. 42 (4): 787-814.
- Carter, C. R., Kaufmann, L., & Michel, A. (2007), "Behavioral supply management: a taxonomy of judgment and decision-making biases", *International Journal of Physical Distribution & Logistics Management*, Vol. 37 (8), 631-669.
- Cantor, D. E. and Macdonald, J. R. (2009), "Decision-making in the supply chain: Examining problem solving approaches and information availability", *Journal of Operations Management*, Vol. 27, 220-232.
- Cantor, D. E., Morrow, P. C., and Montabon, F. (2012), "Engagement in environmental behaviours among supply chain employees: an organizational support theoretical perspective", *Journal of Supply Chain Management*, Vol. 48 (3), 33-51.
- Chang, L., Ouzrout, Y., Nongaillard, A., Bouras, A., and Jiliu, Z. (2013), "Multi-criteria decision making based on trust and reputation in supply chain", *Journal of Production Economics* (2013), Digital Object Identifier: <http://dx.doi.org/10.1016/j.ijpe.2013.04.014>: 1-11 (accessed: 16 October, 2013).
- Crnkovic, J., Tayi, G. K., and Ballou, P. (2008), "A decision-support framework for exploring supply chain tradeoffs", *International Journal of Production Economics*, 115, 28-38.
- Cruz, J. M. (2009), "The impact of corporate social responsibility in supply chain management: Multicriteria decision-making approach", *Decision Support Systems*, 48, 224-236.
- Dewberry, C., Juanchich, M., and Narendran, S. (2013), "Decision-making competence in everyday life: The roles of general cognitive styles, decision-making styles and personality", *Personality and Individual Differences*, Vol. 55, 783-788.
- Di Fabio, A. and Palazzeschi, L. (2012), "Incremental variance of the core self-evaluation construct compared to fluid intelligence and personality traits in aspects of decision-making", *Personality and Individual Differences*, Vol. 53, 196-201.
- Eltantawy, R. A., Fox, G. L., and Guinipero, L. (2009), "Supply management ethical responsibility: reputation and performance impacts", *Supply Chain Management: An International Journal*, Vol. 14 (2), 99-108.
- Fildes, R., Goodwin, P., Lawrence, M., and Nikolopoulos, K. (2009), "Effective forecasting and judgmental adjustments: an empirical evaluation and strategies for improvement in supply-chain planning", *International Journal of Forecasting*, Vol. 25, 3-23.

- Frachette, G., Schotter, A., & Trevino, I. (2012), "Personality and Choice in Risky and Ambiguous Environments: An Experimental Study", Published Thesis, New York University, Presented in: *INSEAD Research Seminar Series 2011-2012 on Decision Sciences*, May 18, 2012, Fontainebleau, 1-38
- Fransoo, J. C. & Wouters, M. J. F. (2000), "Measuring the bullwhip effect in the supply chain", *Supply Chain Management: An International Journal*, Vol. 5 (2): 78-89.
- Frederick, S. (2005), "Cognitive Reflection and Decision Making", *Journal of Economic Perspectives*, Vol.19 (4), 25-42.
- Furnham, A. and Stringfield, P. (1993), "Personality and work performance: Myers-Briggs Type Indicator correlates of managerial performance in two cultures", *Personality and Individual Differences*, Vol. 14 (1), 145-153.
- Garrety, K., Badham, R., Morrigan, V., Rifkin, W., and Zanko, M. (2003), "The Use of Personality Typing in Organizational Change: Discourse, Emotions & the Reflexive Subject", *Human Relations*, Vol. 56 (2), 211- 235.
- Geary, S., Disney, S. M., & Towill, D. R. (2003), "Bullwhip in Supply Chains: Past, Present and Future", *In 17th International conference on Production Research*, 3-7 August, Virginia, USA, 1-14.
- Germeijs, V. and Verschueren, K. (2011), "Indecisiveness and Big Five personality factors: Relationship and specificity", *Personality and Individual Differences*, Vol. 50, 1023-1028.
- Guinipero, L. and Dawley, D. (1999), "The Impact of Tacit Knowledge on Purchasing Decisions", *The Journal of Supply Chain Management*, Vol. 35 (1), 42-49.
- Guss, C. D. and Dorner, D. (2011), "Cultural differences in dynamic decision-making strategies in a non-linear, time-delayed task", *Cognitive Systems Research*, Vol. 12, 365-376.
- Hair, J. F., Black, W. C., Babin, B. J., and Anderson, R. E. (2009), "Multivariate Data Analysis", London: Pearson.
- Haley, U. C. V. and Stumpf, S. A. (1989), "Cognitive trails in strategic decision-making: linking theories of personalities and cognitions", *Journal of Management Studies*, Vol. 26 (5), 477-497.
- Handfield, R. B. and Baumer, D. L. (2006), "Managing Conflict of Interest Issues in Purchasing", *The Journal of Supply Chain Management*, Vol. 42 (3), 41-50.
- Howitt, D. and Cramer, D. (2011). "Introduction to research methods", London: Pearson.
- Hunt, R. G., Krzystofiak, F. J., Meindl, J. R., and Yousry, A. M. (1989), "Cognitive style and decision-making", *Organizational Behaviour and Human Decision Processes*, Vol. 44, 436-453.
- John, O. P. and Srivastava, S. (1999), "The Big-Five Trait Taxonomy: History, Measurement, and Theoretical Perspectives", University of California at Berkeley, 2-71.
- Johnson, R. A., and Bhattacharyya, G. K. (2010). "Statistics - Principles and Methods", NY: Wiley.
- Lauriola, M. and Levin, I. P. (2001), "Personality traits and risky decision-making in a controlled experimental task: an exploratory study", *Personality and Individual Differences*, Vol. 31, 215-216.
- Lee, H. L., Padmanabhan, V., & Whang, S. (1997), "Information distortion in a supply chain: The bullwhip effect", *Management Science*, Vol. 43 (4): 546-558.

- Lee, J., Deck, C., Reyes, J., & Rosen, C. (2008), "Measuring Risk Attitudes Controlling for Personality Traits", Departments of Economics in Florida International University and University of Arkansas, 1-35.
- Mantel, S. P., Tatikonda, M. V., and Liao, Y. (2006), "A behavioral study of supply manager decision-making: Factors influencing make versus buy evaluation", *Journal of Operations Management*, Vol. 24, 822-838.
- McHugh, M., Humphreys, P., and McIvor, R. (2003), "Buyer-Supplier Relationships and Organizational Health", *The Journal of Supply Chain Management*, Vol.39 (1), 15-25.
- McNally, R. C. and Griffin, A. (2004), "Firm and Individual Choice Drivers in Make-or-Buy Decisions: A Diminishing Role for Transaction Cost Economics?", *Journal of Supply Chain Management*, Vol. 40 (4), 4-17.
- Meier, R. L., Humphreys, M. A., and Williams, M. R. (1998), "The Role of Purchasing in the Agile Enterprise", *International Journal of Purchasing and Materials Management*, Vol. 34 (3), 39-45.
- Nagurney, A. and Matsypura, D. (2005), "Global supply chain network dynamics with multicriteria decision-making under risk and uncertainty", *Transportation Research Part E*, Vol. 41, 585-612.
- Narasimhan, R. and Mahapatra, S. (2004), "Decision models in global supply chain management", *Industrial Marketing Management*, Vol. 33, 21- 27.
- Nicholson, N., O'Creevy, M. F., Soane, E., & Willman, P. (2001), "Risk Propensity and Personality", London Business School, 2-33.
- Oosterhuis, M., van der Vaart, T., and Molleman, E. (2012), "The value of upstream recognition of goals in supply chains", *Supply Chain Management: An International Journal*, Vol. 17 (6), 582-595.
- Raja, U., Johns, and Ntalianis, F. (2004), "The impact of personality on psychological contracts", *Academy of Management Journal*, Vol. 47 (3), 350-367.
- Rawwas, M. Y. A. (2001), "Culture, personality, and morality - a typology of international consumers' ethical beliefs", *International Marketing Review*, Vol. 18 (2), 188-209.
- Reuter, C., Foerstl, K., hartmann, E., and Blome, C. (2010), "Sustainable global supplier management: the role of dynamic capabilities in achieving competitive advantage", *Journal of Supply Chain Management*, Vol. 46 (2), 45-63.
- Schneeweiss, C. (2003), "Distributed decision making in supply chain management", *International Journal of Production Economics*, Vol.84, 71-83.
- Seliaman, M. E., and Ahmad, A. R. (2008), "Optimizing inventory decisions in a multi-stage supply chain under stochastic demands", *Applied Mathematics and Computation*, Vol. 206, 538-542.
- Soane, E. and Chmiel, N. (2005), "Are risk preferences consistent? The influence of decision domain and personality", *Personality and Individual Differences*, Vol. 38, 1781-1791.
- Soane, E., Dewberry, C., Narendran, S. (2010), "The role of perceived costs and perceived benefits in the relationship between personality and risk-related choices", *Journal of Risk Research*, Vol. 13 (3): 303-318.
- Svensson, G. and Baath, H. (2008), "Supply chain management ethics: conceptual framework and illustration", *Supply Chain Management: An International Journal*, Vol. 13 (6), 398-405.

- Svensson, G. (2009), "The transparency of SCM ethics: conceptual framework and empirical illustrations", *Supply Chain Management: An International Journal*, Vol. 14 (4), 259-269.
- Thomas, R. W., Fugate, B. S., and Koukova, N. T. (2011), "Coping with timepressure and knowledge sharing in buyer-supplier relationships", *Journal of Supply Chain Management*, Vol. 47 (3), 22-42.
- Thornton, L.M., Autry, C. W., Gligor, D. M., and Brik, A. B. (2013), "Does socially responsible supplier selection pay off for customer firms? A cross-cultural comparison", *Journal of Supply Chain Management*, Vol. 49 (3), 66-89.
- Tokar, T. (2010), "Behavioural research in logistics and supply chain management", *International Journal of Logistics Management*, Vol. 21 (1): 89-103.
- UOK (2002), "Myers-Brigg Type Indicator handbook", College of Engineering, University of Kentucky, 1-7.
- Wu, Z. and Pagell, M. (2011), "Balancing priorities: Decision-making in sustainable supply chain management", *Journal of Operations Management*, Vol. 29, 577-590.
- Xia, D. and Chen, B. (2011), "A comprehensive decision-making model for risk management of supply chain", *Expert Systems with Applications*, Vol. 38, 4957-4966.
- Xie, G., Yue, W., Wang, S., and Lai, K. K. (2011), "Quality investment and price decision in a risk-averse supply chain", *European Journal of Operational Research*, Vol. 214, 403-410.
- Yu, H., Zeng, A. Z., and Zhao, L. (2009), "Single or dual sourcing: decision-making in the presence of supply chain disruption risks", *Omega*, Vol. 37, 788-300.

Appendix A: Structured Questionnaire

General:

- (a) Age Group:
1. Less than 25 years
 2. 25 years to less than 30 years
 3. 30 years to less than 35 years
 4. 35 years to less than 40 years
 5. 40 years and above
- (b) Gender:
1. Male
 2. Female
- (c) SCM experience:
1. Less than 5 years
 2. 5 years to less than 10 years
 3. 10 years to less than 15 years
 4. 15 years to less than 20 years
 5. 20 years and above

(d) Please state your nationality.

1. Greece
2. Germany
3. UAE
4. India

SCM Moderators

(a) What is the level of integration in your supply chain system?

1. Low
2. Moderate
3. Good
4. High
5. Very High

(b) What is the level of information availability in your supply chain system?

1. Low
2. Moderate
3. Good
4. High
5. Very High

(c) What is the extent of multi-supplier availability in your supply chain system?

1. Low
2. Moderate
3. Good
4. High
5. Very High

SCM decision-making:

Consider a practical SCM setting in which, you face the following challenges:

There is a high level of demand and supply uncertainty.

There is a high level of environmental constraints implied upon you.

There is a high level of ethical code of conduct expected from you.

There are high levels of customer orientation and reputational commitments prescribed in the organizational culture.

However, you also enjoy the SCM moderators reported by you in the previous three questions.

Given this scenario, please think about your decision-making carefully and respond to the following questions.

(a) Given the practical SCM setting described above, and the SCM moderators reported by you, what is the extent up to which, you will consider profitability in your decision-making?

1. Low
2. Moderate
3. Good

4. High
 5. Very High
- (b) Given the practical SCM setting described above, and the SCM moderators reported by you, what is the extent up to which, you will consider environment commitment in your decision-making?
1. Low
 2. Moderate
 3. Good
 4. High
 5. Very High
- (c) Given the practical SCM setting described above, and the SCM moderators reported by you, what is the extent up to which, you will consider customers' trust in your decision-making?
1. Low
 2. Moderate
 3. Good
 4. High
 5. Very High
- (d) Given the practical SCM setting described above, and the SCM moderators reported by you, what is the extent up to which, you will consider company reputation in your decision-making?
1. Low
 2. Moderate
 3. Good
 4. High
 5. Very High
- (e) Given the practical SCM setting described above, and the SCM moderators reported by you, what is the extent up to which, you will consider market in your decision-making?
1. Low
 2. Moderate
 3. Good
 4. High
 5. Very High
- (f) Given the practical SCM setting described above, and the SCM moderators reported by you, what is the extent up to which, you will consider risk minimization in your decision-making?
1. Low
 2. Moderate
 3. Good
 4. High
 5. Very High

Appendix B: Sample description

Age

		<i>Frequency</i>	<i>Percent</i>	<i>Valid Percent</i>	<i>Cumulative Percent</i>
Valid	Less than 25 years	14	13.5	13.5	13.5
	25 years to less than 30 years	35	33.7	33.7	47.1
	30 years to less than 35 years	30	28.8	28.8	76.0
	35 years to less than 40 years	19	18.3	18.3	94.2
	40 years and above	6	5.8	5.8	100.0
	Total	104	100.0	100.0	

Gender

		<i>Frequency</i>	<i>Percent</i>	<i>Valid Percent</i>	<i>Cumulative Percent</i>
Valid	Male	68	65.4	65.4	65.4
	Female	36	34.6	34.6	100.0
	Total	104	100.0	100.0	

SCMExp

		<i>Frequency</i>	<i>Percent</i>	<i>Valid Percent</i>	<i>Cumulative Percent</i>
Valid	Less than 5 years	30	28.8	28.8	28.8
	5 years to less than 10 years	47	45.2	45.2	74.0
	10 years to less than 15 years	20	19.2	19.2	93.3
	15 years to less than 20 years	6	5.8	5.8	99.0
	20 years and above	1	1.0	1.0	100.0
	Total	104	100.0	100.0	

Nationality

		<i>Frequency</i>	<i>Percent</i>	<i>Valid Percent</i>	<i>Cumulative Percent</i>
Valid	Greece	51	49.0	49.0	49.0
	Germany	23	22.1	22.1	71.2
	UAE	12	11.5	11.5	82.7
	India	18	17.3	17.3	100.0
	Total	104	100.0	100.0	

Appendix C: Factor rotation table**Rotated Component Matrix^a**

	<i>Component</i>			
	1	2	3	4
Profitability	.875	.000	.022	.043
Environment	.880	.038	-.031	-.001
Customer Trust	-.009	.061	.984	.049
Company Reputation	.044	.783	.171	-.110
Market Share	.035	.031	.048	.984
Risk Minimization	-.007	.806	-.087	.149

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 4 iterations.

	<i>Component</i>			
	1	2	3	4
Extraversion	-.061	.978	.198	-.027
Neuroticism	-.357	.272	.887	-.106
Openness	.779	-.065	-.245	.573
Agreeableness	.934	-.067	-.253	.141
Consciousness	.948	-.077	-.255	.053

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Appendix D: Scale reliability tests**Scale Reliability – Profit & Environment**

<i>Cronbach's Alpha</i>	<i>N of Items</i>
.805	5

Item-Total Statistics

	<i>Scale Mean if Item Deleted</i>	<i>Scale Variance if Item Deleted</i>	<i>Corrected Item-Total Correlation</i>	<i>Cronbach's Alpha if Item Deleted</i>
Profitability	13.5952	4.166	.655	.766
Environment	13.5375	5.383	.431	.832
Openness	12.6221	5.659	.733	.738
Agreeableness	12.5923	5.933	.709	.752
Consciousness	12.5721	6.001	.711	.754

Reliability Statistics - Culture

<i>Cronbach's Alpha</i>	<i>N of Items</i>
.436	5

Item-Total Statistics

	<i>Scale Mean if Item Deleted</i>	<i>Scale Variance if Item Deleted</i>	<i>Corrected Item- Total Correlation</i>	<i>Cronbach's Alpha if Item Deleted</i>
CustomerTrust	13.1769	3.345	.141	.460
CompanyReputation	12.9077	3.211	.268	.350
RiskMinimization	13.0135	3.384	.201	.402
Extraversion	12.7913	3.478	.308	.334
Neuroticism	12.5875	3.636	.261	.366

Reliability Statistics - Sustainability

<i>Cronbach's Alpha</i>	<i>N of Items</i>
.674	4

Item-Total Statistics

	<i>Scale Mean if Item Deleted</i>	<i>Scale Variance if Item Deleted</i>	<i>Corrected Item- Total Correlation</i>	<i>Cronbach's Alpha if Item Deleted</i>
MarketShare	10.9029	2.516	.015	.954
Openness	9.9106	1.861	.632	.494
Agreeableness	9.8808	1.817	.779	.418
Consciousness	9.8606	1.889	.754	.444

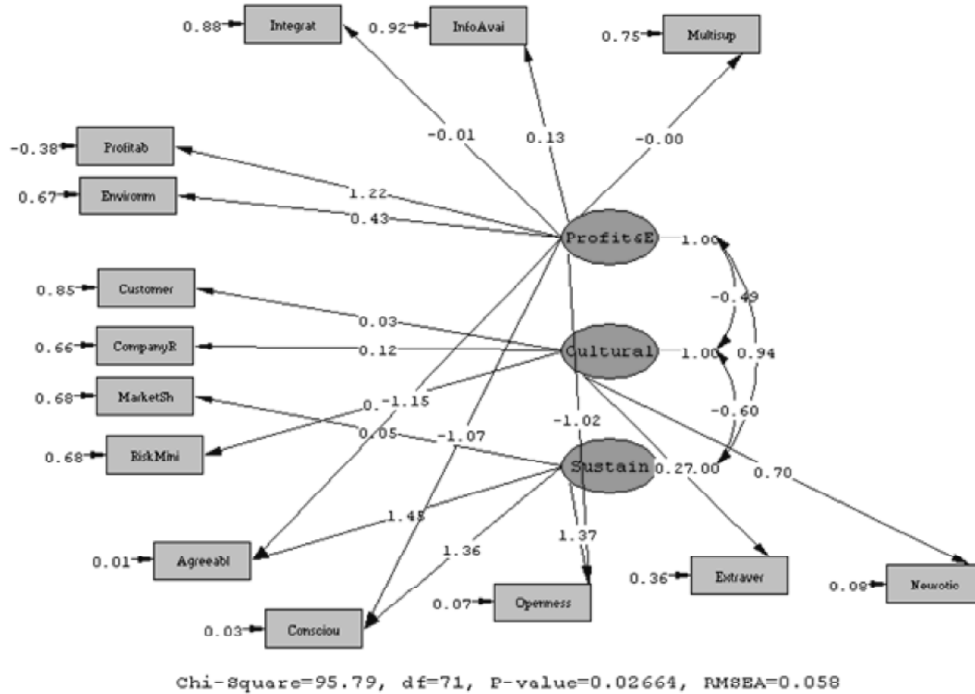
Appendix E: Normality tests

Tests of Normality

	<i>Kolmogorov-Smirnov^a</i>			<i>Shapiro-Wilk</i>		
	<i>Statistic</i>	<i>df</i>	<i>Sig.</i>	<i>Statistic</i>	<i>df</i>	<i>Sig.</i>
Integration	.223	104	.000	.891	104	.000
InfoAvailability	.189	104	.000	.898	104	.000
MultisupplierAvailability	.213	104	.000	.878	104	.000
Profitability	.198	104	.000	.908	104	.000
Environment	.215	104	.000	.889	104	.000
CustomerTrust	.227	104	.000	.852	104	.000
CompanyReputation	.254	104	.000	.818	104	.000
MarketShare	.281	104	.000	.839	104	.000
RiskMinimization	.237	104	.000	.828	104	.000
Extraversion	.142	104	.000	.946	104	.000
Neuroticism	.114	104	.002	.975	104	.045
Openness	.111	104	.003	.972	104	.028
Agreeableness	.115	104	.002	.968	104	.013
Consciousness	.129	104	.000	.967	104	.011

a. Lilliefors Significance Correction

Appendix F: Model A



Goodness of Fit Statistics

Degrees of Freedom = 71

Minimum Fit Function Chi-Square = 99.45 (P = 0.015)

Normal Theory Weighted Least Squares Chi-Square = 95.79 (P = 0.027)

Estimated Non-centrality Parameter (NCP) = 24.79

90 Percent Confidence Interval for NCP = (3.21 ; 54.44)

Minimum Fit Function Value = 0.97

Population Discrepancy Function Value (F0) = 0.24

90 Percent Confidence Interval for F0 = (0.031 ; 0.53)

Root Mean Square Error of Approximation (RMSEA) = 0.058

90 Percent Confidence Interval for RMSEA = (0.021 ; 0.086)

P-Value for Test of Close Fit (RMSEA < 0.05) = 0.31

Expected Cross-Validation Index (ECVI) = 1.59

90 Percent Confidence Interval for ECVI = (1.38 ; 1.88)

ECVI for Saturated Model = 2.04

ECVI for Independence Model = 6.67

Chi-Square for Independence Model with 91 Degrees of Freedom = 659.31

Independence AIC = 687.31
Model AIC = 163.79
Saturated AIC = 210.00
Independence CAIC = 738.33
Model CAIC = 287.70
Saturated CAIC = 592.66
Normed Fit Index (NFI) = 0.85
Non-Normed Fit Index (NNFI) = 0.94
Parsimony Normed Fit Index (PNFI) = 0.66
Comparative Fit Index (CFI) = 0.95
Incremental Fit Index (IFI) = 0.95
Relative Fit Index (RFI) = 0.81
Root Mean Square Residual (RMR) = 0.066
Standardized RMR = 0.091
Goodness of Fit Index (GFI) = 0.88
Adjusted Goodness of Fit Index (AGFI) = 0.83
Parsimony Goodness of Fit Index (PGFI) = 0.60

Appendix G: Model B

W_A_R_N_I_N_G: THETA-DELTA is not positive definite

W_A_R_N_I_N_G: The solution was found non-admissible after 500 iterations.

The following solution is preliminary and is provided only
for the purpose of tracing the source of the problem.
Setting AD>500 or AD=OFF may solve the problem

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