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The country context in triple-A supply chains: an advanced PLS–SEM research study in emerging vs developed countries

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Received 15 September 2020
Revised 22 October 2020
Accepted 4 November 2020

Abstract

AQ: 5 **Purpose** – This paper analyzes whether the Triple-A supply chain (SC)–competitive advantage (CA) relationship is influenced by the country context and considers the case of emerging vs developed countries. Any differences in the importance of the three Triple-A SC dimensions (agility, adaptability and alignment) and a potential synergy effect among them when pursuing CA are also analyzed.

Design/methodology/approach – Partial least squares (PLS) method is applied to an international multiple informant sample of 304 manufacturing plants in nine developed and five emerging countries.

Findings – A significant positive relationship is found between the Triple-A SC and CA in the full sample and in the two separate samples of emerging and developed countries, which is more intense in the emerging countries. For the same samples, it is also concluded that (1) there are no significant differences in the importance of SC adaptability (SC-Ad), SC agility (SC-Ag) and SC alignment (SC-Al) as levers in the Triple-A SC–CA relationship and (2) a synergy effect among the Triple-A SC dimensions when pursuing CA is not supported.

Research limitations/implications – The present study brings new evidence to the previous research on Triple-A SC and its relationship with CA in different country contexts. For managers, this work (1) shows that Triple A should be considered in the design of global SCs irrespective of the country context and (2) offers a first approach for determining the Triple-A SC levers that must be taken into consideration when pursuing a CA.

Originality/value – This paper contributes to Triple-A SC theory development. It is the first research study that analyzes the effect of the country context on the Triple-A SC–CA relationship and the importance of each of the Triple-A SC dimensions and their possible synergy effect when pursuing CA using a multiinformant international sample taken from different country contexts.

Keywords Triple-A supply chain, Agility, Adaptability, Alignment, Competitive advantage, Emerging and developed countries, Advanced PLS–SEM applications

Paper type Research paper

1. Introduction

Companies with global supply chains (SCs) have been forced to seek new ways to manage their operations outside the boundaries of the individual firm. Effective SC management has become critical for the survival and growth of organizations and for gaining a competitive advantage (CA). CA could be defined as the capability that allows firms to achieve a higher level of performance than their competitors (Hayes and Wheelwright, 1984). A CA cannot be generated by resources alone; these resources also need to be exploited and deployed effectively and this requires specific capabilities (Barney, 1992; Fang *et al.*, 2019). In this sense, Lee (2004) states that only Triple-A SCs are capable of producing a sustainable CA.

Industrial Management & Data Systems

0263-5577
DOI 10.1108/IMDS-09-2020-0536

The Triple-A is formed of three dimensions, SC adaptability (SC-Ad), SC agility (SC-Ag) and SC alignment (SC-Al)–, and these represent the SC dynamic capabilities that need to be developed to respond to changes in customer demand, markets and economies in order to achieve CA (Whitten *et al.*, 2012).

In the literature, there are discrepancies on the conceptual level as to the definitions of the three Triple-A SC dimensions as well as a lack of research on these dimensions (individually and jointly), especially SC-Ad and alignment (Marin-Garcia *et al.*, 2018). In this work, *SC-Ag* is defined as an SC's ability "to respond rapidly to unexpected short-term changes in supply and demand in order to generate or maintain a competitive advantage" (Alfalla-Luque *et al.*, 2018). Agility is by far the Triple-A SC dimension that has been most investigated. It has also been recognized as a crucial component of competitiveness (Li *et al.*, 2008). *SC-Ad* is the "ability of the SC to adapt its strategies, products and/or technologies to structural changes in the market" (Alfalla-Luque *et al.*, 2018). SC-Ad is also considered an important requirement for high performance and achieving a sustainable CA in a complex and unstable business environment (Touminen *et al.*, 2004). Lastly, *SC-Al* is "the way in which operations and activities along the SC should be managed to meet product/market speed and complexity demands through the synchronization and coordination of operations" (Kehoe *et al.*, 2007). Alignment is the state that exists when SC members share information, responsibilities and roles and also incentives to synchronize and coordinate their processes and activities. It has been stated that alignment leads to several benefits (improvements in on-time delivery, lead times, sales, costs, etc.) and helps SCs achieve CA (Attia, 2016) through the use of a variety of practices, tools and technologies (Hinkka *et al.*, 2013; Rezaei *et al.*, 2017).

The Triple-A SC is an underresearched field. No empirical research was developed by Lee (2004) and only limited empirical research has analyzed the relationship between the Triple-A SC and performance (Whitten *et al.*, 2012; Attia, 2015; Feizabadi *et al.*, 2019a) or the Triple-A SC and CA (Alfalla-Luque *et al.*, 2018). These studies conclude that not only a positive relationship exists but also agree that further research needs to be done. Besides, there are also some limitations to Whitten *et al.* (2012) and Attia (2015) regarding generalization: they both focus on one single country (Egypt and the USA, respectively), data are taken from single respondents and their scales are exclusively taken from Lee's (2004) theoretical reasoning, with no analysis of the previous literature (the two studies use the same items). Alfalla-Luque *et al.* (2018) subsequently overcome these shortcomings but stress that their work on developed countries may not be generalizable to other types of country, while stating the need to extend Triple-A SC analysis to other country contexts, such as emerging countries. Feizabadi *et al.* (2019a) conduct a survey of respondents in countries on three continents. However, they do not specify the countries involved or address the possible existence of any differences due to the country context.

To contribute to theory building on this topic, this study seeks to overcome the mentioned limitations while also taking into account the call for further research emphasized by previous empirical research and then to analyze in greater depth Lee's statement (Lee, 2004) that "only supply chains that are agile, adaptable, and aligned provide companies with sustainable competitive advantage." It will also take into account the fact that previous studies have still not considered any contextual factors, even though these may influence the impact on performance (Flynn *et al.*, 2010), and that they have not analyzed a sample of firms composed of emerging and developed countries. Therefore, no evidence of any possible differences between these two country typologies has been reported to date (Attia, 2016), although the *divergence perspective* (Ralston *et al.*, 1997) and the *contingency theory* (Lawrence and Lorsch, 1967) argue that contextual variables (such as the country context) influence the level of achievement of business practices. However, there is no agreement regarding this influence as, on the opposing side, the *convergence hypothesis* (Ralston *et al.*, 1997) states that the growing global transfer of technology and organizational systems will lead to similar behaviors in different countries to the detriment of national cultures (Dore, 1973; Form, 1979).

Given the important role played by emerging countries in the design of global SCs, the enormous amount of investment involved and the growing need to improve SC performance in these economies, the need to determine whether the country context is or is not an influential factor becomes a critical research goal, especially as there is no general agreement on the matter. So, Triple-A SC research is required that might shed some light on the topic to gain new insights that can be beneficial for the design of effective global SCs.

Despite this importance, only Attia (2015) analyzes the Triple-A SC performance relationship in emerging countries, albeit in a very limited way (only one country (Egypt) and one industry (the textile sector). For their part, Whitten *et al.* (2012) and Alfalla-Luque *et al.* (2018) focus their analyses on developed countries while Feizabadi *et al.* (2019b) focus theirs on international firms in general. Consequently, no previous research has compared a sample of emerging and developed countries using the same scales, time period and research framework for both in order to analyze the influence of the country context on the Triple-A SC–CA relationship.

The primary objective of the present research is, therefore, to provide new empirical evidence to assess Lee's (2004) statement by analyzing whether the country context (with a focus on emerging and developed countries) influences the Triple-A-CA relationship, while overcoming some other limitations of the previous research through the use of a wider multicountry, multiinformant sample. It is also important to examine the possibility of improving SC design to achieve CA in line with Lee's proposition (2004). It should not be forgotten that Lee states that only the existence of a Triple-A SC is required to produce a sustainable CA, but he makes no statement as to the individual importance of each of the three Triple-A SC dimensions or of a possible joint synergy effect. These are important aspects that need to be taken into consideration in SC design as the Triple-A SC dimensions require the implementation of different business practices that may have different effects on CA. So, two further objectives will be considered to further develop Triple-A SC theory and practice: (1) an analysis of whether there are any differences in the importance of the three Triple-A SC dimensions for a CA to be achieved and whether this result differs in the cases of emerging and developed countries and (2) an analysis of the potential synergy effect produced by the interaction of the three Triple-A dimensions.

F1 The research framework is summarized in Figure 1 in line with the above (see acronyms in Appendix 1).

This article is organized as follows. Section 2 analyzes the theoretical background of this research and sets out the hypotheses to be tested. Section 3 describes the sample and methodology. Section 4 reports the analysis of the data and the results. Lastly, Section 5 presents the most important conclusions and specifies the paper's contributions, implications for managers and academics and limitations and further research.

2. Theoretical background and hypotheses

2.1 Triple-A SC and performance

Following the dynamic capabilities view (Teece *et al.*, 1997) and the initial conceptual framework established by Lee (2004), SC agility, adaptability and alignment are dynamic capabilities that respond to changing business environments. They demand complex resources whose implementation might be difficult, expensive and hard to replicate (Whitten *et al.*, 2012) and, therefore, generate CA and a superior level of performance. The Triple-A SC is a set of dynamic capabilities and so should be supported by a positive relationship with CA.

The previous literature has considered the Triple-A SC framework in two different ways. Some authors have analyzed the Triple-A SC dimension as an independent variable in

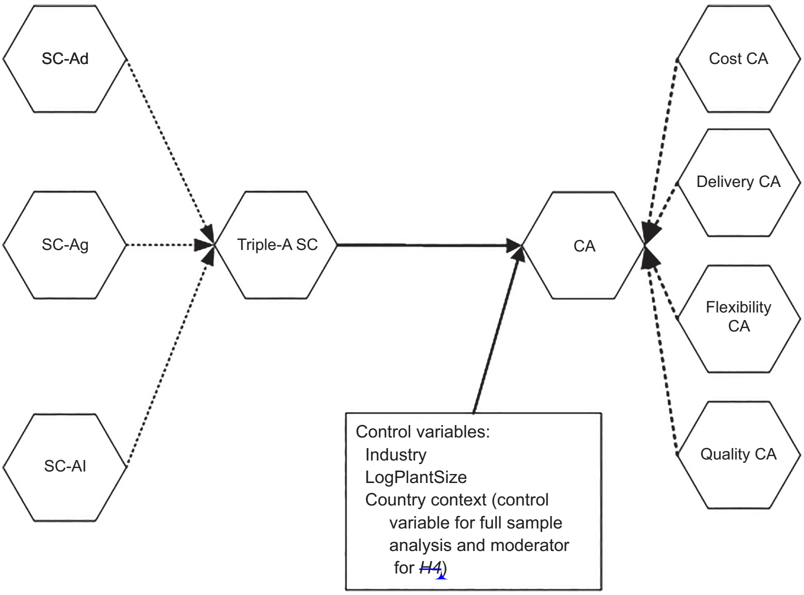


Figure 1. Research framework (Dashed lines correspond to measurement model for higher-order constructs)

conceptual (Gunasekaran *et al.*, 2017; Umar *et al.*, 2017; Feizabadi *et al.*, 2019b) and empirical research (Dubey *et al.*, 2015; Dubey and Gunasekaran, 2016; Attia, 2016; Dubey *et al.*, 2018; Alfalla-Luque *et al.*, 2018). They have usually concluded a positive relationship between each of the individual Triple-A SC dimensions and performance or CA. However, some works have not supported some of these relationships, including, for example, Dubey *et al.* (2015) for SC-Ad and human performance, Dubey and Gunasekaran (2016) for SC-Al and humanitarian SC performance and Alfalla-Luque *et al.* (2018) for SC-Ag and cost CA, quality CA and delivery CA.

The second approach considers the three Triple-A SC dimensions together in a single construct either as a common factor (Attia, 2015; Whitten *et al.*, 2012) or a composite (Alfalla-Luque *et al.*, 2018). ~~In reality, this approach could be considered the best fit for testing Lee's proposition as this author states that all three dimensions are necessary for CA to be achieved.~~ In this sense, based on a survey of 132 APICS members in the United States, Whitten *et al.* (2012) concluded that a positive relationship exists between a Triple-A SC-based strategy and SC performance and that marketing performance mediates the relationship between SC performance and financial performance. Using data from 153 companies (textile sector, Egypt), Attia (2015) studied the Triple-A SC and marketing strategy alignment relationships with SC performance and organizational performance, finding that both are positively related to SC performance. SC performance and organizational performance are also found to be positively related. Attia compared these results to those of Whitten *et al.* (2012) and concluded that their results are similar in the case of the Triple-A SC and marketing strategy alignment relationships with organizational performance. Alfalla-Luque *et al.* (2018) overcame some of the limitations of the previous works by using a database of 151 manufacturing plants taken from three sectors and eight developed countries to examine the Triple-A SC and its relationship with various CA dimensions (cost, quality, delivery, flexibility and financial proxy). They found that this relationship is positive and significant for all the CA measures except quality. All these articles stressed the need for further research to test the Triple-A SC–performance/CA relationship with wider samples from more countries. Following the call for further evidence to develop the Triple-A SC theory and taking into account that most results of the previous research support a positive relationship, the following hypothesis is proposed:

H1. There is a positive relationship between Triple-A SC and CA.

In the globalization context, it is necessary to dig deeper into what has gone before and to consider the possible influence of national culture on obtaining a CA (Naor *et al.*, 2010). Although the analysis of contextual factors is becoming more frequent in OM and SC management (Qamar and Hall, 2018) and the influence of the country or region has been analyzed as a contextual factor in some OM topics (e.g. Ahmad and Schroeder, 2003; Rungtusanatham *et al.*, 2005; Naor *et al.*, 2008; 2010; Katiyar *et al.*, 2018; Miras-Rodríguez *et al.*,
AQ: 6 2018), it is still considered an underdeveloped area. In relation to the present research, no previous analysis has been done on the possible influence of the country context on the Triple-A SC–CA relationship despite its importance for facilitating appropriate global SC design. Given the high level of investment devoted to the design and implementation of SCs and the increasingly important role of SCs in the world economy, it is relevant to analyze whether or not the Triple-A SC–CA relationship is influenced by the country context.

In conceptual terms, Lee's statement (2004) that a Triple-A SC has a positive relationship with CA seems to indicate that this must occur irrespective of where the SC partners are located, in emerging or developed countries. This means that, as the Triple-A SC is developed in a global context and as dynamic capabilities should flow along the chain to achieve a CA, the right practices must be implemented in each link of the chain for this to happen. The increasing speed of globalization, which is making countries resemble each other more and more, seems to support the above comment. However, there is no agreement about the possible influence of the country, and the "convergence vs divergence debate" (Bird and Kotha, 1994) is still open (Rungtusanatham *et al.*, 2005; Naor *et al.*, 2008; Naor *et al.*, 2010).

Despite its importance, this topic has not been empirically tested in the previous research using a unique wide sample composed of emerging and developed countries. In this sense, Attia (2015) focused only on emerging countries, with a sample of only one single country (Egypt). This is clearly insufficient to validate a theory, as the author himself recognizes. Besides, a comparison of the results of his work with Whitten *et al.* (2012) (again only one country, the USA) is neither sufficient nor appropriate for drawing robust conclusions on the topic. Using a sample of developed countries, Alfalla-Luque *et al.* (2018) stressed that further research should include emerging countries to be able to determine whether there are any differences due to the country context. Therefore, the present research seeks to contribute to the literature by using a wide sample of emerging and developed countries to analyze whether Lee's (2004) statement is supported irrespective of the country context. Therefore, the second hypothesis has been formulated as follows:

H2. There is a positive relationship between Triple-A SC and CA in different country contexts (emerging and developed countries).

As stated above, the "convergence vs divergence debate" (Bird and Kotha, 1994) is still open (Rungtusanatham *et al.*, 2005; Naor *et al.*, 2008; Naor *et al.*, 2010). The *convergence hypothesis* argues that as countries develop, they adopt a work behavior similar to that of industrialized countries (Ralston *et al.*, 1997), i.e. the transfer between countries of technology and organizational systems results in alignment with this transfer (Cole, 1973). This would lead to different countries displaying similar behaviors (Dore, 1973; Form, 1979), which implies that management practices could be applied universally, bringing countries into line with one another and reducing the effects of national cultures (Von Glinow *et al.*, 2002). In contrast, based on the National Specificity argument (Child and Kieser, 1979), the *divergence hypothesis* argues that the value system of a country's workforce remains in place to a large extent despite the country becoming industrialized, and, so, a country's national culture should have an effect on the implementation of business practice (Ralston *et al.*, 1997) and, therefore, on its effects. This is in harmony with the contingency theory, which argues that no theory or method is applicable in every circumstance (Lawrence and Lorsch, 1967). In this line, contextual factors could affect the levels of implementation of practices, strategies and SC capabilities and their link with performance (Schroeder and Flynn, 2001; Arana-Solares *et al.*, 2019).

The lack of consensus on this important matter calls for further research. This is why the following hypothesis is formulated to contribute to the literature on the topic and, more specifically, the literature related to the Triple-A.

H3. The positive relationship between the Triple-A SC and CA is different in emerging countries than in developed countries.

2.2 The importance of Triple-A SC's capabilities in the Triple-A SC–performance/CA relationship

Following Lee (2004), all three Triple-A dimensions need to be present in an SC for CA to be obtained. However, to make improvements to SC design, it is important to know whether there is a difference in the importance of the three Triple-A SC dimensions (agility, adaptability and alignment) in achieving CA. This would give managers a guide to the appropriate deployment of these dimensions and resource investment. This makes this topic a key factor for SC design in global contexts. The Triple-A SC theory is currently under construction. Pioneering research is required to develop the Triple-A SC theory. In this sense, this work initiates an innovative line of research that has still not been tested in the literature, although it has been possible to extract some partial but not conclusive information from the previous research.

Focusing on Indian firms, Dubey *et al.* (2015) analyzed the individual relationships of SC agility, adaptability and alignment with logistics and human performance. They showed that SC-Al is strongly related to logistics performance but, although still significantly, less so to human performance. SC-Ag was also found to be a significant driver of logistics performance but not as strong as SC~~-alignment~~. The path linking SC-Ad and human performance was found not to be statistically significant. However, the path with logistics performance was significant but quite negligible.

Whitten *et al.* (2012) (for a developed country) and Attia (2015) (for an emerging country) did not report the values of the importance of each of the Triple-A SC dimensions in the relationship with SC performance. In Attia (2016), the paths between each of the Triple-A SC dimensions and organizational performance showed similar values in an emerging country (Egypt). Finally, Alfalla-Luque *et al.* (2018) showed that the contribution of SC-Ad and alignment to CA achievement was significant at 1% in the context of eight developed countries and that SC-Ag was nonsignificant at 5% ($p = 0.068$).

Therefore, there is no specific analysis in the previous research that addresses differences in the importance of the Triple-A SC dimensions when pursuing performance/CA. Besides, the possible partial insights into this matter that could be obtained from their results are neither clear nor show a consensus. Thus, to contribute to the literature, this work analyzes two aspects of this topic. First, whether there are any differences in the importance of the three Triple-A SC dimensions in the same sample when pursuing CA. So, the following hypothesis is formulated:

H4. There are differences in the importance of the three Triple-A SC dimensions (agility, adaptability and alignment) in the same sample when pursuing CA.

Second, a new hypothesis is formulated in the search for new evidence on the topic that takes into account the possible relevance of the country context for the design of global supply chains and the still open debate about the *divergence vs convergence perspectives* in relation to the influence of the country context. Therefore, it is now proposed that the importance of SC agility, adaptability and alignment differs in plants located in emerging and developed countries (i.e. differences in the importance of specific dimensions between subsamples):

H5. There are differences in the importance of the three Triple-A SC dimensions in the subsamples of emerging and developed countries when pursuing CA.

2.3 The synergy effect of the Triple-A SC dimensions when pursuing CA

The synergy effect derived from any interaction between the different capabilities has been analyzed in several previous studies on OM, and its importance has been stressed. For example, in an empirical study of manufacturing strategy (MS) and technology practices in the auto supplier sector, Machuca *et al.* (2011) did not find any significant proof of the existence of synergy among these practices but stressed an interest in further research exploring any interaction between them that might lead to improved performance. Other studies have shown a positive effect on performance of interaction between some capabilities. For example, in research on technology and production strategy practices in three industrial sectors in a multicountry sample, Garrido-Vega *et al.* (2015) found that high performing plants show reciprocal relationships between these practices and conclude that the interconnection between these practices facilitates the path to high performance, which advises their synergistic implementation. In this line, working with an international sample from the machinery and electronics sectors, Arana-Solares *et al.* (2019) concluded that operational performance (OP) appears to be a function of the interaction between MS and technology management (TM) and that any possible environmental effects on OP are minimized when MS and TM are integrated.

Regarding the present research topic, a literature review of Triple-A SC dimensions (Gunasekaran *et al.*, 2017) concluded that "it is important that managers build particular capabilities for achieving synergy among the three-As to achieve competitive advantage manifested through the three competitive elements." However, this possible synergy among the three dimensions of the Triple-A supposedly needed to achieve CA, i.e. whether the effect of the Triple-A SC is greater than the sum of the effects of the three dimensions when acting separately, has not been analyzed to date in the Triple-A framework, despite its possible influence on achieving higher performance. Therefore, although the scarce previous OM and SCM research does not show any consensus on this matter, there are more studies in favor of
AQ: 7 the existence of an interaction effect. For this reason, the following hypotheses are proposed:

H6. There is a synergy effect among the Triple-A SC dimensions in the full sample when pursuing CA.

H7. There is a synergy effect among the Triple-A SC dimensions in emerging and developed countries when pursuing CA.

3. Methodology

3.1 Sample and data collection

The empirical analysis uses part of the current database of the fourth round of the international High Performance Manufacturing (HPM) project (data collection completed in 2016) obtained from manufacturing plants (with ≥100 employees) in three sectors (automotive components, electronics and machinery) in nine developed countries (Austria, Finland, Germany, Italy, Japan, Spain, Sweden, United Kingdom and USA) and five emerging countries (Brazil, China, South Korea, Taiwan and Vietnam). Data from Israel were discarded as a high volume of variables needed for this research were missing. The three sectors included in the HPM project were selected due to their intense global competition, their large numbers of plants around the world and as they face different competitive environments and are alert to competitiveness (Garrido *et al.*, 2015; Morita *et al.*, 2018). Also, these sectors widely share practices relevant to this research in global networks. In this line, other authors have also opted for these sectors either jointly (Naor *et al.*, 2010; Miras *et al.*, 2018; Morita *et al.*, 2018; Danese *et al.*, 2019) or separately (e.g. Droge *et al.*, 2004; Machuca *et al.*, 2011; Ortega *et al.*, 2012).

The HPM fourth-round questionnaires were developed and updated from the HPM international project, in which survey questions were based on a wide-ranging review of the operations management literature. A panel of experts reviewed the instruments to guarantee content validity and pilot tests were conducted in several plants to analyze the instruments' reliability, validity and internal consistency (Schroeder and Flynn, 2001; Flynn *et al.*, 1995). Questionnaires have been reviewed over the HPM project's various rounds. Also, the items and scales used as the international HPM project's measurement instruments have been tested in line with prescriptive reliability and validity and internal consistency analyses (Flynn *et al.*, 1995; McKone *et al.*, 1999; Sakakibara *et al.*, 1997; Ahmad and Schroeder, 2002; Cua *et al.*, 2002; Marin-Garcia *et al.*, 2018).

The various measurement scales and objective questions of the entire HPM survey were listed in 12 questionnaires targeted (depending on their content) at different managerial functions in the plant (plant management, production control, accounting, process engineering, quality, environmental affairs, supply chain management, human resources management, information system management, product development and supervision), giving a total of 23 surveys per plant. The contact person in each plant was approached to request his/her participation (in exchange the plant would receive a report on its situation [practices and performance] compared to its competitors). The questionnaires were sent to the plants in pdf format and, except in the case of plant managers, were answered by two different managers in the function, most related to the corresponding questionnaire. The questions related to the scales of the present research were in the questionnaires sent to the SC managers and to the plant manager. To triangulate information and minimize any variability caused by differences between individuals, many of the measurement scales were included in at least two different questionnaires, leading to greater reliability. This gave a cross-section of the plants and thus prevented any individual bias (Van Bruggen *et al.*, 2002; Sakakibara *et al.*, 1997) while simultaneously improving validity. In addition, as already indicated above, two people in each function were asked to respond to each of the questionnaires in order to minimize common method bias (Danese *et al.*, 2019). The items and questions on the scale were combined in different ways in each of the questionnaires to prevent respondent bias. Putting each scale in several questionnaires improves interrater reliability, since the questions are looked at from multiple perspectives, and the answers are less affected by random errors and, therefore, more reliable. More detailed information about the HPM Round 4 questionnaires can be found in Danese *et al.* (2019).

A global selection of countries is beneficial for strategic research such as this as it improves the generalizability of the results, which is more restricted when the sample is obtained at a national or regional level. This research classification of the sample into developed and emerging countries is in line with the classification made by the United Nations (2019) and other authors such as Danese *et al.* (2019), Katiyar et al. (2018) and Geng *et al.* (2017). The classification is also confirmed by the Logistics Performance Index (LPI). Developed by the World Bank, the LPI enables comparisons across 160 countries (2018) and is a measure of the performance of a country's logistics SC. In the present study, countries classified as developed are shown to have higher LPIs than those classified as emerging countries.

Therefore, classification into these two groups is in line with the purpose of this research, while at the same time it provides a sufficiently large sample size to use the appropriate methodology. Plants that did not fully answer the questionnaires considered for this research
T1 were discarded from the initial sample. The final sample (Table 1) consisted of 304 plants (135 from emerging countries and 169 from developed countries), which are adequate numbers for analysis. There were fewer than 5% of missing values in most of the Triple-A and CA variables (exceptions were as follows: Adapt31 (7.2%), Adapt32 (7.2%), Agil11 (10.5%), Agil12 (12.2%), Agil21 (7.2), Align11 (7.6%), Align21 (7.2%) and Aling31 (7.6%)). The meanings of these variables can be found in Appendix 1. Missing completely at random
AQ: 8 (MCAR) was analyzed using the SPSS (IBM Corp, 2013) MVA procedure. The test showed that the responses were MCAR (Little's MCAR test: chi-square = 1125.694, DF = 1093 and Sig. = 0.240). As there were over 10% of missing values in some variables (Agil11 and Agil12), multiple imputation with five sets (Schafer and Olsen, 1998; Sarstedt and Mooi, 2019; Marin-Garcia, 2020) was applied using the SPSS multiple imputation procedure with the random seed set at a fixed value (SET RNG = MT MTINDEX = 2000000).

3.2 Measurement instrument

Items for SC-Ag, SC-Ad and SC-Al were measured on a 1–5 Likert scale with informants asked to indicate their degree of agreement with statements (1– strongly disagree, 3 – neither agree nor disagree and 5 – strongly agree). Based on the previous literature, the three Triple-A SC dimensions were measured following the validated scale developed by Marin-Garcia *et al.* (2018) (Appendix 1).

The SC-Ag, SC-Ad and SC-Al constructs were operationalized as a composite Mode A higher-order construct (HOC) (Hair *et al.*, 2019a), with each based on three dimensions; these were the first-order composites calculated from the measures taken from the questionnaires. Composites enable the summarization and measurement of complex concepts based on several items developed to adapt to the construct's theoretical aspects (Sarstedt *et al.*, 2016). Dimensions and items were selected for being mutually complementary, and composite constructs were estimated as Mode A (correlation weights) to prevent any unexpected sign changes or any diminished weights due to collinearity or moderate positive correlation between the indicators (Rigdon, 2016; Becker *et al.*, 2013; Marin-Garcia *et al.*, 2018; Felipe *et al.*, 2019).

The present study focuses on the specific CA in the OM area. Therefore, only operational measures were targeted. To enable modeling of the interrelationships of the operational CA

	Number of plants	Mean plant size
Emerging countries		
Electronics	52	1216
Machinery	46	861
Automotive components	37	880
Total emerging	135	999
Developed countries		
Electronics	49	517
Machinery	72	574
Automotive components	48	1211
Total developed	169	738
Full sample	304	852

Table 1. Sample demographic data

components, the operational CA was modeled as a composite HOC (Mode A) composed of four composites (cost CA, quality CA, delivery CA and flexibility CA). The CA lower-order constructs (LOCs) were designed and validated by other authors (Konecny and Thun, 2011; Alfalla-Luque *et al.*, 2012, and 2015). Mode A was chosen for CA LOCs as they were intercorrelated. CA dimensions were measured on a 1–5 Likert scale with informants asked to give their perceptions of their plants' performance compared to their competitors (1 – poor, 3 – average and 5 – much better) (see Appendix 1). It is important to stress that this comparison with competitors allows the obtention of a measure of CA perceived by managers.

Some previous studies have proposed the inclusion of plant size, plant age or industry as a control variable when studying the relationship between SC strategies or practices and CA (Dubey *et al.*, 2019; Gligor *et al.*, 2015; Dubey and Gunasekaran, 2016; Aslam *et al.*, 2018; Hult *et al.*, 2018). The following control variables have been included in this research: (1) plant size (measured by its log10), as larger firms may possess more resources and be able to use scale economies to implement specific SC practices that could improve their competitive position (Dubey *et al.*, 2019; Gligor, 2015); (2) industry, as the context of some industries may be more uncertain or unpredictable than others (e.g. the stability of customer preferences or product features may differ (Dubey *et al.*, 2019); (3) country context, although this is a variable that does not explicitly appear as a control variable, studies of developed/emerging countries exist in which this variable is used as a sample control but without any analyses or evidence as to whether any differences exist between the groups. Plant age has not been included because its value is not a representative parameter in our sample.

We have found that the control variable with the greatest explanatory capacity is the country context, which also forms part of our hypotheses. We then tested the metric invariance compared to the country context. In these analyses and all those done with subsamples by country context (H2, H3, H5 and H7), the model was adapted in line with the other two control variables (industry and plant size). In the analyses with the full sample, parameter estimation was matched to the country context, industry and plant size.

3.3 Analysis method

The second-order constructs have been considered composites, so our model, both for Triple-A SC and for CA, is formative-formative (type 4 in the Jarvis *et al.* 2003 terminology) as we are AQ: 9
interested in total variance and the contribution made to this by each of the LOC (Wong *et al.*, 2008; Polites *et al.*, 2012). Also, modeling by composites is better adapted to the nature of CA LOCs, where there may be operational excellence strategies that have a certain trade-off in some situations (e.g. cost advantages rather than flexibility benefits). In addition, the Triple-A SC dimension LOCs are complementary and can be implemented more or less sequentially in some plants. In other words, they do not necessarily need to be correlated because each of the LOCs shares different antecedents.

As the model contained HOCs with different numbers of indicators across the LOCs, the disjoint two-stage approach was used (Becker *et al.*, 2012; Sarstedt *et al.*, 2019; Wright *et al.*, 2012; Van Riel *et al.*, 2017). Model 1 (Appendix 3, Figures A1–A3), used to evaluate F3–5
hypotheses H1–H5, included the main effects of the Triple-A SC (3rd stage) or its dimensions (2nd stage) and the corresponding control variables. Model 2 (Appendix 3, Figure A4), used F6
for H6 and H7, extended Model 1 used in the second stage (now as simple effects of the three Triple-A SC dimensions), together with the synergy effect, operationalized as the multiplication (SC-Ad x SC-Ag x SC-Al) of the standardized latent variable scores (LVS) obtained in second-stage Model 1 (Gunasekaran *et al.*, 2017; Cao *et al.*, 2009; Gao *et al.*, 2019; Fassot *et al.*, 2016; Pérez-Luño *et al.*, 2019). ~~Partial least squares (PLS)~~ was chosen to estimate the model (Sarstedt *et al.*, 2016; Hair and Sarstedt, 2019; Hair *et al.*, 2017a, b; Henseler *et al.*, 2016a) with SmartPLS v3.2.8 (Ringle, 2015). The primary advantage of PLS–SEM for our

research is the opportunity to analyze composite constructs and, therefore, total variance and predictive validity, apart from enabling us to obtain the LVS used for modeling the synergy effect (Khan *et al.*, 2019; Shiau *et al.*, 2019; Hair *et al.*, 2019b; Marin-Garcia and Alfalla-Luque,
AQ: 10 2019). Finally, G Power (Faul *et al.*, 2007) was used to test whether the sample size guaranteed power ≥ 0.80 for power analysis (Hair *et al.*, 2019b; Marin-Garcia and Alfalla-Luque, 2019).

4. Results

4.1 Measurement invariance (MICOM) by emerging vs developed countries

To assess measurement invariance between emerging and developed countries, the measurement invariance of composite models (MICOM) permutation with 5000 permutations was followed, and the significance test was two-tailed 5% as there was no theoretical evidence of any sign of any differences between the groups (Hair *et al.*, 2018; Henseler *et al.*, 2016b; Felipe *et al.*, ~~2019~~). Configural invariance was guaranteed by design, with the same indicators used for the constructs in both subsamples. Compositional invariance was analyzed by checking whether there were any correlations in the composites in emerging and developed countries that were significantly below one. When this is not the case (permutation p-values greater than 0.05), the weights of composites do not differ greatly in two groups. When there is configural and compositional invariance, partial measurement invariance is established (Ringle *et al.*, 2015; Hair *et al.*, 2018; Sarstedt *et al.*, 2011; Felipe *et al.*, ~~2019~~).

T2 All LOCs (stage 1) and all HOCs (stages 2 and 3) (Table 2) presented both configural (MICOM step 1) and compositional invariance (MICOM step 2). This is referred to as partial measurement invariance and is the required condition for group-specific comparisons. It, therefore, seems that all the measurement model constructs were confirmed to be the same in the developed and emerging country samples. This enables conclusions to be reached as to whether any differences in the two samples' LVS mean and variance values are significant.

4.2 Measurement model

As partial metric invariance was confirmed in the previous section, the measurement model needed to be assessed for the full sample. For this, two of the four steps recommended for composite constructs (Hair *et al.*, 2019b; Sarstedt *et al.*, 2019) were followed: (1) significance of the indicator weights: bootstrap confidence interval of weights does not include zero or loadings greater than 0.5; and (2) relevance of the indicator weights: weights close to zero show weak relevance. Convergent validity of Triple-A dimensions (correlation of the construct with an alternative measure of the same concept, with single or multiple items, above 0.7) has been demonstrated in the previous research (Marin-Garcia *et al.*, 2018) and so was not required in the present study. Indicator collinearity assessment was not necessary as all our composites were modeled as Mode A.

After running bootstrapping (5000 subsamples, no sign changes), only the weights of two indicators (agil11 and align33) were not significantly different from zero in the first stage, although their loadings were practically 0.5 or higher (0.7 and 0.5, respectively). All the weight values were relevant (the lowest was 0.3 but the majority were approx. 0.45–0.60 (see Appendix 2).

In the second stage, the only weight that was not significantly different from zero was SC-Ag1 (short-term sensitivity to market), and it did not have a loading of over 0.5 (0.38). However, it was not omitted from the model as the statistical criterion is not sufficiently important for this when, as in this case, the items are relevant for the definition of the construct (Wieland *et al.*, 2017). Except for the commented weight, in most cases, all the other values that can be considered relevant were above 0.4. Regarding the third stage, only the

Table 2. MICOM results: emerging vs developed countries

	Step1	Step2 compositional invariance							Step 3a						Step 3b
		MI1	MI2	MI3	MI4	MI5			MI1	MI2	MI3	MI4	MI5		
	Conf. inv	Perm. *P*-val	Perm. *P*-val	Perm. *P*-val	Perm. *P*-val	Perm. *P*-val	Part. meas	Mean orig. diff	Perm. *P*-val	Perm. *P*-val	Perm. *P*-val	Perm. *P*-val	Perm. *P*-val	Equal means	Equal Var
1st stage															
Cost CA	Yes	Single item	Single item	Single item	Single item	Single item	Yes	0.51	<0.01	<0.01	<0.01	<0.01	<0.01	No	Yes
Delivery CA	Yes	0.15	0.61	0.50	0.07	0.13	Yes	0.14	0.13	0.19	0.14	0.33	0.35	Yes	Yes
Flexibility CA	Yes	0.55	0.41	0.93	0.52	0.35	Yes	−0.17	0.21	0.17	0.12	0.08	0.11	Yes	No
Quality CA	Yes	0.52	0.84	0.85	0.98	0.83	Yes	−0.17	0.14	0.19	0.09	0.14	0.19	Yes	No
SC-Ad1	Yes	0.29	0.28	0.27	0.15	0.30	Yes	0.05	0.66	0.57	0.77	0.64	0.66	Yes	Yes
SC-Ad2	Yes	0.06	0.24	0.04	0.11	0.13	Yes	0.47	<0.01	<0.01	<0.01	<0.01	<0.01	No	Yes
SC-Ad3	Yes	0.17	0.46	0.37	0.70	0.15	Yes	0.23	0.02	0.13	0.03	0.07	0.06	Yes	Yes
SC-Ag1	Yes	0.98	0.34	0.15	0.72	0.39	Yes	0.37	<0.01	<0.01	<0.01	<0.01	<0.01	No	Yes
SC-Ag2	Yes	0.48	0.35	0.29	0.28	0.37	Yes	0.05	0.86	0.68	0.81	0.50	0.39	Yes	Yes
SC-Ag3	Yes	0.35	0.32	0.31	0.27	0.23	Yes	−0.06	0.76	0.58	0.53	0.57	0.54	Yes	Yes
SC-Al1	Yes	0.99	0.87	0.62	0.87	0.57	Yes	0.61	<0.01	<0.01	<0.01	<0.01	<0.01	No	No
SC-Al2	Yes	0.66	0.67	0.69	0.49	0.82	Yes	0.04	0.53	0.79	0.72	0.89	0.69	Yes	Yes
SC-Al3	Yes	0.32	0.50	0.62	0.59	0.47	Yes	−0.16	0.24	0.28	0.08	0.12	0.18	Yes	No

(*continued*)

Table 2.

	Step1	Step2 compositional invariance							Step 3a						Step 3b
		MI1	MI2	MI3	MI4	MI5			MI1	MI2	MI3	MI4	MI5		
	Conf. inv	Perm. *P*-val	Perm. *P*-val	Perm. *P*-val	Perm. *P*-val	Perm. *P*-val	Part. meas	Mean orig. diff	Perm. *P*-val	Perm. *P*-val	Perm. *P*-val	Perm. *P*-val	Perm. *P*-val	Equal means	Equal Var
2nd stage															
CA	Yes	0.13	0.49	0.49	0.34	0.49	Yes	0.09	0.29	0.41	0.47	0.55	0.41	Yes	No
SC-Ad–LVS	Yes	0.38	0.66	0.62	0.79	0.66	Yes	0.33	<0.01	0.01	0.01	0.01	0.01	No	Yes
SC-Ag–LVS	Yes	0.26	0.64	0.26	0.39	0.64	Yes	0.06	0.58	0.67	0.36	0.78	0.67	Yes	Yes
SC-Al–LVS	Yes	0.56	0.21	0.64	0.51	0.21	Yes	0.24	0.03	0.03	0.05	0.07	0.03	No	Yes
3rd stage															
Triple-A SC	Yes	0.24	0.16	0.19	0.10	0.26	Yes	0.28	0.01	0.02	0.01	0.04	0.01	No	Yes

Note(s): Conf. inv. = Configural invariance; Perm. *P*-val: Permutation *p*-value; Part. meas.: Partial measurement invariance; Mean orig. diff: Mean original difference; Equal var.: Equal variances. Multi-group test based on 5000 permutations. Significance at the 5% level. Two-tailed test for group comparisons. MI1–MI5 multiple imputation datasets. Variance original difference and its permutations. *P*-values of each multiple imputation dataset were omitted to make the table more compact (data available from contact author on request) weight between the SC-Ag LVS and the HOC Triple-A was not significant (p-value = 0.099), but its loading was above 0.5. The weights of the other two dimensions in the third stage could be considered relevant (above 0.35).

Appendix 4 presents the descriptive statistics (Table A3) and the correlations between constructs (Table A4), both for the full sample and the subsamples per the country typology of the plant. It can be seen that, in general terms, the means were at the higher end of the scale (values approaching 4 on a scale of 1–5) and fairly similar in the emerging and developed countries subsamples. However, the minimum values in the developed countries subsample were higher than in the emerging countries subsample. T9 T10

4.3 Structural model

Support has previously been given to no collinearity issues in the structural model as all the VIF values are lower than 1.9, which is below the commonly accepted value limit of 3.3 (Hair *et al.*, 2019b; Marin-Garcia and Alfalla-Luque, 2019). AQ: 11

In relation to H1 (Table 3, column 5), the in-sample explanatory power of the Triple-A SC ($R2$ = 0.18; R2 adj = 0.17) is significant, so H1 is supported. Although the value of R2 is not high (Hair *et al.*, 2019a, 2019b), it is in line with findings in other articles in the management field (Blome *et al.*, 2014; Agarwal *et al.*, 2018; Shmueli *et al.*, 2019). The path value (0.416) can be considered to be relevant and in line with the results obtained by the previous research for the relationship between these constructs (e.g. Attia, 2015). The full sample used is sufficient to achieve a power above the lower threshold of 0.8 in all the omnibus R^2 adjusted tests for the dependent construct. T3

The analysis of out-of-sample *predictive validity* (Shmueli *et al.*, 2016; Shmueli *et al.*, 2019; Marin-Garcia and Alfalla-Luque, 2019; Danks and Ray, 2018; Felipe *et al.*, 2016) tested the ability of our Model 1 first stage to predict values for new cases by checking that all the PLS Q2 prediction values were positive, and that the RMSE and MAE PLS values were lower than the corresponding values for LM (see Appendix 5). Predictive power was assessed with PLS predict with k-folds = 10 and 10 repetitions (Shmueli *et al.*, 2016; Danksand Ray, 2018). All the PLS prediction errors had moderately negative skewness (between −0.2 and −0.8), which indicated that the error distribution was slightly asymmetrical, so the focus should be put on the RMSE difference (Appendix 5, last column). Hence, these results support predictive validity and offer additional support for H1 tested in this paper.

The obtained results also support H2, indicating that there is a positive relationship between the Triple-A SC and CA for the emerging and developed country groups (Table 3, columns 6 and 7).

Likewise, H3 was also supported as there are significant differences between the paths (permutation p-values below 5% in all five multiple imputation datasets, see Table 4). In general terms, Triple-A SC explains 17% more CA variance in plants in emerging countries than in developed countries. T4

Regarding H4, it must be borne in mind that for the difference between parameters (in this case paths) to be assessed, it is not sufficient to compare whether the estimated value is different, whether the p-values are higher in one case or the other or whether one is significantly different from zero and the other is not (Rodriguez-Entrena *et al.*, 2018).

Differences in the paths between each pair of Triple-A dimensions (SC-Ad vs SC-Ag, SC-Ad vs SC-Al and SC-Ag vs SC-Al) were computed and the confidence intervals checked to determine whether they included zero values (which would indicate that any difference was not significant). The confidence intervals of the path differences included zero values in all the multiple imputation datasets for both the full sample and each of the subsamples (Table 5). For example, in the first dataset (MI1) for the full sample, the confidence interval of the difference between adaptability minus agility [−0.185; 0.323] included zero. This was the case T5

Table 3. Summary of results (paths, R2, R2adjusted and BIC) for Model 1 and Model 2

	Model 1 2nd stage			Model 1 3rd Stage			Model 2 2nd stage		
	Full sample	Emerging	Developed	Full sample	Emerging	Developed	Full sample	Emerging	Developed
Emerging/developed→CA	0.009	–	–	0.008	–	–	0.009	–	–
Industry dummy→CA	−0.08	−0.099	−0.063	−0.08	−0.1	−0.08	−0.075	−0.101	−0.070
LogSize→CA	−0.06	−0.194*	0.072	−0.06	−0.18*	0.074	−0.057	−0.195*	0.083
SC-Ad→CA	0.229**	0.258*	0.219*	–	–	–	0.226**	0.315*	0.205*
SC-Ag→CA	0.114	0.235*	0.025	–	–	–	0.113	0.280*	−0.011
SC-Al→CA	0.149*	0.127	0.150	–	–	–	0.149*	0.138	0.165
Triple-A→CA	–	–	–	0.416**	0.533**	0.323**	–	–	–
AdxAgxAl→CA	–	–	–	–	–	–	0.001	−0.146	0.008
R2 CA	0.181**	0.305**	0.135**	0.181**	0.299**	0.129**	0.182**	0.303**	0.128*
R2 adjusted CA	0.164**	0.278**	0.109	0.170**	0.283**	0.113*	0.162**	0.270**	0.095
Model BIC	−21.532	−20.630	5.191	−32.939	−29.381	−3.848	−16.214	−15.365	11.814

Note(s): BIC (Bayesian information criteria). *p*-value significance levels based on bootstrap 5000 samples (*<5%; **<1%)

in all the comparisons of the pairs of Triple-A dimensions. This means that H4 should be rejected in both the full sample and the emerging and developed country samples as no significant differences have been found in the Triple-A SC dimension paths.

Analyzing this in greater detail, we thought that it would prove interesting to conduct an importance performance map analysis (IPMA), as this may indicate the managerial actions that should be prioritized (albeit tentatively in this case, due to the nonsignificant differences in the weights of the different Triple-ASC dimensions) (Hair *et al.*, 2019a; Hair *et al.*, 2018; Höck *et al.*, 2010; Ringle and Sarstedt, 2016). IPMA helps to determine how important the three Triple-A -SC dimensions are when pursuing CA and their degree of deployment (IPMA settings: target construct = CA; all predecessors of the selected target construct; ranges for IPMA rescaling, all indicators min. 1, max. 5). Logically, the variables that are important (strong total effect) but that show low performance (low average LVS) would then be major areas for improvement.

In the present case, the results (Figure 2) show that practically all the sample means for the Triple-A SC dimensions had a similar level of deployment (values between 68 and 78) (see performance in Figure 2), i.e. almost two-thirds of the scale. Despite these values being relatively high, they did not reach the maximum, so the mean of the plants in the sample still allowed a degree of margin for further deployment of all three variables. The relative importance of the various Triple-A SC dimensions when pursuing CA indicates what should be, in principle, the order of deployment to follow but, in this case with due reservation, as no significant differences in the paths of the components of the Triple-A SC dimensions were found in the H4 test. Figure 2 showed that SC-Al and, to some degree, SC-Ad had similar importance values between samples (full sample, emerging and developed), while for SC-Ag the values of the emerging and developed subsamples were different. F2

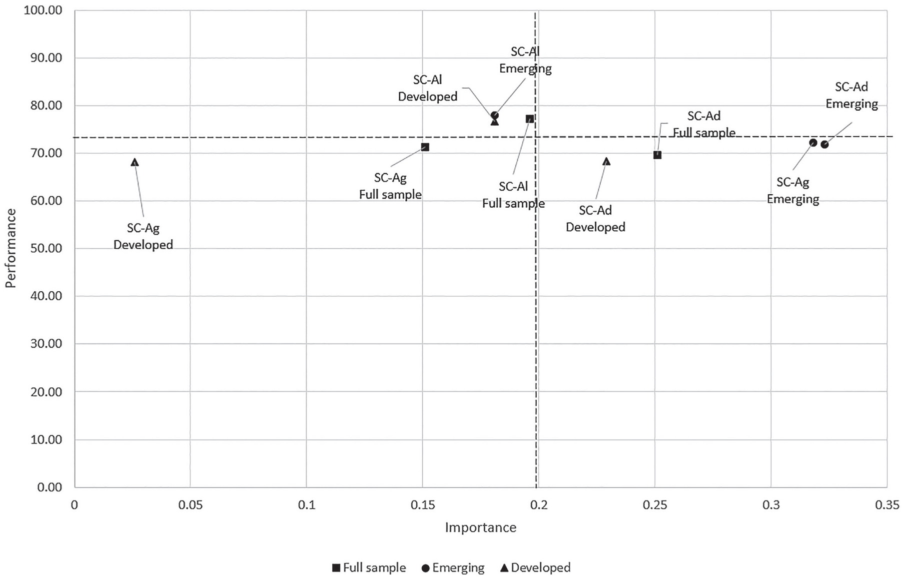
Table 4.
Summary of permutation group comparison results for Model 1 3rd stage

	Emerging	Developed	Emerging-developed	Permutation *p*-values MI1	MI2	MI3	MI4	MI5
Path Triple-A SC – > CA	0.533	0.323	0.210	0.013	0.035	0.009	0.031	0.034
CA *R* square	0.299	0.129	0.170	0.016	0.031	0.036	0.026	0.038

Full sample	MI1 LCI	MI1 UCI	MI2 LCI	MI2 UCI	MI3 LCI	MI3 UCI	MI4 LCI	MI4 UCI	MI5 LCI	MI5 UCI
Ad-Ag	−0.185	0.323	−0.130	0.381	−0.098	0.381	−0.161	0.341	−0.189	0.318
Ad-Al	−0.158	0.286	−0.172	0.274	−0.100	0.316	−0.172	0.282	−0.130	0.296
Ag-Al	−0.205	0.195	−0.278	0.125	−0.223	0.153	−0.244	0.170	−0.170	0.215
Emerging										
Ad-Ag	−0.394	0.442	−0.390	0.479	−0.310	0.546	−0.500	0.370	−0.429	0.414
Ad-Al	−0.199	0.490	−0.301	0.431	−0.170	0.590	−0.348	0.360	−0.198	0.468
Ag-Al	−0.159	0.433	−0.256	0.340	−0.176	0.404	−0.229	0.427	−0.142	0.481
Developed										
Ad-Ag	−0.220	0.414	−0.118	0.474	−0.187	0.441	−0.112	0.474	−0.263	0.377
Ad-Al	−0.289	0.351	−0.221	0.319	−0.203	0.353	−0.192	0.373	−0.232	0.342
Ag-Al	−0.422	0.304	−0.448	0.199	−0.415	0.316	−0.433	0.252	−0.353	0.375

Note(s): Bootstrap 5000 samples. LCI: Lower end confidence interval; UCI: Upper end confidence interval from path differences between dimensions 2.5% and 97.5% percentile bootstrap confidence interval. MI1–MI5 multiple imputation datasets

Table 5.
Model 1 second stage paths differences



Note(s): (CA endogenous construct, unstandardized effects). Mean values of 5 multiple imputation data sets (dotted lines: mean importance value and mean performance value for full sample)

Figure 2. IPMA

Precisely, hypothesis H5 addresses this possible difference between subsamples. The T6 permutation *p*-values in Table 6 led to the rejection of H5; taking the set of values for the five multiple imputation data set, no significant differences in the importance of each of the Triple-A SC dimensions have been found when plants in emerging countries are compared to plants in developed countries. The difference in the adaptability paths in the emerging and developed countries has a value of 0.039 and the likelihood (permutation *p*-value) takes values from 0.47 to 0.91, so the difference is not significant. The situation for alignment is very similar to adaptability. The difference in the paths for emerging and developed countries is −0.023 and the permutation *P*-value is between 0.71 and 0.85, so the difference is not significant. The difference in the agility paths between emerging and developed countries is 0.210 and significant in one dataset (MI4) (permutation *p*-value 0.047) but not significant in the other four (permutation *P*-values from 0.108 to 0.192). Even though the value of the path differences is striking and significant in this case, as it is not significant in the other four cases, overall H5 must be rejected.

	Emerging-developed	MI1 Permutation *p*-values	MI2 Permutation *p*-values	MI3 Permutation *p*-values	MI4 Permutation *p*-values	MI5 Permutation *p*-values
SC-Ad – > CA	0.039	0.574	0.919	0.475	0.657	0.734
SC-Ag – > CA	0.210	0.178	0.108	0.187	0.047	0.192
SC–Al – > CA	−0.023	0.718	0.859	0.739	0.816	0.727

Note(s): 5000 permutation *p*-value (probability that the difference in the emerging-developed parameter is zero)

Table 6. Permutation *p*-values model 1 second stage

Model 2 was constructed to check whether the synergy effect among the three Triple-A SC dimensions adds further information to the effect of the sum of the three dimensions. For this, we added the interaction term (multiplication of the standardized LVS of SC-Ad, SC-Ag, and SC-Al) to Model 1 2nd stage. The result of this analysis (Table 3, columns 8 to 10) showed that the interaction term is not significant for either the full sample or the two subsamples. Furthermore, the Bayesian information criterion (BIC), as an indicator of fit, was worse in Model 2 than in Model 1. This implies that hypotheses H6 and H7 are not supported for the sample in this research as the multiplier synergy effect between SC-Ag, SC-Ad and SC-Al is not greater than the sum of their effects, as represented by the Triple-A SC construct.

5. Discussion and conclusions

The results of this paper represent relevant contributions to the previous literature and to theory development on the topic and provide new evidence in a wider and more complex context. This section summarizes these contributions (points [1–6]) below and subsequently develops them in greater detail.

5.1 Summary of findings

(1) As a natural extension of the previous research (in line with the dynamic capabilities view), the positive relationship between Triple-A SC and CA has been supported. However, this has been done overcoming limitations of previous research through the use—for the first time—of a wider multicountry, multiinformant sample.

At a more granular level, as a pioneering research topic, support has been given to the following:

(2) *A significant positive relationship has been found between Triple-A SC and CA in different country contexts*; although the positive relationship between Triple-A SC and CA is stronger in plants in emerging countries than in developed countries, these differences are not significant for each of the individual Triple-A dimensions. Previous studies have not considered any contextual factors. Never before have any possible differences between these two country typologies been analyzed or a unique wide sample of firms composed of emerging and developed countries been used. It is also the first time that the same scales, time period and research framework have been used. It should also be stressed that this is considered an underdeveloped research area, despite its importance for an appropriate global SC design.

(3) Significant differences in the *importance of SC-Ag, SC-Ad and SC-Al as levers in the Triple-A SC–CA relationship* have not been found. With this result, this work contributes to an innovative line of research that is relevant as, to make improvements to SC design, it is extremely valuable to know whether there are any differences in the importance of the three Triple-A dimensions for achieving CA. This knowledge would provide managers with guidelines that would enable them to better deploy these dimensions and resource investment, which makes this topic a key factor for SC design in global contexts. It should be highlighted ~~that there is no specific analysis in the previous research that addresses this topic and~~ that Lee (2004) makes no statement as to the individual importance of the three Triple-A SC dimensions. Our research contributes to the literature by analyzing this topic in the full sample as well as in the emerging and developed country subsamples.

(4) *The development of all the Triple-A SC dimensions has been found to improve CA* (IPMA analysis). However, *a synergy effect among the Triple-A SC dimensions when pursuing CA has not been supported.* It should be stressed that all these findings have been found to be valid for different country contexts (in emerging and developed countries and in the full sample) and that no evidence has been found of any possible significant differences between these two country typologies. In spite of the importance of the issue of synergy in the Triple-A (Gunasekaran *et al.*, 2017), Lee (2004) makes no statement as to a possible joint synergy effect, and this has not been analyzed to date. This analysis supersedes previous research by using an unparalleled sample of emerging and developed countries and the same scales, time period and research framework for both.

(5) In relation to the still open debate between divergence vs convergence perspectives, the results of this research provide new empirical evidence to the *convergence hypothesis,* which make these findings more generalizable.

(6) The use for the first time in this kind of research of advanced PLS tools such as predict and IPMA analyses has allowed major new insights to be obtained into the topic and can serve as a useful example for other researchers in the OM and SCM fields. These insights are described below.

5.2 Results discussion and implications for research

The conclusions of this work are in line with some of the previous research on the Triple-A SC and performance/CA relationship in developed (Whitten *et al.*, 2012; Alfalla-Luque *et al.*, 2018) and emerging countries (Attia, 2015) but take one step forward. After comparing his results in Egypt with the results of Whitten *et al.* (2012) in the USA, Attia (2015) stated that the relationship between Triple-A and performance is positive in both cases, i.e. in both developed and emerging countries. However, data are required from more than two countries to properly establish such a statement, and the same data analysis model must be used for any comparison to be made. This has been considered a major issue in the (scant) previous research, which has called for new analyses of different samples and countries to obtain stronger empirical evidence for Lee's statement. This has been overcome by the present research with the first ever analysis of data from a broad international and multiinformant sample of nine developed and five emerging countries. Consequently, the Triple-A SC variables can be considered difficult to replicate dynamic capabilities that generate CA and enable firms to boost their levels of performance (Alfalla-Luque *et al.*, 2018) in different country contexts, which seems to be in line with the convergence hypothesis (Ralston *et al.*, 1997). The results of the present research contribute to Triple-A SC theory development as they support Lee's (2004) statement and go beyond the previous literature by demonstrating for the very first time that a positive Triple-A SC–CA relationship exists in plants in different country contexts.

In addition, these findings are backed up by the results obtained with PLS predict as the predictive nature of the model indicates that it seems to be able to generate sufficiently accurate predictions of new observations, both temporal and cross-sectional. Therefore, although further research is still required, the present empirical research allows it to be stated that the Triple-A SC is positively related to SC competitive advantage, and the fact that this is true for different country contexts (emerging and developed) makes this finding more universally applicable. PLS predict has not previously been used in this context, and its use strengthens the results of this research topic.

In relation to *the possible influence of the country context*, another original result is the confirmation of a positive Triple-A–CA relationship in both emerging and developed countries. Despite the relationship being stronger in the former, the difference is not found to be significant when the dimensions (adaptability, agility and alignment) are analyzed individually. This is proof of the integrating role of the Triple-A as a composite construct and its utility for deducing managerial implications, as its inclusion in the model has enabled important insights to be gleaned for managerial decision-making into the SC. This would not have been the case if only the three Triple-A dimensions had been analyzed separately. This can be considered another contribution to the literature on the topic under study, as this is the first study that (using the Triple-A as a composite) has determined that the joint effects of the three dimensions (agility, adaptability and alignment) are more clearly and more precisely related to CA than their individual effects. This secures the position of the Triple-A as a useful composite construct, especially as the configuration of its dimensions has been observed to be stable in a multicountry context.

In relation to the *importance of the three Triple-A SC dimensions* (agility, adaptability and alignment) in their relationship with CA, the limited research on this topic does not offer conclusive results. The works by Whitten *et al.* (2012) for a developed country and Attia (2015) do not report about the values of the importance of the Triple-A dimensions in their relationship with performance. Attia (2016), for an emerging country, show that SC-Ag, SC-Ad and SC-Al have similar levels of importance in their relationship with performance. Other research studies in emerging (Dubey *et al.*, 2015) and developed countries (Alfalla-Luque *et al.*, 2018) show differences in the mentioned importance. For example, Dubey *et al.* (2015) find that SC-Al is strongly related to performance, with SC-Ag is also significant but not as strong, and SC-Ad is not significantly related to human performance. Alfalla-Luque *et al.* (2018) state that SC-Ad and SC-Al make significant contributions to the relationships of Triple-A SC with both of the CA dimensions (operational/financial), but SC-Ag makes no significant contribution. Notwithstanding, Alfalla-Luque *et al.* (2018) conclude that major differences in the contributions of the Triple-A SC dimensions to CA achievement cannot be supported. The present research is in line with this conclusion, as no significant differences have been found in the importance of the three Triple-A SC dimensions (agility, adaptability and alignment) in pursuit of CA. Besides, the effects of each of these dimensions on CA are also concluded to be significant in the full sample and in the two developed and emerging countries subsamples, which can be considered a new contribution to the literature. This seems to be in line with the convergence hypothesis (Ralston *et al.*, 1997). It is perhaps interesting to note that, while SC-Al or SC-Ad maintain their hierarchy in both the full sample and in the emerging and developed country subsamples, SC-Ag has different levels of importance in the construction of the CA in the subsamples. However, despite these differences in SC-Ag appearing to indicate a possible trend, the available data do not allow them to be considered significant.

It is interesting to highlight that the lack of any significant differences between the adaptability, agility and alignment relationships with CA for the two country typologies (emerging and developed countries) can be explained in light of the “convergence perspective”, which (as was previously mentioned) argues that, as countries develop (as would be the case of the emerging countries), they begin to behave in a similar way to developed countries (Ralston *et al.*, 1997). This leads to behaviors imported into different types of countries asserting themselves over any possible country context effects and behaviors being similar (Dore, 1973; Form, 1979). So, the outcome is that the final results are very much alike in different contexts. To put it another way, the levers that provide competitive advantage in developed countries would also provide these in emerging countries and in a similar fashion in both cases. In the present research, this would imply that when the same Triple-A practices are applied, there would be no significant differences between the subsequent results obtained by plants in emerging countries and developed countries. It, therefore, seems that in the context that interests us, the transfer of technology and organizational systems from developed countries to emerging countries would result in an alignment of managerial behavior in their respective industrial firms (Cole, 1973). This would be even more evident in highly internationalized and competitive sectors such as in the sample in our research (electronics, automotive and machinery). The outcome of all this is that any possible differences due to the country context might become diluted because of the growing similarity and universality of management practices (Von Glinow *et al.*, 2002). In the same line, Naor *et al.* (2010) found that the impact of country differences on business performance is weak. Other works on different management best practices also uphold the country factor's lack of influence (e.g. Rungtusanatham *et al.*, 2005). The above is reinforced by rapidly growing globalization, due to which different countries are becoming more and more alike. All this supports the findings of this research and its vision that similar patterns of behavior can be found in the relationships between the Triple-A dimensions and competitive advantage analyzed in this work, in plants in emerging and developed countries that form part of global SCs. We believe that our findings can also be considered new empirical evidence of the convergence hypothesis and, therefore, contribute to the still open (Rungtusanatham *et al.*, 2005; Naor *et al.*, 2008; Naor *et al.*, 2010) "convergence vs divergence debate" (Bird and Kotha, 1994).

The innovative use of IPMA in Triple-A research has enabled major new findings on the topic and shown that SC-Ad and perhaps SC-Ag for plants in emerging countries could be considered the most important levers in the Triple-A SC–CA relationship (albeit with some reservations in this case, as the within dimension differences are not significant for these data). In spite of the interest of the obtained results, it seems clear that further research is needed into the importance of SC agility, adaptability and alignment in the Triple-A SC framework when CA is being sought.

Therefore, for researchers, this study offers new empirical proof regarding the Triple-A SC and its relationship with CA. These results are a contribution to theory in the sense that they can be considered a clear step forward in the topic since, as has been indicated, the present study overcomes the limitations of some previous studies of the Triple-A SC (Whitten *et al.*, 2012; Attia, 2015; Alfalla-Luque *et al.*, 2018) and provides new evidences in a wider and more complex context.

5.3 Managerial implications

Another important finding that brought to light by the IPMA analysis is that clearly better results are obtained if all the Triple-A SC dimensions are developed, as the effects of the dimensions are summative (this research found no synergy relationship among the Triple-A dimensions). In other words, individual plants might approach the development of SC adaptability, agility and alignment as more or less independent levers, although this could imply that one of the As is developed further than the others. For example, if resources are limited, the decision might be taken to increase the deployment of agility that the plant considers suitable to the level that it deems sufficient and, subsequently, deploy one (or both) of the others. This would not imply any loss of effect on the CA compared to other plants that decide to distribute their resources equally with a balanced deployment of all three As. The high level of investment in the design and implementation of global SCs and the increasingly important role of SCs in the world economy makes these findings extremely valuable for SC managers. However, it must be taken into account that the results of our research are valid for the sample used and may be affected by the fact that all three As present high correlation in the said sample and that this might mean that the interaction model (multiplier) does not take on any more explanation for the CA than that given by the Triple-A construct (summative). It would, therefore, be advisable to compare the results of other samples in future research.

Moreover, in relation to managerial implications, it should be said that specific decisions will depend on the actual circumstances of each plant, such as, for example, the availability of resources required for execution and the real deployment levels of the variables, which might be different from the mean sample value.

Continuing with managerial implications, new evidence for both emerging and developed countries has been found, supporting the hypothesis that the Triple-A SC is significantly and positively related to CA independently of the country context. Consequently, SC managers involved in the design and development of global SCs in developed and/or emerging countries should follow a strategy that recognizes that SC agility, adaptability and alignment are prerequisites to obtaining CA. This implies coordinating a set of decisions in the long, medium and short term in order to secure a Triple-A SC. This should be done from a perspective of continuous improvement and should take into account both current accomplishments in the deployment levels of each of the Triple-A dimensions, the CA and the targets established for the plant in relation to its competitive situation. In this regard, again the use of IPMA leads to results that offer useful information for consideration by researchers and managers. In the present dataset, at the full sample aggregate level, the three As were observed to be at a very similar deployment level for CA. However, it has not been possible to demonstrate whether there are any differences in the importance of the dimensions for achieving CA due to their differences' lack of significance. However, as a sign of the interest of the use of IPMA analysis for OM researchers and managers, it is worth commenting that, if these differences were significant, the obtained information (at the aggregate level) for the plants in the sample would show that the first step should be to raise the deployment level of adaptability, which is the most important A for achieving CA. In other words, when pursuing CA, managers should give importance to the long-term management of the SC by duly adapting SC-Ad dimensions (organizational design, use of technology and medium- and long-term market knowledge). This should be followed by SC alignment, which also has a major impact on CA. So, SC managers should develop SC-Al dimensions (incentive, information and process alignment). This would be followed by agility development in third place, as this seems to have the lowest impact on CA compared to the other two Triple-A SC dimensions.

5.4 Limitations and further research

However, this study is not without its limitations, although these can also be used as a source for further research. First, the data refer to three specific industries (electronics, machinery and automotive components) and a sample of emerging and developed countries. The results should, therefore, be analyzed in this context and cannot be extrapolated to other sectors or types of countries. As the proposed model is hypothesis based and needs to be supported with other samples, it would be interesting to undertake future analyses to further examine the topic by considering other countries and production sectors. This could also provide new evidence on the two hypotheses that are not supported in our research. Finally, one further limitation is shared with the majority of studies undertaken in the area: the cross-sectional analysis used does not allow change and reactions to change in practice to be observed. Consequently, despite the results obtained in the predict analysis being a hopeful sign, it has not been possible to test the effects of the Triple-A SC on obtaining a "sustainable CA", as new data are required to enable a longitudinal study. Due to the mentioned lack of data to analyze CA sustainability, this research focuses on the effects of the Triple-A SC on CA as, in any case, a CA must first be obtained before it can be maintained and sustained in the future. A longitudinal analysis would allow the evolution of the variables to be analyzed and so enable the evolution of the levels of the variables and the impact on CA to be studied. This would determine whether it is really the Triple-A SC firms that are attaining sustainable CAs, as Lee

(2004) states. It is to be hoped that the database of the next round of the HPM project will make this further research possible.

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Appendix 1

Code	Variables/Dimensions/Items
SC-Ag	*SC AGILITY*
SC-Ag1	Short-term sensitivity to market
Agil11	The following applications communicate in real time: Supply chain applications with internal applications in our organization (such as enterprise resource planning)
Agil12	The following applications communicate in real time: Customer relationship applications with internal applications in our company
SC-Ag2	*Volume flexibility*
Agil21	Our customers choose us because we deliver flexibly for their needs
Agil22	Our company strives to shorten supplier lead time in order to prevent inventory and stockouts
Agil23	Flexibility in response to requests for changes is a characteristic of our relationships with our key suppliers
SC-Ag3	*Variety flexibility*
Agil31	We can add product variety without sacrificing quality
Agil32	We can easily add significant product variety without increasing cost
Agil33	Our capability for responding quickly to customization requirements is very high
SC-Ad	*SC ADAPTABILITY*
SC-Ad1	*Organizational design of the SC*
Adapt11	Our production system is designed to accommodate changes in demand volume
Adapt12	Our production system is designed to accommodate changes in the production mix
SC-Ad2	*Use of technology*
Adapt21	We have a good understanding of where our production technology stands in terms of technology life cycles
Adapt22	Our plant stays on the leading edge of new technology in our industry
SC-Ad3	*Medium- and long-term market knowledge*
Adapt31	We monitor economies around the world to detect potential new markets
Adapt32	We are concerned about the needs of both our immediate customers and our end consumers
Adapt33	We monitor economies around the world to find potential new suppliers
Adapt34	We have a very good understanding of our suppliers' distribution processes
SC–Al	*ALIGNMENT*
SC–Al1	*Incentive alignment*
Align11	Our top managers repeatedly tell us that sharing supply chain risks and rewards with our customers is critical to our plant's success
Align12	Our top managers repeatedly tell us that sharing supply chain risks and rewards with our suppliers is critical to our plant's success
Align13	Our supply chain members have clearly defined goals in our supply chain
SC–Al2B1	*Information alignment*
Align21	We emphasize openness of communication in collaboration with our customers
Align22	We emphasize openness of communication in collaboration with our suppliers
Align24	We use unambiguous language and communication with our supply chain partners
SC–Al3	*Process alignment*
Align31	Cooperating with our customers is beneficial to us
Align32	Cooperating with our suppliers is beneficial to us
Align33	Our supply chain partners understand our manufacturing capabilities
CA	*COMPETITIVE ADVANTAGE*
	Please, rate your plant compared to its competitors in the same industry
Cost-CA	*Cost CA*
GLOBLX01	Unit cost of manufacturing
Quality-CA	*Quality CA*
GLOBLX02	Conformance to product specifications
GLOBLX10	Product capability and performance

Table A1.
Triple-A SC variables, dimensions and items

(*continued*) AQ: 14

Code	Variables/Dimensions/Items
Delivery-CA	*Delivery CA*
GLOBLX03	On-time delivery performance
GLOBLX04	Fast delivery
GLOBLX08	Cycle time (from raw materials to delivery)
Flexibility-CA	*Flexibility CA*
GLOBLX05	Flexibility to change product mix
GLOBLX06	Flexibility to change volume

Table A1.

Appendix 2

Table A2.
Lower order and higher order constructs' measurement model

1st stage

Item codes (See Appendix 1)	Original sample (O) weights	Standard deviation (ST DEV)	p-values	Weights LCI 95%	Weights UCI 95%	Original sample (O) loadings	Standard deviation (ST DEV)	p-values	Loadings LCI 95%	Loadings UCI 95%
Adapt11- > SCAd1	0.494	0.159	0.002	0.182	0.805	0.743	0.130	0.000	0.487	0.998
Adapt12- > SCAd1	0.714	0.138	0.000	0.444	0.984	0.886	0.081	0.000	0.727	1.045
Adapt21- > SCAd2	0.562	0.099	0.000	0.364	0.76	0.847	0.057	0.000	0.734	0.96
Adapt22- > SCAd2	0.602	0.097	0.000	0.408	0.796	0.868	0.055	0.000	0.759	0.977
Adapt31- > SCAd3	0.408	0.096	0.000	0.219	0.597	0.708	0.099	0.000	0.514	0.903
Adapt32- > SCAd3	0.389	0.094	0.000	0.204	0.574	0.647	0.103	0.000	0.445	0.848
Adapt33- > SCAd3	0.337	0.097	0.001	0.146	0.527	0.582	0.103	0.000	0.38	0.784
Adapt34- > SCAd3	0.453	0.122	0.000	0.214	0.693	0.579	0.118	0.000	0.347	0.811
Agil11- > SCAg1	0.32	0.232	0.168	−0.14	0.774	0.74	0.157	0.000	0.432	1.049
Agil12- > SCAg1	0.792	0.194	0.000	0.411	1.173	0.962	0.101	0.000	0.765	1.16
Agil21- > SCAg2	0.546	0.170	0.001	0.213	0.879	0.629	0.174	0.000	0.286	0.972
Agil22- > SCAg2	0.457	0.135	0.001	0.191	0.722	0.692	0.128	0.000	0.44	0.943
Agil23- > SCAg2	0.487	0.153	0.002	0.186	0.787	0.692	0.153	0.000	0.393	0.991
Agil31- > SCAg3	0.44	0.096	0.000	0.252	0.628	0.729	0.080	0.000	0.571	0.887
Agil32- > SCAg3	0.363	0.108	0.001	0.152	0.575	0.699	0.095	0.000	0.513	0.885
Agil33- > SCAg3	0.512	0.080	0.000	0.354	0.669	0.829	0.047	0.000	0.737	0.922
Align11- > SCAl1	0.423	0.137	0.002	0.154	0.691	0.636	0.125	0.000	0.391	0.881
Align12- > SCAl1	0.482	0.102	0.000	0.28	0.683	0.763	0.083	0.000	0.6	0.926
Align13- > SCAl1	0.486	0.101	0.000	0.287	0.684	0.745	0.086	0.000	0.576	0.915
Align21- > SCAl2	0.546	0.131	0.000	0.286	0.806	0.73	0.109	0.000	0.513	0.948
Align22- > SCAl2	0.386	0.102	0.000	0.183	0.588	0.729	0.083	0.000	0.566	0.892
Align24- > SCAl2	0.431	0.109	0.000	0.215	0.647	0.733	0.093	0.000	0.551	0.916
Align31- > SCAl3	0.628	0.154	0.000	0.326	0.929	0.764	0.126	0.000	0.517	1.01
Align32- > SCAl3	0.494	0.149	0.001	0.202	0.786	0.731	0.139	0.000	0.46	1.003
Align33- > SCAl3	0.322	0.182	0.076	−0.03	0.679	0.495	0.184	0.007	0.133	0.855
GLOBLX01 <- Cost CA	Single item	Single item	Single item	Single item	Single item	Single item	Single item	Single item	Single item	Single item
GLOBLX03 <- Delivery CA	0.559	0.073	0.000	0.415	0.704	0.871	0.039	0.000	0.792	0.949

(continued)

Table A2.

1st stage

Item codes (See Appendix 1)	Original sample (O) weights	Standard deviation (ST DEV)	*p*-values	Weights LCI 95%	Weights UCI 95%	Original sample (O) loadings	Standard deviation (ST DEV)	*p*-values	Loadings LCI 95%	Loadings UCI 95%
GLOBLX04 <- Delivery CA	0.368	0.052	0.000	0.264	0.472	0.804	0.043	0.000	0.719	0.889
GLOBLX08 <- Delivery CA	0.448	0.040	0.000	0.369	0.528	0.882	0.020	0.000	0.843	0.921
GLOBLX05 <- Flexibility CA	0.626	0.047	0.000	0.534	0.718	0.922	0.016	0.000	0.89	0.954
GLOBLX06 <- Flexibility CA	0.488	0.044	0.000	0.402	0.573	0.867	0.032	0.000	0.805	0.929
GLOBLX02 <- Quality CA	0.383	0.055	0.000	0.274	0.493	0.804	0.040	0.000	0.726	0.882
GLOBLX10 <- Quality CA	0.581	0.073	0.000	0.437	0.726	0.881	0.038	0.000	0.807	0.956

2nd stage

Item codes (See Appendix 1)	Original sample (O) weights	Standard deviation (ST DEV)	*p*-values	Weights LCI 95%	Weights UCI 95%	Original sample (O) loadings	Standard deviation (ST DEV)	*p*-values	Loadings LCI 95%	Loadings UCI 95%
Cost CA - > CA	0.286	0.091	0.002	0.108	0.464	0.609	0.092	0.000	0.428	0.791
Delivery CA - > CA	0.412	0.037	0.000	0.338	0.485	0.856	0.025	0.000	0.807	0.905
Flexibility CA - > CA	0.368	0.052	0.000	0.265	0.471	0.792	0.043	0.000	0.707	0.877
Quality CA - > CA	0.278	0.063	0.000	0.154	0.401	0.65	0.074	0.000	0.505	0.796
SCAd1 - > SC-Ad–LVS	0.423	0.077	0.000	0.273	0.574	0.732	0.065	0.000	0.604	0.86

(*continued*)

Table A2.

2nd stage Item codes (See Appendix 1)	Original sample (O) weights	Standard deviation (ST DEV)	*p*-values	Weights LCI 95%	Weights UCI 95%	Original sample (O) loadings	Standard deviation (ST DEV)	*p*-values	Loadings LCI 95%	Loadings UCI 95%
SCAd2 - > SC-Ad–LVS	0.403	0.064	0.000	0.276	0.53	0.741	0.056	0.000	0.629	0.852
SCAd3 - > SC-Ad–LVS	0.537	0.081	0.000	0.379	0.696	0.727	0.073	0.000	0.584	0.87
SCAg1 - > SC-Ag–LVS	0.18	0.155	0.247	−0.13	0.487	0.381	0.168	0.025	0.049	0.714
SCAg2 - > SC-Ag–LVS	0.587	0.103	0.000	0.384	0.79	0.757	0.086	0.000	0.589	0.925
SCAg3 - > SC-Ag–LVS	0.614	0.103	0.000	0.413	0.815	0.788	0.076	0.000	0.639	0.937
SCAl1 - > SC-Al–LVS	0.46	0.079	0.000	0.304	0.617	0.759	0.057	0.000	0.647	0.871
SCAl2 - > SC-Al–LVS	0.44	0.075	0.000	0.293	0.588	0.794	0.045	0.000	0.704	0.883
SCAl3 - > SC-Al–LVS	0.381	0.075	0.000	0.234	0.529	0.788	0.058	0.000	0.673	0.903
3rd stage Item codes (See Appendix 1)	**Original sample (O) weights**	**Standard deviation (ST DEV)**	***p*-values**	**Weights LCI 95%**	**Weights UCI 95%**	**Original sample (O) loadings**	**Standard deviation (ST DEV)**	***p*-values**	**Loadings LCI 95%**	**Loadings UCI 95%**
SC-Ad - > Triple-A	0.529	0.177	0.003	0.183	0.876	0.902	0.067	0.000	0.771	1.033
SC-Ag - > Triple-A	0.297	0.179	0.099	−0.06	0.65	0.793	0.090	0.000	0.617	0.97
SC–Al - > Triple-A	0.357	0.158	0.024	0.047	0.668	0.797	0.088	0.000	0.625	0.969

Note(s): Bootstrapping based on $n = 5000$ sub-samples. Multiple imputation overall estimate based on Schafer and Olsen (1998). LCI: Lower confidence interval and UCI: Upper confidence interval form multiple imputation summary

Appendix 3
Figures of models used in Smart PLS (SmartPLS represents composites as circles instead of hexagons that would be our preferred representation for composites)

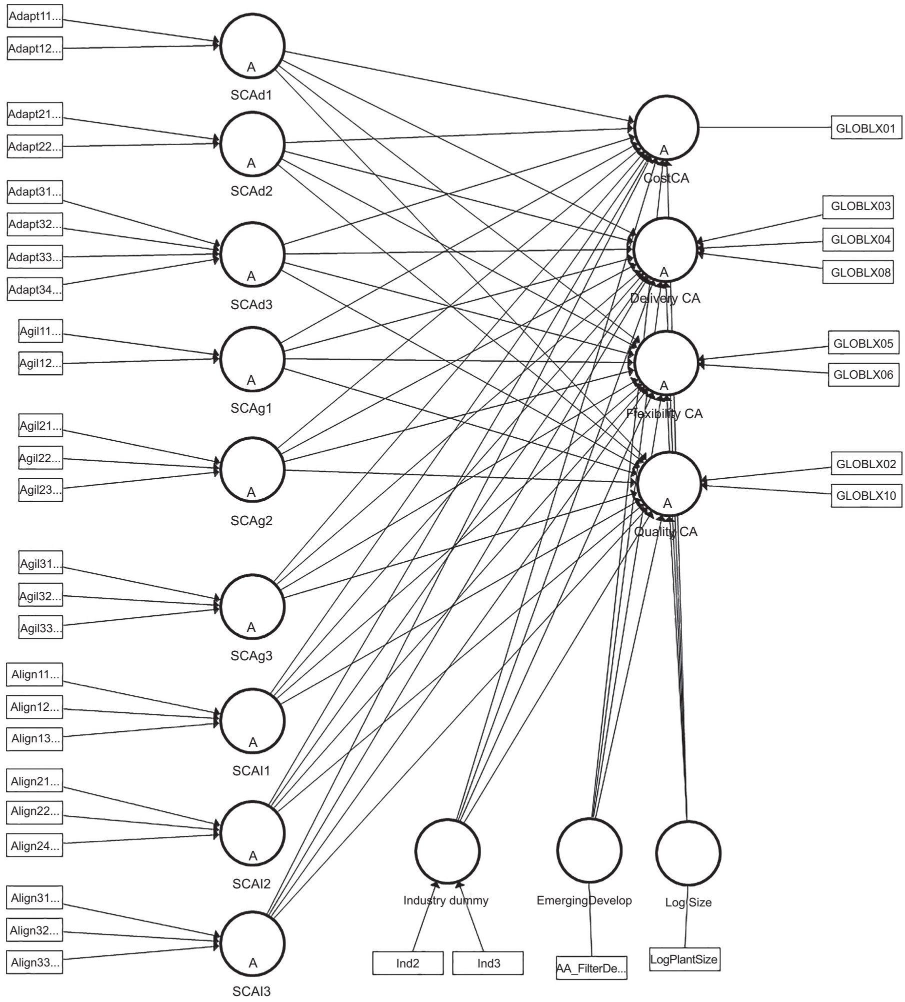

Figure A1.
Model 1 first stage

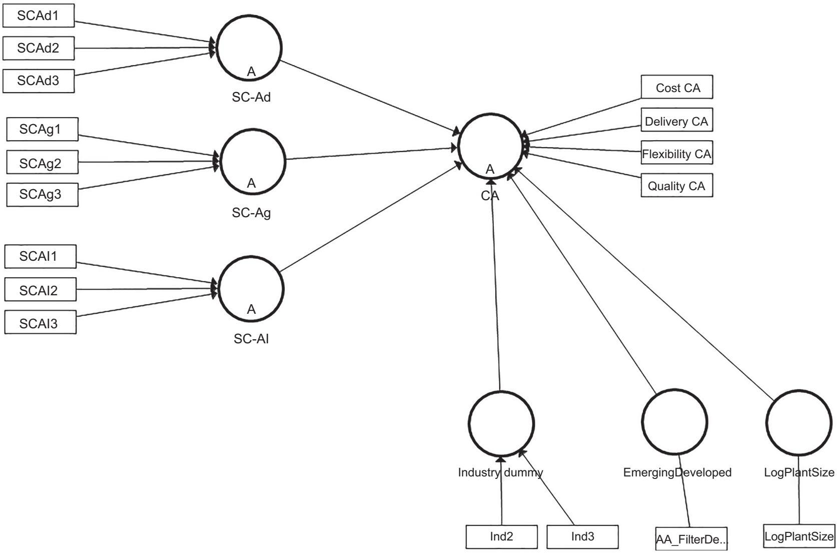

Figure A2.
Model 1 second stage

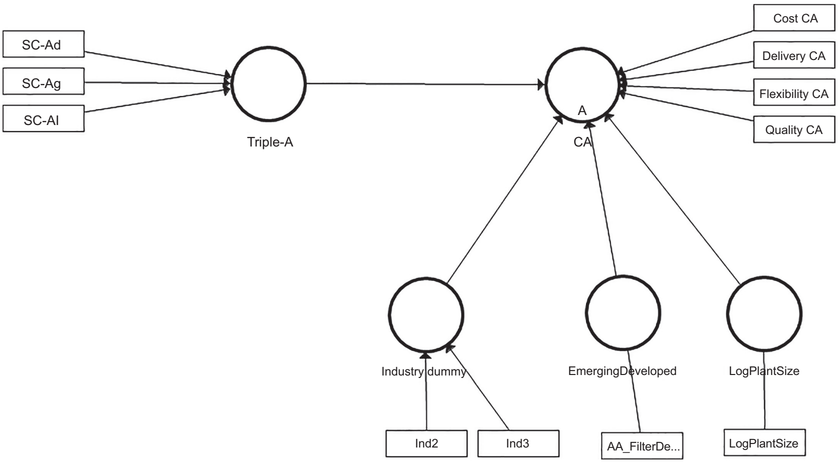

Figure A3.
Model 1 third stage

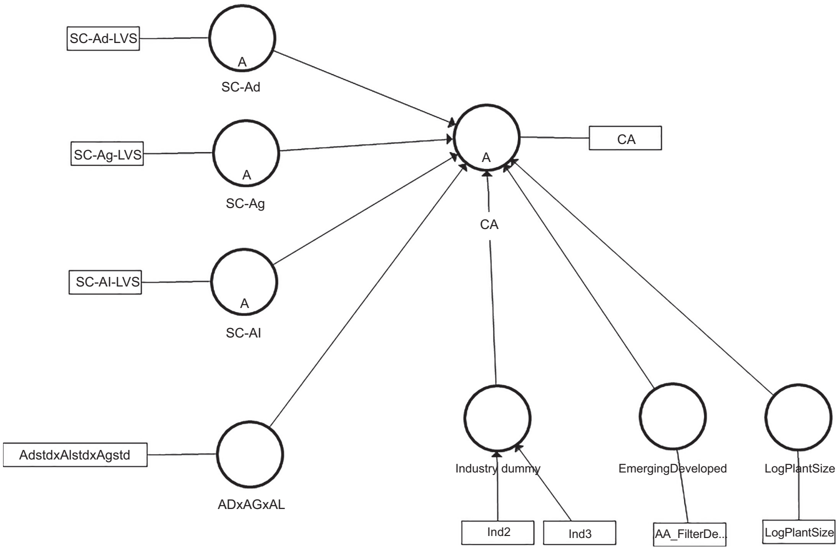

Figure A4.
Model 2 second stage

Appendix 4
Descriptive statistics by sample

	Full sample				Emerging				Developed			
	Min	Max	Mean	Std. dev	Min	Max	Mean	Std. dev	Min	Max	Mean	Std. dev
CA	1.12	5.00	3.75	0.56	1.13	5.00	3.78	0.64	2.47	5.00	3.75	0.47
Triple-A SC	2.64	4.96	3.90	0.39	2.38	4.92	3.92	0.42	2.69	4.82	3.88	0.37
Cost CA	1.00	5.00	3.33	0.97	1.00	5.00	3.60	0.97	1.78	5.00	3.11	0.90
Delivery CA	1.00	5.00	3.76	0.70	1.00	5.00	3.82	0.76	2.00	5.00	3.71	0.64
Flexibility CA	1.00	5.00	3.85	0.75	1.00	5.00	3.77	0.84	1.95	5.00	3.90	0.66
Quality CA	1.49	5.00	3.93	0.66	1.49	5.00	3.87	0.73	2.00	5.00	3.98	0.59
SC-Ad	2.14	5.00	3.78	0.49	2.14	5.00	3.87	0.51	2.64	4.88	3.71	0.46
SC-Ag	1.72	4.92	3.85	0.46	1.72	4.92	3.86	0.48	2.49	4.81	3.84	0.44
SC-Al	2.77	5.00	4.09	0.42	2.78	5.00	4.14	0.45	2.84	5.00	4.04	0.40

Table A3.
Descriptive statistics for 2nd and 3rd stage constructs

Full sample	Cost CA	Delivery CA	Flexibility CA	Quality CA	SC-Ad–LVS	SC-Ag–LVS	SC-Al–LVS
Cost CA	1.000	0.361	0.293	0.240	0.265	0.216	0.216
Delivery CA	0.361	1.000	0.597	0.436	0.324	0.293	0.294
Flexibility CA	0.293	0.597	1.000	0.338	0.283	0.285	0.223
Quality CA	0.240	0.436	0.338	1.000	0.214	0.145	0.233
SC-Ad	0.265	0.324	0.283	0.214	1.000	0.597	0.548
SC-Ag	0.216	0.293	0.285	0.145	0.597	1.000	0.505
SC–Al	0.216	0.294	0.223	0.233	0.548	0.505	1.000
Emerging sample	**Cost CA**	**Delivery CA**	**Flexibility CA**	**Quality CA**	**SC-Ad–LVS**	**SC-Ag–LVS**	**SC-Al–LVS**
Cost CA	1.000	0.435	0.421	0.407	0.343	0.372	0.278
Delivery CA	0.435	1.000	0.672	0.519	0.388	0.399	0.343
Flexibility CA	0.421	0.672	1.000	0.533	0.296	0.334	0.250
Quality CA	0.407	0.519	0.533	1.000	0.378	0.327	0.285
SC-Ad	0.343	0.388	0.296	0.378	1.000	0.657	0.606
SC-Ag	0.372	0.399	0.334	0.327	0.657	1.000	0.528
SC–Al	0.278	0.343	0.250	0.285	0.606	0.528	1.000
Developed sample	**Cost CA**	**Delivery CA**	**Flexibility CA**	**Quality CA**	**SC-Ad–LVS**	**SC-Ag–LVS**	**SC-Al–LVS**
Cost CA	1.000	0.276	0.227	0.129	0.130	0.071	0.111
Delivery CA	0.276	1.000	0.530	0.359	0.243	0.183	0.230
Flexibility CA	0.227	0.530	1.000	0.084	0.313	0.242	0.221
Quality CA	0.129	0.359	0.084	1.000	0.076	−0.040	0.202
SC-Ad	0.130	0.243	0.313	0.076	1.000	0.548	0.474
SC-Ag	0.071	0.183	0.242	−0.040	0.548	1.000	0.483
SC–Al	0.111	0.230	0.221	0.202	0.474	0.483	1.000

Table A4.
Correlations between 2nd stage constructs

Appendix 5

PLS				LM				
MI 1	RMSE	MAE	Q^2_predict	RMSE	MAE	Q^2_predict	Dif MAE (PLS–LM)	Dif RMSE (PLS–LM)
GLOBLX01	0.938	0.767	0.087	0.964	0.778	0.036	−0.011	−0.026
GLOBLX08	0.868	0.687	0.023	0.898	0.704	−0.046	−0.017	−0.03
GLOBLX04	0.832	0.654	0.034	0.870	0.678	−0.058	−0.024	−0.038
GLOBLX03	0.804	0.601	0.006	0.839	0.631	−0.081	−0.030	−0.035
GLOBLX05	0.801	0.627	0.041	0.820	0.647	−0.004	−0.020	−0.019
GLOBLX06	0.859	0.672	−0.001	0.900	0.707	−0.097	−0.035	−0.041
GLOBLX10	0.756	0.578	0.006	0.789	0.622	−0.083	−0.043	−0.033
GLOBLX02	0.764	0.571	−0.014	0.782	0.604	−0.063	−0.033	−0.018
MI 2	RMSE	MAE	Q^2_predict	RMSE	MAE	Q^2_predict	Dif MAE (PLS–LM)	Dif RMSE (PLS–LM)
GLOBLX01	0.927	0.756	0.062	0.954	0.770	0.006	−0.014	−0.027
GLOBLX08	0.863	0.688	0.015	0.891	0.692	−0.050	−0.004	−0.028
GLOBLX04	0.818	0.629	0.057	0.853	0.657	−0.026	−0.028	−0.035
GLOBLX03	0.816	0.610	0.011	0.849	0.647	−0.070	−0.037	−0.033
GLOBLX05	0.782	0.609	0.079	0.782	0.624	0.079	−0.015	0
GLOBLX06	0.839	0.653	0.013	0.879	0.687	−0.083	−0.034	−0.04
GLOBLX10	0.762	0.579	0.012	0.793	0.617	−0.070	−0.038	−0.031
GLOBLX02	0.733	0.541	0.014	0.752	0.577	−0.039	−0.036	−0.019
MI 3	RMSE	MAE	Q^2_predict	RMSE	MAE	Q^2_predict	Dif MAE (PLS–LM)	Dif RMSE (PLS–LM)
GLOBLX01	0.929	0.763	0.084	0.962	0.789	0.018	−0.026	−0.033
GLOBLX08	0.845	0.660	0.044	0.863	0.658	0.003	0.002	−0.018
GLOBLX04	0.826	0.641	0.053	0.867	0.670	−0.044	−0.029	−0.041
GLOBLX03	0.812	0.602	0.013	0.845	0.643	−0.069	−0.042	−0.033
GLOBLX05	0.773	0.598	0.076	0.795	0.629	0.023	−0.031	−0.022
GLOBLX06	0.839	0.656	0.016	0.885	0.694	−0.094	−0.038	−0.046
GLOBLX10	0.746	0.568	0.021	0.783	0.610	−0.077	−0.042	−0.037
GLOBLX02	0.750	0.557	0.008	0.767	0.593	−0.036	−0.036	−0.017
MI 4	RMSE	MAE	Q^2_predict	RMSE	MAE	Q^2_predict	Dif MAE (PLS–LM)	Dif RMSE (PLS–LM)
GLOBLX01	0.915	0.750	0.094	0.948	0.769	0.027	−0.019	−0.033
GLOBLX08	0.855	0.679	0.027	0.883	0.689	−0.038	−0.010	−0.028
GLOBLX04	0.826	0.644	0.065	0.867	0.674	−0.029	−0.030	−0.041
GLOBLX03	0.805	0.598	0.033	0.832	0.625	−0.033	−0.027	−0.027
GLOBLX05	0.802	0.627	0.075	0.821	0.650	0.033	−0.022	−0.019
GLOBLX06	0.857	0.668	0.018	0.899	0.706	−0.081	−0.038	−0.042
GLOBLX10	0.753	0.570	0.020	0.787	0.614	−0.068	−0.044	−0.034
GLOBLX02	0.748	0.560	0.017	0.772	0.595	−0.045	−0.036	−0.024
MI 5	RMSE	MAE	Q^2_predict	RMSE	MAE	Q^2_predict	Dif MAE (PLS–LM)	Dif RMSE (PLS–LM)
GLOBLX01	0.927	0.762	0.093	0.957	0.776	0.033	−0.014	−0.03

(*continued*)

Table A5.
PLS predict assessment for full sample of each multiple imputation dataset (MI1–MI5), based on 1st stage LOCs. Indicator prediction summary

MI 5	RMSE	MAE	Q^2_predict	RMSE	MAE	Q^2_predict	Dif MAE (PLS–LM)	Dif RMSE (PLS–LM)
GLOBLX08	0.867	0.684	0.017	0.897	0.698	−0.053	−0.014	−0.03
GLOBLX04	0.830	0.644	0.033	0.867	0.671	−0.057	−0.027	−0.037
GLOBLX03	0.802	0.595	0.020	0.838	0.632	−0.068	−0.037	−0.036
GLOBLX05	0.790	0.618	0.071	0.799	0.640	0.052	−0.022	−0.009
GLOBLX06	0.866	0.675	0.005	0.906	0.712	−0.089	−0.037	−0.04
GLOBLX10	0.753	0.572	0.015	0.785	0.614	−0.071	−0.042	−0.032
GLOBLX02	0.737	0.556	0.023	0.756	0.590	−0.029	−0.035	−0.019

Note(s): PLS: Partial least squares path model; LM: Linear regression model; RMSE: Root mean squared error; MAE: Mean absolute error. Dif MAE: PLSMAE–LMMAE. Dif RMSE: PLSRMSE–LMRMSE

Table A5.