Supply Chain Quality Integration in Manufacturing Firms: Examining the Role of Intellectual Capital and Absorptive Capacity In a Developing Economy

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Abstract

This paper explores the direct relationship between intellectual capital and supply chain quality integration (SCQI). Furthermore, the indirect effect of intellectual capital through absorptive capacity is also explored. Based on the resource-based view, dynamic capabilities perspective and relational view, a theoretical model developed from the extant literature was empirically validated through a cross-sectional survey of 101 manufacturing firms in Uganda. The data were analysed by using correlations and regressions. The findings revealed that intellectual capital has a positive and significant effect on absorptive capacity – absorptive capacity also positively and significantly influences SCQI. Moreover, intellectual capital significantly influences SCQI both directly and indirectly through the partial mediation of absorptive capacity. The fundamental novelty of this article is contribution to the limited empirical studies on SCQI and its antecedents by incorporating the three components of intellectual capital besides unveiling empirical evidence confirming the partial mediating role of absorptive capacity in the intellectual capital- SCQI relationship in manufacturing firms in a developing country context.

Keywords: Supply chain quality integration, Intellectual capital, Absorptive capacity, Developing economy

Introduction

In the recent past, the manufacturing supply chains world-wide have witnessed a surge in product recalls, especially exacerbated by quality scandals that have seriously tainted firms' reputations, brands and entire operations (Tse *et al.*, 2011; Soltani *et al.*, 2011; Lawrence & Kopcha, 2017; Zhang *et al.*, 2022). For example, Toyota's recalls of millions of its vehicles due to quality problems, despite its reputation as a top-notch quality focused manufacturer reflects the increasing vulnerability of manufacturing firms to high profile quality threats (Li *et al.*, 2011; Zhang *et al.*, 2022). Due to the contemporary firm interconnectedness and interdependences, it is not surprising that quality risk easily propagates through supply networks. Such proliferation underlines the need to adopt a systemic approach to mitigate the supply chain quality risk through integrating effective quality risk management practices within the supply chain (Tse *et al.*, 2011; Zhang *et al.*, 2022). This implies that the traditional firm-driven quality management practices should extend to the supply network level to leverage from

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the synergies gained from downstream and upstream inter-firm relationships. This alludes to the notion of supply chain quality management (Foster 2008; Soltani *et al.,* 2011; Soares et al., 2017; Teoman &Ulengin, 2018; Zhang *et al.,* 2022).

Indeed, the international quality standards such as ISO 9000 series are set to help companies develop and maintain supply chain processes that meet certain performance metrics through quality management principles that depict both downstream and upstream supply chain orientation (ISO 9000:2015). The recognition of critical aspects such as inter-firm relationships, visibility, alignment, independences and synergies in the quest for quality improvement suggests that quality management should be implemented through supply chain integration (Huo *et al.,* 2014; Zhang *et al.,* 2019; Yu & Huo, 2018; Zhang *et al.,* 2022). This practice coined as supply chain quality integration (SCQI) (Huo *et al.,* 2014; Soares *et al.,* 2017; Teoman & Ulengin, 2018; Yu & Huo, 2018) ensures the implementation of consistent quality throughout the entire supply network (Soares *et al.,* 2017; Zhang *et al.,* 2019). However, it is reported that firms have experienced challenges in the implementation of supply chain quality management due to difficulties in building integration within their supply chains (Sarrico & Rosa, 2016; Zhang *et al.,* 2022).

The notion of SCQI has attracted considerable interest in the recent years but there is still limited understanding of its antecedents (Yu & Huo, 2018; Alkalha *et al.,* 2019). More generally, previous studies indicate that there is still limited research on supply chain quality management (Soares *et al.,* 2017). Furthermore, studies investigating supply chain integration from the quality management perspective are still rare (Huo *et al.,* 2014). Understanding the enablers of SCQI is important since there are testimonies of successful stories from manufacturing firms such as Dell that have benefited from its implementation (Yu & Huo, 2018). Furthermore, SCQI has been associated with positive outcomes such as enhancing quality performance (Huo *et al.,* 2014; Soares *et al.,* 2017; Huo *et al.,* 2019; Zhang *et al.,* 2022), competitive advantage (Soares *et al.,* 2017; Teoman & Ulengin, 2018; Zhang *et al.,* 2019), improved supply chain and firm performance (Attia, 2016; Zhong *et al.,* 2016; Zhang *et al.,* 2019), green supply chain management and environmental performance (Yu *et al.,* 2019), and enhancing firm's ambidexterity capability (Escorcia-Caballero *et al.,* 2022).

The manufacturing sector in Uganda is dominated by SMEs, which have evidently experienced supply chain quality problems (Eyaa & Ntayi, 2010; Ggoobi *et al.,* 2017). Besides this, the Ugandan Vision 2040 acknowledges the need to overcome the hurdle of poor quality products in the manufacturing sector in order to improve competitiveness and achieve socio-economic transformation. It is reported that stiff competition from better quality and cheaper imported goods pose a threat to Ugandan manufacturing firms (African Development Bank Group, 2014). The Uganda National Bureau of Standards (UNBS) recently destroyed 232 metric tonnes of goods worth Shs2.5 billion that had been confiscated in the Financial Year 2019/2020 due to deficient quality (Daily Monitor, Tuesday, July 28th 2020). Similarly, in the year 2018, the UNBS discovered that Uganda's locally manufactured toilet papers were of poor quality, potentially posing health risks (The East-African, Friday, May 11th, 2018). Furthermore, the Uganda National Drug Authority accused Ugandan manufacturers of supplying poor quality medical products with associated financial implications (Daily Monitor, May 25th, 2021).

It has been hitherto noted that research on the enablers of SCQI is still scarce (Yu & Huo, 2018; Alkalha et al., 2019). From the extant literature, the few available studies include Huo *et al.* (2014) focusing on competitive hostility and organisational-wide approach, Alkalha *et al.* (2019) on absorptive capacity, Yu & Huo (2018) on relational capital & Zhang *et al.* (2019) on mass customisation, and product modularity. Distinctive from the previous research, this study investigates intellectual capital and absorptive capacity as potential antecedents of SCQI, and assesses the mediating effect of absorptive capacity in the intellectual capital-SCQI relationship. It is generally understood that the construct of intellectual capital is composed of human, structural and social dimensions (Subramanian and van de Vrande, 2019). Hence, this study goes beyond prior studies (e.g. Yu & Huo, 2018), which focussed only on relational capital, but it is emphasised here that the three intellectual capital dimensions should be considered holistically as they complement each other in determining positive outcomes (Gürlek, 2021). Alkalha *et al.* (2019) found that absorptive capacity helps in facilitating SCQI practices. Absorptive capacity necessary to yield supply chain outcomes is composed of knowledge acquisition, knowledge dissemination and knowledge usage (Ambulkar *et al.,* 2016). Furthermore, recent empirical studies have suggested that there is a positive relationship between facets of intellectual capital and absorptive capacity (Engelman *et al.,* 2017; Mahmood & Mubarik, 2020; Gürlek, 2021).

In summary and hinging on the foregoing discourse, this study intends to address the following research gaps identified in the extant literature: Generally, there is need for more research on supply chain quality management (Soares et al., 2017), and particularly on SCQI (Huo et al., 2014). Second and more specifically, there is need for more research on the antecedents of SCQI (Yu & Huo, 2018; Alkalha et al., 2019). Third, besides the emphasis by previous scholars that the three dimensions of intellectual capital should be considered holistically due to their complementary nature (Gürlek, 2021), the available literature on SCQI indicates that studies using all the three dimensions are scant (e.g. Yu & Huo 2018). Fourth, although the available literature suggests a link between intellectual capital, absorptive capacity and SCQI, it is noticeable that studies establishing the mediating role of absorptive capacity in the intellectual capital-SCQI relationship are hardly traceable. Investigating the mediating role is important in understanding the mechanism through which intellectual capital builds SCQI. Therefore, to address the aforementioned gaps, this study seeks to answer the following two related research questions through a survey of 101 manufacturing firms in Uganda:
RQI: What is the relationship between intellectual capital and SCQI?
RQ2: What is the mediating role of absorptive capacity in the intellectual capital-SCQI relationship?

Theoretical review and research hypotheses

The resource-based view (RBV), dynamic capabilities and relational view provide theoretical underpinnings for this study. The RBV posits that a firm's internal resources, which should be valuable, imitable, rare and difficult to substitute, are a source of its competitive advantage (Wernerfelt, 1984; Barney, 2001). Within the the RBV, organisational resources include skills, technologies, capabilities and infrastructure (Wang *et al.,* 2020). The contemporary information age suggests that organisational success depends more on intangible resources than tangible ones (Ahmed *et al.,* 2020; Gürlek, 2021). Such intangible resources may include intellectual capital elements such as employee skills, customer relationships, social networks and

intellectual property (Bontis *et al.,* 2015). Ahmed *et al.* (2020) observed that human capital is capable of acquiring all of the four RBV characteristics of intangible resources. Structural capital can be in the form of stock of knowledge owned by the firm, which includes aspects such as corporate culture, information technology, and explicit knowledge, process optimisation and innovation (Kamukama &Tumwine, 2017). Furthermore, Yu & Huo (2018) stressed that relational capital is a critical resource that helps to build unique capability for creating and maintaining sustainable competitive advantages in firms and their supply chains.

Gürlek (2021) argues that intellectual capital and knowledge can be combined to create competitive advantage in firms. The RBV also suggests that internal capabilities can enhance an organisation's ability to strategically absorb and exploit external resources. Huo *et al.* (2014) emphasised that internal quality integration is a core strategic resource required for quality improvement. In order to cater for the changing and dynamic market environment (Eisenhardt & Martin, 2000), the RBV has been extended to the dynamic capabilities perspective for the reason that a firm's ability to integrate, build and reconfigure internal and external resources in addressing rapidly changing environment is necessary in order to achieve sustainable competitive advantage (Teece *et al.,* 1997). Alkalha *et al.* (2019) argued that absorptive capacity has a role in SCQI, which leads to dynamic capabilities through creating, extending and modifying companies' resources. Alkalha *et al.* (2019) further reiterated that SCQI is a remedy for the limited resources available for firms, which can be expanded through supply chain integration.

The relational view, which is built on the foundation of the RBV is also relevant in this study to show that a firm's competitive advantage arises from inter-firm partnership and cooperation (Dyer & Singh, 1998; Chen *et al.,* 2004). The relational view suggests that firms' partnering with other firms allows them to access inimitable resources and skills that are not available within the firm (Srivastava *et al.,* 2015). Hence, this explains dimensions such as relational capital resources, which are connected to the firm's external relations with its suppliers, customers and stakeholders (Mahmood & Mubarik, 2020). Absorptive capacity also encompasses knowledge received from external sources such as customers, suppliers or alliance partners (Liu *et al.,* 2013). Thus, the relational view is an important supplement to the RBV in explaining inter-firm linkage phenomena such as SCQI (Chen *et al.,* 2013).

Supply chain quality integration

The issue of quality has become an important competitive weapon for all firms. However, in order to maximise competitive advantage, firms need to integrate their internal quality practices with those of their external partners within their supply chains (Teoman & Ulengin, 2018; Zhang *et al.,* 2022). According to Attia (2016), improving quality is important in enhancing the firm's supply chain performance. Similarly, Zhong et *al.* (2016) found a positive link between supply chain quality management and supply chain performance. Supply chain quality integration (SCQI), involves a focal firm integrating both upstream and downstream for quality improvement (Huo *et al.,* 2019). Borrowing from the notions of supply chain integration and quality management, Huo *et al.* (2014) defined SCQI in terms of operational and strategic collaboration of the firm's internal functions and supply chain partners in order to jointly manage intra-firm and inter-organisational quality-related relationships and other aimed to optimise quality-related performance with minimum costs.

SCQI is composed of internal quality integration, supplier quality integration and customer quality integration (Huo *et al.,* 2014). Whereas internal quality integration focuses on the integrative quality related activities of a firm's internal functions, external quality integration focuses on quality-related processes with upstream and downstream supply chain partners (Yu & Huo, 2018). SCQI is a fundamental component of supply chain quality management (Sarrico & Rosa, 2016) but a knowledge gap still exists regarding its implementation (Alkalha *et al.,* 2019). Researchers (Huo *et al.,* 2014; Zhang *et al.,* 2022; Soares *et al.,* 2017) concluded that SCQI is important for enhancing quality-related performance.

Intellectual capital

The extant literature presents different definitions of intellectual capital (Engelman *et al.,* 2017; Mahmood & Mubarik, 2020). However, many of the scholars seem to agree on three dimensions of intellectual capital i.e. human capital, structural capital and relational capital (Kamukama *et al.,* 2011; Engelman *et al.,* 2017; Subramanian and van de Vrande, 2019; Oliveira *et al.,* 2020; Mahmood & Mubarik 2020; Gürlek 2021; Mubarik *et al.,* 2022). Human capital is composed of the knowledge, skills, and capabilities of an individual within the firm (Mubarik *et al.,* 2018). Structural capital incorporates all non-human knowledge resources, which include organisational processes and structures (Mahmood & Mubarik 2020). Structural capital ranges from tangible to intangible resources such as copyrights, patents, software systems, databases, processes and trademarks, accountability, organisational culture, and trust among employees (Zameer *et al.,* 2022). Structural capital is composed of valuable assets belonging to the company whereas human capital is possessed by employees (Engelman *et al.,* 2017; Gürlek, 2021). Relational capital or social capital is considered as the bond that is formed through organisational relationships with suppliers, customers and other stakeholders that create embedded knowledge within the firm (Engelman *et al.,* 2017; Mahmood & Mubarik 2020). Whereas some researchers have analysed the effects of one or two dimensions of intellectual capital, scholars (e.g. Kamukama *et al.,* 2010; Engelman *et al.,* 2017; Gürlek, 2021) emphasised that all components of intellectual capital complement one another, which makes it logical to analyse their joint rather than individual and separate effects.

Absorptive capacity

Cohen & Levinthal (1990) defined absorptive capacity as the ability to recognise, assimilate and utilise the value in new external information in order to fulfill commercial ends. Zahra and George (2002) added that absorptive capacity involves potential absorptive capacity and realised absorptive capacity that relate to acquisition, absorption, transformation and utilisation of knowledge. In the operations and supply chain research, Rojo *et al.* (2018) operationalised absorptive capacity in terms of acquisition, assimilation, transformation and exploitation of knowledge. Ambulkar *et al.* (2016) considered knowledge acquisition, knowledge dissemination and knowledge usage as the three main dimensions of absorptive capacity. Knowledge acquisition refers to the firm's capacity to recover, identify and acquire external knowledge for the benefit of the organisation (Engelman *et al.,* 2017). Knowledge dissemination is about distributing the acquired knowledge to different members of the firm while knowledge usage is concerned with the utilisation of such knowledge in the firms'processes of making decisions (Ambulkar *et al.,* 2016). Previous studies indicate that the

ability to absorb knowledge is influenced by prior knowledge residing within the firm (Oliveira *et al.*, 2020).

The research gap

Generally, scholars have noted that there is limited research on quality management from the supply chain context (Soares *et al.*, 2017). In the same vein, research on supply chain integration has generally paid less attention to the quality management perspective (Huo *et al.*, 2014). This therefore implies that there is a further need for quality management research that takes an integrative perspective in the supply chain context. This is supported by Huo *et al.* (2014) who observed that empirical research on SCQI is still scarce. Other scholars also stressed that the antecedents of SCQI are less understood (Yu & Huo, 2018; Alkalha *et al.*, 2019). As already mentioned, recent empirical studies have focused on antecedents such as competitive hostility and organisational-wide approach (Huo *et al.*, 2014), absorptive capacity (Alkalha *et al.*, 2019), relational capital (Yu & Huo, 2018), mass customisation and product modularity (Zhang *et al.* 2019). Further, while scholars (e.g. Yu & Huo, 2018) have used a single component of intellectual capital as an antecedent of SCQI, others (e.g. Kamukama *et al.*, 2010; Engelman *et al.*, 2017; Gürlek, 2021) emphasised that studies using intellectual capital should incorporate all the three dimensions (i.e. relational, structural and human capital) because they are complementary. Lastly, whereas scholars (e.g. Alkalha *et al.*, 2019) indicated that absorptive influences SCQI, others argue that such absorptive capacity is facilitated by a certain stock of prior knowledge, which is intellectual capital (Oliveira *et al.*, 2020; Mahmood & Mubarik, 2020; Gürlek, 2021). This therefore suggests that absorptive capacity potentially mediates in the intellectual capital-SCQI relationship. In this study, the theoretical model suggests that both intellectual capital and absorptive capacity are antecedents of SCQI. It is further conjectured that absorptive capacity plays a mediating role in the intellectual capital-SCQI relationship as demonstrated in Figure 1

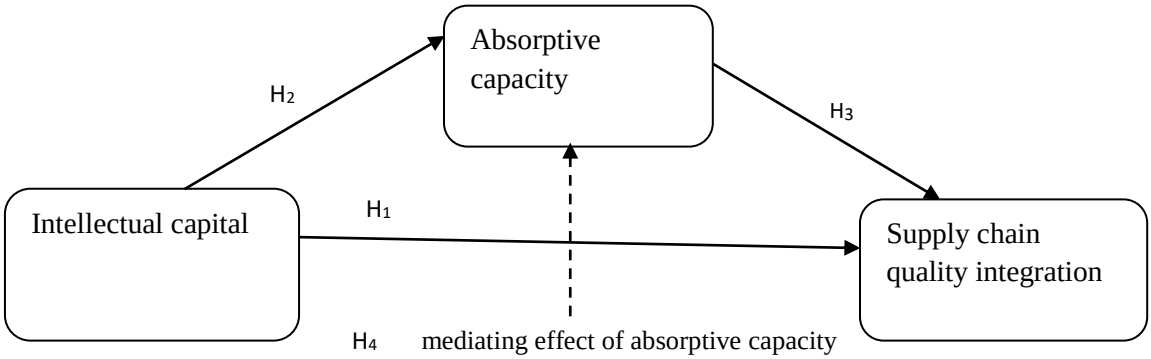


Figure 1: Conceptual model

Research hypotheses

Intellectual capital and supply chain quality integration

Previous studies have established a link between intellectual capital dimensions and supply chain integration. For example, Song and Song (2021) found that human capital has a positive effect on supply chain integration. Shou *et al.* (2018) indicated that both human capital and

relational capital have direct impact on supply chain intelligence integration, whereas structural capital only influences supply chain intelligence integration through relational capital. Ataseven *et al.* (2018) established that intellectual capital is important for supply chain integration in humanitarian organisations. From the available literature, studies linking all the three intellectual capital components to SCQI are limited. However, theoretical and empirical studies have shown that different intellectual capital elements are positively related to SCQI. For example, Yu Huo (2018) investigated the relationship between relational capital and SCQI and found that relational capital elements have positive impacts on supplier, internal and customer quality integration. Teoman Ulengin (2018) concluded that SCQI requires structural and relational capital elements such as the culture of employee involvement in quality improvement activities; involvement and cooperation of all affected departments and the entire staff in design reviews; and top management support for group works and group goals as well as customer focus. Soares *et al.* (2017) considered the facets of relational capital such as communication and information sharing as important prerequisites for optimising quality performance in supply chains. This therefore leads to the following hypothesis:

H1. There is a positive influence of intellectual capital on SCQI.

Intellectual capital and absorptive capacity

Cohen & Levinthal (1990) clarified that the possession of prior knowledge is an important enabler of absorptive capacity. Following this, Oliveira *et al.* (2020) recently argued that intellectual capital enhances absorptive capacity because identifying the value of new knowledge requires a certain stock of knowledge, which is the intellectual capital. Ahmed *et al.* (2020) added that social capital facilitates knowledge acquisition and creation through external and internal sources of information. According to Minbaeva *et al.* (2014), the acquisition of human capital through employee education and training enhances the capability for absorption and utilisation of new knowledge. Gürlek (2021) also argued that human capital in the form of qualified and knowledgeable workforce can help to acquire novel knowledge, integrate, , share, and apply the acquired knowledge to organisational processes.

Ahmed *et al.* (2020) stressed that the main function of social capital is to facilitate the gathering and distribution of knowledge across the firm. In the same vein, Mahmood &Mubarik (2020) indicated that an organisation's intellectual capital can play a fundamental role in innovation and exploitation as well as enhancement of technology absorptive capacity. Similarly, Ahmed *et al.* (2020) claimed that all the three dimensions of intellectual capital can help a firm to interact with external environment as well as to identify, acquire and assimilate the external technology related knowledge.. Soo *et al.* (2017) also emphasised that human capital has a direct relationship to the capability of the firmto absorb and exploit external knowledge. Information technology technical skills are used by the teams at workplaces to translate their potential knowledge into useable knowledge (Bolívar-Ramos *et al.,* 2013). Furthermore, Ahmed *et al.* (2020) found a positive and significant relationship between human capital, organisational capital, social capital, and absorptive capacity. Ahmad &Erçek (2020) also established that intellectual capital is positively related to absorptive capacity. Mubarik *et al.* (2022) revealed a significant influence of all dimensions of intellectual capital on a firm's supply chain learning. Finally, Gürlek (2021) argued that information systems, which are part of structural capital, can

help to develop an organisation's ability to acquire, assimilate, transform and apply knowledge. Hence, the following hypothesis is stated:

H2. There is a positive relationship between intellectual capital and absorptive capacity.

Absorptive capacity and SCQI

The importance of buyer-supplier knowledge integration for enhancing supply chain integration is well acknowledged (Saenz *et al.,* 2014). Yang *et al.* (2013) found that knowledge acquisition and dissemination have significant effects on upstream supply chain integration. According to Alkalha *et al.* (2019), absorptive capacity plays an important role in SCQI because it creates, extends and modifies companies' knowledge resources, which can be utilised for successful quality integration with supply chain partners. Similarly, Lin *et al.* (2013) identified knowledge management as one of the enablers of supply chain quality management. Absorptive capacity helps in ensuring information availability in the firm, and according to Teoman &Ulengin (2018); the availability of information on quality and productivity improves quality performance in the supply chain. This leads to the hypothesis below:

H3. There is a positive influence of absorptive capacity on SCQI.

Intellectual capital, absorptive capacity and SCQI

Absorptive capacity requires a certain stock of prior knowledge, which can be termed as intellectual capital (Oliveira *et al.,* 2020; Mahmood &Mubarik, 2020; Gürlek, 2021). Furthermore, it is argued that firm-level knowledge repositories (intellectual capital) should be used to build knowledge exploration and exploitation capabilities (absorptive capacity) (Ahmad Erçek, 2020), which can facilitate SCQI (Alkalha *et al.,* 2019). Moreover, Ahmed *et al.* (2020) confirmed that some of the elements of absorptive capacity play a positive mediating role in the relationship between the dimensions of intellectual capital and those of business performance – quality can be considered as one of the key business performance indicators. This leads to the hypothesis below:

H4. Absorptive capacity mediates in the relationship between intellectual capital and SCQI

Methodology

Design, population and sample

This study followed a positivist epistemological positioning using a deductive cross-sectional approach to test research hypotheses developed based on the extant literature. The study population comprised of 630 manufacturing firms in Kampala, Wakiso and Mukono districts (Uganda Manufacturers Association, 2019). These areas house the majority of business establishments compared to other regions in Uganda (Uganda Bureau of Statistics report, 2010/2011). Guided by Krejcie Morgan (1970)'s sample determination procedure, a sample of 242 manufacturing firms was selected through simple random sampling. One questionnaire was administered to each firm and in the end; usable data were obtained from 101 firms representing 41.7% response rate. The unit of analysis was a manufacturing firm while that of inquiry included procurement managers, operations managers, quality managers, supply chain managers, firm owners and other employees that were considered knowledgeable in supply chain and quality-related functions. All questionnaires were either hand-delivered or e-mailed to

the respondents and filled questionnaires were collected within a period of three months.

Measurement of variables

The questionnaire items were anchored on a 5-point Likert scale ranging from "1= Strongly Disagree (SD) to 5= Strongly Agree (SA)". The measures for all study variables were adapted from previously validated scales and considered as higher order constructs. SCQI was measured using three dimensions – supplier quality integration, internal quality integration and customer quality integration as adapted from Huo *et al.* (2014) and Zhang *et al.* (2019). Absorptive capacity was measured based on Ambulkar *et al.* (2016) using items capturing three dimensions – knowledge acquisition, knowledge dissemination and knowledge usage, while intellectual capital was measured based on Kamukama (2013), Oliveira *et al.* (2020) and Mubarik *et al.* (2022) using three dimensions – relational capital, human capital and structural capital.

Common methods variance

The procedural remedies were applied as recommended by Podsakoff *et al.* (2003) to control for common method variance. These included adapting previously validated measurement scales to suit the study context, keeping questions short and precise, avoiding double-barrelled questions and limiting the use of negatively worded items. The respondents' anonymity was also ensured to enable them provide unbiased responses.

Tests of factorability, validity and reliability

An exploratory factor analysis (EFA) was carried out through a rotated component matrix to assess convergent and discriminant construct validity by examining item loadings to their constructs. Items whose loadings were less than 0.5 were suppressed. But before conducting EFA, the suitability of data was assessed based on sample size adequacy, which yielded the Keiser – Meyer – Olkin (KMO) (KMO>0.7) and a significant Bartlett's test of sphericity ($p < 0.05$), implying that the data were suitable for factor analysis. The questionnaire was also pre-tested with three academic professionals and two managers from manufacturing firms and the items were adjusted accordingly to suit the study context and to ensure content validity. Furthermore, validity and reliability of the instrument were assessed by using content Validity Index (CVI) and Cronbach Alpha tests respectively, which yielded coefficients satisfying the 0.70 threshold. The Cronbach Alpha coefficients were 0.787, 0.845 and 0.890 for intellectual capital, absorptive capacity and SCQI respectively while the CVI values were 0.867, 0.909 and 0.850 for intellectual capital, absorptive capacity and SCQI respectively. From the factorability of the items, the three components of intellectual capital i.e. structural capital, human capital and relational capital accounted for 68% of the variance, with structural capital (38%) emerging as the dominant component. It was further observed that knowledge acquisition best explains absorptive capacity by 41% of the variance. And together with knowledge usage and knowledge dissemination, the three components account for 68.8% of the variance in absorptive capacity. Lastly, EFA results for SCQI revealed that the three components i.e. customer quality integration, internal quality integration and supplier quality integration account for 75% of the variance in SCQI, with the most outstanding component emerging as customer quality integration, which explained a variance of 38%.

Results

Demographic analysis

With regards to the unit of inquiry, the majority of respondents (57.4%) were aged between 36-45 years, followed by those between 26-35years. The least represented age group was for those aged 46 years and above (12.9%). Regarding the level of education, the majority of the respondents (66.3%) were educated to a Bachelor's degree level while 27.7% held diploma and other qualifications. Finally, in terms of the position held in the firm, 5.9% were owners, 30.7 % were operations managers, 14.9% were procurement managers, 48.5% had other titles but dealing in activities related to supply chain and quality management.

Regarding the unit of analysis, the majority of the studied firms (87.2%) had been in operation for over 5 years and only a few (12.9%) had operated for less than 5 years. The majority (48.5%) employed between 50 and 100 employees, while 24.8% employed between 5 - 50 employees. This implies that the manufacturing industry in Uganda is dominated by SMEs. As for the nature of business, the the majority of manufacturing firms were in Foods & Beverages industry (47.5%) and general agro-processing (23.8%). The dominance of the Foods & Beverages and agro-processing may be attributed to the nature of Ugandan economy, which is agro-based.

Correlation analysis

The Pearson correlation coefficients were assessed to determine the linear associations between the study variables as demonstrated in Table 1. The correlation results revealed a positive and significant relationship between intellectual capital and SCQI ($r = .524^{**}$, $p<.01$). This implies that manufacturing firms that ensure a positive change in their intellectual capital are likely to achieve a positive change in SCQI. The results further indicated a positive and significant relationship between intellectual capital and absorptive capacity ($r= .538^{**}$, $p<.01$). This implies that manufacturing firms that improve on their structural, human and relational capital are likely to achieve increased absorptive capacity in terms of knowledge acquisition, usage and dissemination. Finally, the findings revealed a positive and significant relationship between absorptive capacity and SCQI ($r=.697^{**}$, $p<0.01$). This implies that when manufacturing firms increase their absorptive capacity, they are likely to achieve increased SCQI.

Table 1: Correlation results

	Mean	SD	Intellectual Capital	Absorptive Capacity	Supply Chain Quality Integration
Intellectual Capital	3.990	.916	1.000		
Absorptive Capacity	3.624	.798	.538**	1.000	
Supply Chain Quality Integration	3.970	.842	.524**	.697**	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

Test of homogeneity of variances

Included among the regression prior conditions was the homogeneity of variances. To assess the homogeneity of variances, Levene's test for equality of variances was used. Table 2 shows that there was homogeneity of variances for all the study variables since the variances were not statistically significant ($P>0.05$).

Table 2: Test of homogeneity of variances

	Levene Statistic	df1	df2	Sig.
Intellectual capital	2.306	2	98	.070
Absorptive capacity	2.491	2	98	.064
SCQI	1.234	2	98	.296

Normality test

Normality was assessed by running Kolmogorov-Smirnov test and the Shapiro-Wilk test. We considered the Shapiro-Wilk test to be more appropriate since our sample was 101. From the table 3, SCQI, absorptive capacity and intellectual capital data were normally distributed since the significance value of the Shapiro-Wilk test was greater than 0.05.

Table 3: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCQI	.176	101	.200	.832	101	.627
Iintellectual capital	.166	101	.200	.851	101	.780
Absorptive capacity	.151	101	.200	.892	101	.837

a. Lilliefors Significance Correction

Multicollinearity test

The Variance Inflation Factor (VIF) values were used to assess for the independence of independent variables in the data set. The results in table 4 indicate that the VIF for each independent variable is less than 3, indicating that the independent variables are different from each other in predicting SCQI.

Table 4: Multicollinearity test

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.967	.306		3.164	.002		
Intellectual capital	.193	.076	.210	2.520	.013	.710	1.408
Absorptive capacity	.617	.088	.584	7.020	.000	.710	1.408

a. Dependent Variable: SCQLT

Regression analysis

The hierarchical regression analysis was conducted to assess the predictive effect of intellectual capital and absorptive capacity on SCQI. As can be observed in table 5, the size of business and nature of business were introduced in model 1, which were found to be significant predictor (β=0.451) and non-significant predictor (β=0.069) respectively. In model 2, when intellectual capital was introduced, it was found to be a significant predictor of SCQI (β=.434, p< .01). In

model 3, absorptive capacity was introduced and it emerged as a significant predictor of SCQI (β=0.576, P<0.01). Finally absorptive capacity emerged as the better predictor of SCQI as compared to intellectual capital (β==0.576, P<0.01), and a combination of both intellectual capital and absorptive capacity accounts for 51.6% variance in SCQI (Adjusted R Square =0.516).

Table 5: Regression analysis

	Model-1		**Model-2**		**Model-3**	
	B	β	B	β	B	B
(Constant)	2.538**		1.889**		.909**	
Firm size	.512**	.451**	.216	.191	.132	.117
Nature of Business	.038	.069	.061	.111	.065	.117
Intellectual Capital			.399**	.434**	.158	.172
Absorptive Capacity					.607**	.576**
Dependent Variable: SCQI						
R		.437		.551		.732
R Square		.191		.304		.536
Adjusted R Square		.174		.282		.516
Std. Error of the Estimate		.765		.713		.586
R Square Change		.191		.113		.232
F statistic		11.568		15.747		47.925
Sig.		.000		.000		.000
** *p*< .01, * p <.05						

Mediation assessment

The mediated effects were tested using the regression strategy commencing with testing to ensure that the conditions suggested by Baron & Kenny (1986) were fulfilled. According to Baron & Kenny (1986), mediation occurs if the following four conditions are satisfied. First, variations in the independent variable must significantly account for variance in the supposed mediator. Second, variations in the independent variable must significantly account for variance in the dependent variable. Third, variations in the presumed mediator must significantly account for variance in the dependent variable. Fourth, the effect of the independent variable on the dependent variable should significantly reduce when the mediator is included in the regression equation. From the regression analysis, all of the four conditions suggested by Baron & Kenny (1986) were met as seen in table 6, and this was later presented using Medigraph programme as seen in Table 7 and Figure 2. First, there was a significant direct effect of intellectual capital on absorptive capacity, thereby satisfying the first condition (β = 0.538). Also, a significant direct effect of intellectual capital on SCQI was observed (β = 0.524). Third, a significant direct effect of absorptive capacity on SCQI was also ascertained (β = 0.697). Finally, when controlling for absorptive capacity, the direct effect of intellectual capital on SCQI reduced (from β = 0.524 to β= 0.210) but remained significant. This implies that absorptive capacity partially mediates in the relationship between intellectual capital and SCQI.

Table 6: Mediation testing

	Dependent: Absorptive Capacity			*Dependent:* SCQI			*Dependent:* SCQI			*Dependent:* SCQI		
	B	**SE**	**β**	**B**	**SE**	**β**	**B**	**SE**	**β**	**B**	**SE**	**β**
Constant	1.753	.302		2.048	.322		1.304	.282		.967	.306	
Intellectual Capital	.469	.074	.538**	.482	.079	.524**				.193	.076	.210**
Absorptive Capacity							.736	.076	.697**	.617	.088	.584**

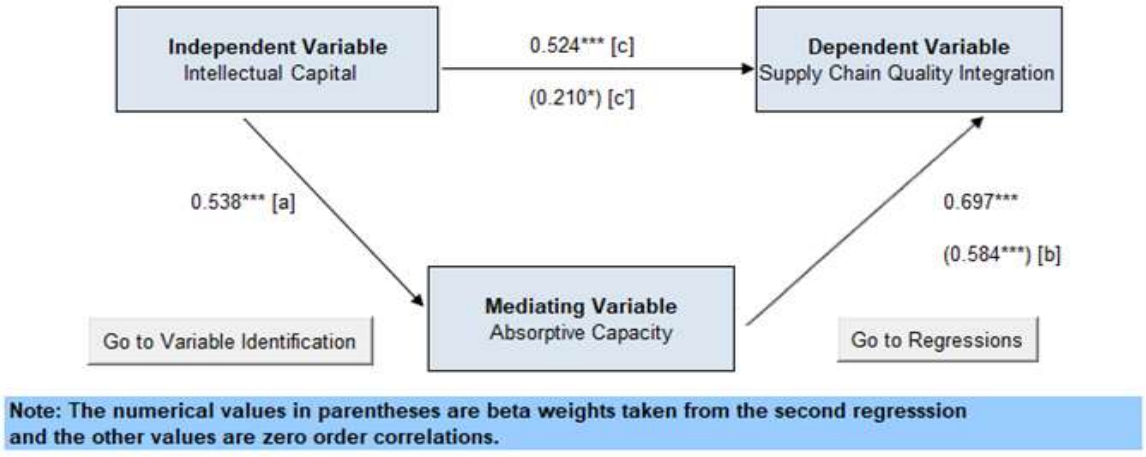
Notes: **Significant at the 0.01 level; B = unstandardized beta coefficients; SE = standard error; β= standardized beta coefficients
Source: Primary data

To ascertain the significance of the mediation effect and nature or type of mediation, testing was done by calculating Sobel's z-value and ratio index using Medigraph program. Table 7 demonstrates the Sobel z-value of 4.702 with p-value of 0.000. It is thus clear that the Sobel z-value is large with a p-value less than 0.05. These results suggest the existence of a significant mediation of absorptive capacity between intellectual capital and SCQI. Furthermore, based on the results of the Medigraph, the indirect effect of intellectual capital on SCQI is 0.314 while the direct effect is 0.210 and the total effect coefficient is 0.524. The indirect to total ratio is 0.599, implying that 59.9% of the effect of intellectual capital on SCQI is mediated through absorptive capacity. Therefore, 40.1% is the direct effect of intellectual capital on SCQI while controlling for the effect of absorptive capacity.

Table 7: Significance and nature of the mediation effect

Type of mediation	Significant		
Sobel z-value	4.702	*p* =	0.000
95% Symmetrical Confidence interval			
Lower	.169		
Higher	.410		
Unstandardized indirect effect			
a*b	.289		
se	.062		
Effective Size measures			
Standardised Coefficients			
Total:	.524		
Direct:	.210		
Indirect:	.314		
Indirect to Total ratio	.599		

Figure 2: Mediation effect



Discussion of Findings

The results from correlation analysis revealed a positive and significant relationship between intellectual capital and SCQI. This was further confirmed by the regression analysis, which

confirmed that intellectual capital is a significant predictor of SCQI. This implies that manufacturing firms that enhance their structural capital, human capital and relational capital can improve their SCQI. This finding confirms those of previous scholars (e.g. Shou *et al.*, 2018; Song & Song, 2021) who confirmed the positive effect of human capital on supply chain integration. Similarly, Ataseven *et al.* (2018) confirmed the role of intellectual capital in facilitating supply chain integration. More specifically, various other scholars have reiterated the important role of individual intellectual capital dimensions in building SCQI (Yu & Huo, 2018; Teoman & Ulengin, 2018).

Furthermore, the results revealed a positive and significant relationship between intellectual capital and absorptive capacity. This suggests that manufacturing firms that improve their structural capital, relational capital and human capital can achieve improvement in knowledge acquisition, knowledge dissemination and knowledge usage. This finding is in agreement with Oliveira *et al.* (2020) who recently argued that intellectual capital enhances absorptive capacity since identifying the value of new knowledge requires a certain stock of knowledge – intellectual capital. In the same vein, Minbaeva *et al.* (2014) argued that the acquisition of human capital through employee education and training enhances the capability for absorbing and utilising new knowledge. Similarly, Gürlek (2021) argued that human capital in the form of qualified and knowledgeable workforce can help in acquisition of novel knowledge for the organisation, integrating, sharing, and application of the acquired knowledge to organisational processes. Ahmed *et al.* (2020) also confirmed that all of the three dimensions of intellectual capital can help a firm to interact with external environment and to identify, acquire and assimilate external knowledge. Several other recent scholars acknowledge the role of intellectual capital in fostering absorptive capacity (Ahmed *et al.*, 2020; Mahmood & Mubarik, 2020)

The correlation results also indicated the existence of a positive and significant relationship between absorptive capacity and SCQI. The regression analysis also confirmed this, whereby absorptive capacity emerged as a significant predictor of SCQI. This finding implies that manufacturing firms that ensure improvement in their knowledge acquisition, knowledge dissemination and knowledge usage are likely to improve their customer quality integration, internal quality integration and supplier quality integration. This concurs with previous scholars such as Yang *et al.* (2013) who found that knowledge acquisition and dissemination have significant effects on supply chain integration. Similarly, Alkalha *et al.* (2019) affirmed that absorptive capacity plays an important role in SCQI because it creates, extends and modifies companies' knowledge resources, which can be utilised for successful supply chain quality integration. Lastly and perhaps the most pertinent contribution is the finding that absorptive capacity partially mediates in the relationship between intellectual capital and SCQI. This implies that intellectual capital can influence SCQI both directly and indirectly through absorptive capacity. This re-echoes the view of Ahmed *et al.* (2020) who concluded that some of the elements of absorptive capacity play a positive mediating role in the relationship between the dimensions of intellectual capital and those of business performance – quality can be considered as a business performance yardstick. This therefore implies that in order to maximise their SCQI, it is important for manufacturing firms to not only boost their intellectual capital but also their absorptive capacity.

Conclusion

The purpose of the study was to examine the relationship between intellectual capital, absorptive capacity and SCQI. Using a sample of 101 manufacturing firms in Uganda, the findings indicated a positive and significant relationship between intellectual capital and SCQI. Intellectual capital is also positively and significantly associated with absorptive capacity, and absorptive capacity is also positively and significantly associated with SCQI. It was also established that absorptive capacity accounts for more variation in SCQI than intellectual capital. Furthermore, absorptive capacity plays a partial mediating role in the relationship between intellectual capital and SCQI. Moreover, both intellectual capital and absorptive capacity account for 51.6% variation in SCQI.

Theoretical implications

Theoretically, this study has demonstrated that the blending of the resource-based view, dynamic capabilities perspective and relational view can provide an empirical explanation for SCQI in manufacturing firms in a developing country. Hence, the paper contributes on the limited literature on the antecedents of SCQI by uniquely demonstrating that intellectual capital does not only directly influence SCQI but also indirectly through absorptive capacity in manufacturing firms in a developing economy.

Implications for practice

First, intellectual capital was found to have a significant influence on SCQI both directly and indirectly. Hence, managers in manufacturing firms should enhance the facets of intellectual capital. For example, structural capital should be enhanced through ensuring that companies maintain their knowledge in manuals, archives, and databases, set and follow particular sequences of written rules and procedures and embed much of their knowledge and information in structures, systems and processes. Further, human capital should be improved through investing in human resources such as recruiting qualified and competent employees and offering continuous training and innovation such that employees can be considered as experts in their particular jobs and functions, well-educated compared with their peers in the industry, and can be able to find simple solutions for more complex problems. In addition, managers should improve their relational capital by collaborating extensively with external parties (e.g. customers and suppliers) to develop new solutions and encourage customer feedback on quality related activities or problems.

Second, managers in Ugandan manufacturing firms should enhance absorptive capacity in the form of knowledge acquisition, knowledge usage and knowledge dissemination. For example, knowledge acquisition should be improved through meeting regularly with key supply chain partners to determine the types of supply chain management services that are necessary in the future, receiving feedback from supply chain members at least once a year, which is used to assess the quality of services or products, and involving all departments in conducting research to determine their future supply chain quality needs. On knowledge usage, managers should often make supply chain decisions based on knowledge that they have gained from their knowledge repositories. Managers should also regularly use formally documented supply chain data and information in their daily work activities, and should frequently access their intranets for supply chain knowledge and information relating to quality. Finally, on knowledge

dissemination, managers should often communicate and discuss their future supply chain needs with key stakeholders, and distribute supply chain partners' performance data on a regular basis.

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