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Research Article

Role of Information Sharing on Supply Chain Performance – A Context of Developing Country

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Abstract:

Purpose – This study aims at finding out how cost, quality, delivery and flexibility as supply chain performance (SCP) measures are affected by information sharing in the context of a developing country Nepal.

Design/Methodology/Approach – The research was carried out in Nepal with data collected through a survey from 131 supply chain participants that includes suppliers, growers, manufacturers, distributors/dealers, wholesalers, retailers and logistics service providers. Exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and path analysis were performed to assess the fitness of the proposed model and test the hypothesis developed for this study.

Findings – The findings demonstrated that information sharing plays a key role in enhancing the performance of supply chains (SC). It shows that delivery and flexibility performance are significantly affected by operational as well as strategic information sharing while cost and quality performance are not affected by information sharing.

Originality/Value – This study adds to the existing knowledge by providing empirical support towards the role of operational and strategic information sharing on cost, quality, delivery and flexibility, especially in the context of a landlocked developing country.

Research Limitations/Implications – The main limitation is the moderate response rate than desired. While the composition of respondents represented the targeted companies, most of the participants were manufacturers (56%).

Practical Implications – The results of this study will help supply chain participants in Nepal to have an enhanced insight and awareness towards the importance of information sharing in enhancing their performance.

Keywords: information sharing (IS), operational information, strategic information, supply chain (SC), supply chain management (SCM), supply chain partners, supply chain performance (SCP)

1. Introduction

A supply chain (SC) is a chain of entities that participate to make products and services available to customers. A well-managed SC satisfies the customers' needs by delivering the products that they want at the time and price that they prefer. While the focus today is more on improving the overall supply chain performance (SCP), the performance of individual SC firms cannot be overlooked because the strength of SC is contingent on the strength of its participants. Thus, individual firms should focus on improving their performance as a prerequisite to enhance the overall SCP. SCP is

said to be optimum when cost, quality, delivery and flexibility of SC members are improved.

Information sharing (IS), acknowledged as a key tool to achieve a well-managed SC, is critical in improving SC efficiency and effectiveness (Baah et al., 2021; Baihaqi & Sohal, 2013; Mason-Jones & Towill, 1997, 1999; Topal & Sahin, 2018). Coordinating various SC processes for improved SCP is made possible through IS (Li et al., 2019; Moberg et al., 2002). Information such as inventory level, marketing/promotions, order fulfilment, demand forecast, capacity planning, manufacturing/delivery plan and supply disruptions are crucial for managing SCs and sharing this information with upstream and downstream partners is immensely important. If such important information is made available to SC members, it can be used to develop strategies to bring down the cost associated with inventory, reduce the mismatch between supply and demand, enhance customer satisfaction, reduce paper works and manual labour, and ensure the delivery of fast and consistent logistical services (Lee & Whang, 2000).

While there are several studies that indicated the significance of IS in improving SCP (Cachon & Fisher, 2000; Lee & Whang, 2000; Li & Lin, 2006; Lin et al., 2002), very few studies have clearly, through empirical examination, found the causal relationship between them (Baah et al., 2021; Koçoğlu et al., 2011; Sahin & Topal, 2019; Tan et al., 2010). In addition, owing to the fact that each performance measure has its own strengths and drawbacks and depends on the aims and objectives of the firms, there is no unanimous opinion in the past studies on deciding the best measures for measuring the performance of SCs (Chow et al., 1994; Lu et al., 2019; Tan et al., 1999). Hence, studies considering different performance measures and their combinations in a context different from frequently studied contexts may add to the existing knowledge in the literature. Lastly, there are limited studies conducted in developing nations that differ vastly from developed nations in areas related to infrastructure, firm size and culture. In today's globalised world, it is critical to enrich supply chain management (SCM) research through context-specific research to study and identify the pre-eminent SCM methods around the world (Piotrowicz & Cuthbertson, 2015). The conclusions drawn from a new context, such as those from developing countries, can not only be used to make comparative assessments with those from prior studies but also assist towards augmenting relationships with the developing countries for improved SCP through enhanced IS (Maskey et al., 2019). Hence, this study is guided by the primary research question 'What is the effect of IS on SCP in developing countries?' With the focus on the relationship between the two, this study aims to carry out a detailed analysis on the impact of IS on SCP from the perspective of a non-coastal emerging nation, Nepal. Nepal was chosen as a developing country for several reasons, such as the context of Nepal would be completely different from those studied previously where the extent of SC development is much high and it is a non-coastal nation which represents many emerging nations in the world (Maskey et al., 2019). Furthermore, in Nepal, SCP is largely affected by its mountainous terrains increasing the delivery time and cost. While the primary intent of this study is to examine how IS affects SCP, it also seeks to propose performance evaluation criteria that aligns with SC objectives. The following sections will review the literature underlying the research model and hypothesis development which will be proceeded by the methodology and analysis section. The results will then be presented followed by discussion, contribution and limitations and future research directions.

2. Information sharing in supply chains

Several studies have cited the importance of IS, collaboration and coordination among SC firms as a major strategy to overcome the impediments to SCM implementation (Moberg et al., 2002). Following the resource-based view (Wernerfelt, 1984), this study deemed information as a valuable and prudent resource and SCM as capabilities (Grant, 1991; Hall, 1992, 1993; Huo et al., 2016; Maskey, 2018; Mason-Jones & Towill, 1997). According to the resource-based view, the firm possessing valuable resources makes it more powerful, augmenting its competitive position in the market (Wernerfelt, 1984). While possessing valuable resource like information is crucial, equally important is to utilise it well to successfully create valuable capabilities such as improved SCP (Huo et al., 2016). SC firms, considering information as a valuable resource, may hoard information. However, it is important to emphasise that more valuable than information will be the collaborative relationships in the SC which can be built through trust and the sharing of critical relevant information as it helps in generating relational rents and improving SCM (Maskey, 2018; Patnayakuni et al., 2006). IS, considered as an important coordination mechanism, facilitates better collaboration and sharing of benefits, risks and rewards among SC partners that lead to reduced uncertainty, improved partnership, better quality

products/services and faster and reliable delivery to the customer (Barratt, 2004; Lee & Whang, 2000; Li & Lin, 2006; Lin et al., 2002; Maskey, 2018; Maskey et al., 2019; Milgate, 2001). It is an important means that brings together all the SC members (Fawcett, Ellram, et al., 2007) with a mutual goal to enhance the overall performance as well as that of the individual firms (Maskey, 2018).

Trading partners in the SC are unwilling to share information with other SC members, who at some point may become their competitors, because it requires the sharing of important and valuable business information (Du et al., 2012). While IS has been deemed necessary to augment SCP, SC members should be cautious when deciding what information should be shared and with whom. With the availability of a range of information and numerous ways to share, it is exhausting to work out the type or the extent of information to be communicated in the SC (Feldmann & Müller, 2003). Therefore, the extent of information to be shared should be decided based on the benefits the company can gain as suggested by Seidmann and Sundararajan (1998). With time frame and the objective as the major differences between the types of information shared, this study categorised IS as operational and strategic IS (Maskey, 2018; Moberg, 2000; Seidmann & Sundararajan, 1998).

2.1 *Operational information sharing*

Operational IS indicates sharing information frequently in a short time span that is required to execute short-term interests to achieve operational efficiencies (Lee et al., 2010). To improve performance in terms of order cycle time, inventory management, asset utilisation and customer services, operational information such as order and delivery status, manufacturing and delivery planning, supply disruptions, promotions, logistics or inventory level play an important role (Moberg et al., 2002; Patnayakuni et al., 2006; Ramayah & Omar, 2010). Operational information is distinct from strategic information because of its quantitative nature and can be generated in forms such as tables and spreadsheets created with the use of various information technologies (Maskey, 2018; Moberg, 2000).

2.2 *Strategic information sharing*

Strategic IS implies sharing information such as marketing and new product development that is prudent in nature, encompasses broad issues and has a prolonged influence on a firm's future growth plans (Maskey, 2018; Moberg et al., 2002; Ramayah & Omar, 2010). Unlike operational information, strategic information is qualitative in nature and as a result, sharing of strategic information through qualitative means like in-person meetings or phone calls is preferred by managers instead of sharing files via electronic means (Moberg et al., 2002). While the speed of sharing operational information is considered important as it determines the day-to-day activity of a firm, strategic IS is not likely to be affected by its speed (Moberg, 2000).

3. Supply chain performance measurement

Performance measurement is essential as it generates improvement prospects based on the feedback obtained through various key performance measures and metrics (Neely et al., 1995). Through the application of various performance measures, a firm can validate whether the current practices and processes, policies and strategies are effective in achieving their fundamental organisational goals (Ghosh & Fedorowicz, 2008). Knowing what and when to measure will assist firms to monitor and track their performance and receive timely information critical in decision-making regarding their SC activities (Gunasekaran & Kobu, 2007). Firms need to pay considerable attention so as not to choose a single measure to assess their performance because it can be risky and deceptive because of its shallow and peripheral evaluation (Beamon, 1999; Hausman, 2004). For example, while a SC may be successful in bringing down their cost, the quality of product or service might not be optimum. According to Hausman (2004), choosing a single performance metric and limiting the effort only to improve it may likely have adverse effect on other performance metrics.

While choosing the specific performance metrics, firms should check if it aligns with their business mission, aims, value it intends to deliver, type of product/service, nature of the market and customers and technological ability (Akyuz & Erkan, 2010; Gunasekaran & Kobu, 2007; Hausman, 2004; Maskey, 2018). Studies in the past have identified and

stressed the significance of different indicators to capture SCP (Beamon, 1999; Gunasekaran et al., 2015; Gunasekaran et al., 2001; Kaplan & Norton, 1992, 1996; Neely et al., 1995). Addressing financial as well as other important measures such as customer, internal processes and innovation and improvement activities, Kaplan and Norton (1992) introduced balanced scorecard, a comprehensive framework that provides a set of performance measures. The performance measures recommended by Neely et al. (1995) includes time, quality, flexibility and cost. Beamon (1999) labelled performance measures as Resource Measures, Output Measures and Flexibility Measures. Gunasekaran et al. (2004) emphasised the importance of monitoring SC procedures and hence carried out an empirical study and labelled SCP metrics as strategic, tactical and operational measures. Furthermore, Gunasekaran et al. (2015) classified performance measurement criteria in outsourcing decisions into financial and non-financial and then into tangible and non-tangible measures. While no consensus is evident on SCP measurement approach, it is recommended that it should include, considering the firm's long-term goals and objectives, non-financial indicators besides financial indicators (Arif-Uz-Zaman & Nazmul Ahsan, 2014; Chow et al., 1994; Gunasekaran et al., 2015; Tan et al., 1999). Figure 1 illustrates some of the important characteristics that firms should consider while selecting their SCP metrics.

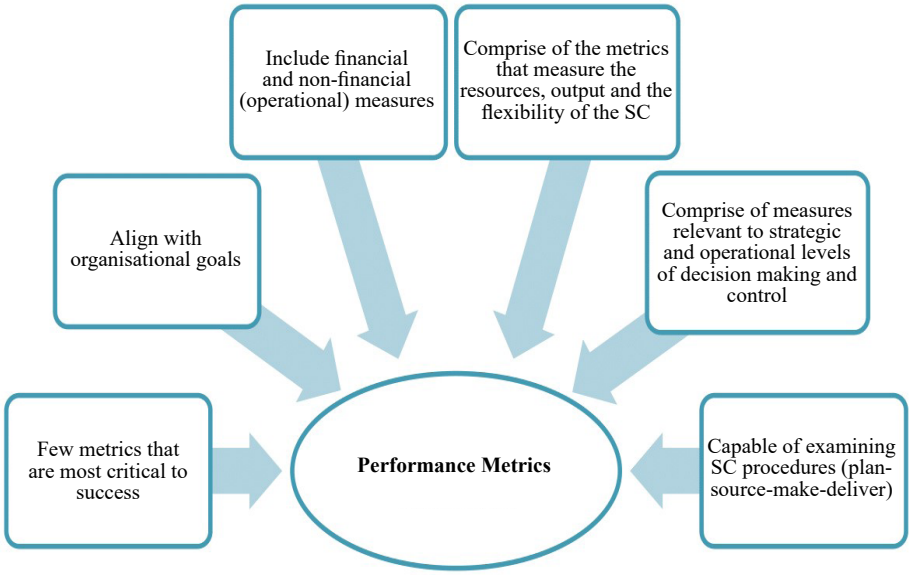

Figure 1. Criteria for supply chain performance metrics (Maskey, 2018)

Superior customer satisfaction and increased profitability are the fundamental objectives of every SCs while individual firms may have other individual goals and objectives (Chow et al., 1994; Hausman, 2004). Customer satisfaction is a key to increased profitability and an ultimate evidence of a company's performance (Fawcett, Ellram, et al., 2007). Different customers behave differently, have different choices and preferences defying the concept of "one shoe size fits all" and hence, some focus on lowering costs and others on improved quality, fast and reliable delivery and flexibility (Maskey, 2018). Flexibility, an indication of how well the system deals with uncertainty, has not been used frequently in comparison to cost and quality (Beamon, 1999). According to Maskey (2018), resource, output and flexibility measures suggested by Beamon (1999) for performance measurement reinforces the concept of SCM which is to serve customers by providing them with what and when they want while making efficient use of resources. Hence, this research considered cost, quality, delivery and flexibility as the indicators of SCP measurement to examine how IS helps to enhance SCP (Maskey, 2018). Moreover, the selection of these four performance indicators aligns with all the critical features illustrated in Figure 1.

4. Effect of information sharing on supply chain performance

Sharing important and related information with trading partners is immensely important. A firm, in possession of information, will have more power over its partners as information is a valuable resource according to the resource based view (Wernerfelt, 1984). Considered a valuable resource, every firm will make effort to hoard information. However, it is important to note that firms can acquire new knowledge through shared information which generates better and practical values (Rashed et al., 2013). Several authors have underlined the prominence of IS for better SCP (Baah et al., 2021; Baihaqi & Sohal, 2013; Cachon & Fisher, 2000; Fawcett, Osterhaus, et al., 2007; Gustin et al., 1995; Lee & Whang, 2000; Sahin & Topal, 2019; Song et al., 2016; Zhou & Benton Jr, 2007). The adverse effect of bullwhip effect can be mitigated by sharing accurate and timely information with SC members (Yu et al., 2001). Sharing information such as supply disruption or delivery and dispatch with downstream partners will help them to plan their activities or make alternative provisions (Li, Lin, et al., 2006; Maskey, 2018). Likewise, receiving demand and order/sales information by the upstream members will help them schedule production timing and quantity (Li, Ragu-Nathan, et al., 2006). Information related to promotional strategies is important strategic information that needs to be shared with the production or operations department. Failure to do so will lead to excessive inventory levels which will have an adverse effect on cost performance as the manufacturers will assume an upsurge in demand and will increase their order for supplies (Ramayah & Omar, 2010). Furthermore, according to Li et al. (2019), customer IS, structured or unstructured, is critical to enhance customer coordination and SCP.

The existence of a strong association between IS and SCP as substantiated above will encourage SC firms to improve and enhance IS in their SCs. Timely and accurate sharing of information will provide SC partners with a prospect to develop their strategies and their action plans on time for better and profitable outcomes (Kocoglu et al., 2011). Table 1 illustrates the association between IS and SCP.

Table 1. Information sharing and performance

Key References	Performance Metrics	Results
Cachon and Fisher (2000)	SC cost	IS → positive effect on SC costs
Lee and Whang (2000)	Cost, customer service and delivery	IS → positive effect on costs, customer service and delivery
Lee et al. (2000)	Inventory reduction and cost reduction	IS → positive effect on inventory reduction and cost reduction
Yu et al. (2001)	Inventory reduction and cost reduction	IS → positive effect on inventory reduction and cost reduction
Fawcett, Osterhaus, et al. (2007)	Operational and competitive performance	IS → positive effect on performance
Zhou and Benton Jr (2007)	Delivery performance	IS → positive effect on delivery performance
Sezen and Yilmaz (2007)	Resource, output and flexibility performance	IS → no effect on resource, output and flexibility performance
Hsu et al. (2009)	Transaction flexibility	IS → positive effect on transaction flexibility
Ramayah and Omar (2010)	Reliability, cost, flexibility, and responsiveness	IS → positive effect on reliability, cost, flexibility, and responsiveness
Yigitbasioglu (2010)	Resource utilisation, output and flexibility	IS → positive effect on buyer performance
Lee et al. (2010)	Efficiency and effectiveness	IS → positive effect on buyer performance
Zelbst et al. (2010)	Cost, delivery and customer satisfaction	IS → positive effect on SCP
Kocoglu et al. (2011)	Costs, asset utilisation, flexibility, reliability, and responsiveness	IS → positive effect on SCP
Sanders et al. (2011)	Costs, quality, delivery and new product development	IS → positive effect on supplier performance and indirect positive effect through communication openness
Hall and Saygin (2012)	Cost and customer responsiveness	IS → positive effect on cost and customer responsiveness
Baihaqi and Sohal (2013)	Delivery, cost, and market and financial	IS → indirect positive effect on performance through collaboration
Ye and Wang (2013)	Cost efficiency and customer responsiveness	IS → positive effect on cost efficiency and customer responsiveness
Wu et al. (2014)	Financial and non-financial measures	IS → positive effect on SCP
Li et al. (2014)	Efficiency and responsiveness	IS → positive effect on SCP

Key References	Performance Metrics	Results
Song et al. (2016)	SME's credit quality	IS → positive effect of SME's credit quality
Topal and Sahin (2018)	Cost, flexibility, response, delivery and financial performance	IS → positive effect on cost and response
Sahin and Topal (2019)	SC process, cost and financial performance	IS → positive effect on SC process financial performance
Li et al. (2019)	Flexibility, effectiveness, efficiency, delivery and customer service	IS → indirect positive effect on SCP through customer strategic coordination
Nazifa and Ramachandran (2019)	Product quality performance and business performance	IS → positive effect on product quality performance and business performance
Alzoubi and Yanamandra (2020)	Operational and competitive performance	IS → indirect positive effects on SCP through agile SCs
Huo et al. (2021)	Flexibility performance	IS → indirect positive effect on flexibility performance through supplier learning
Baah et al. (2021)	Flexibility and resource performance	IS → positive effect on SCP

5. Research Model

Figure 2 demonstrates the research framework, developed based on the literature review, to evaluate the relationship between IS and SCP. The research model in this research illustrates that operational and strategic IS will affect SCP. The aim of this study is to find out how operational and strategic IS will affect cost, quality, delivery and flexibility as SCP measures.

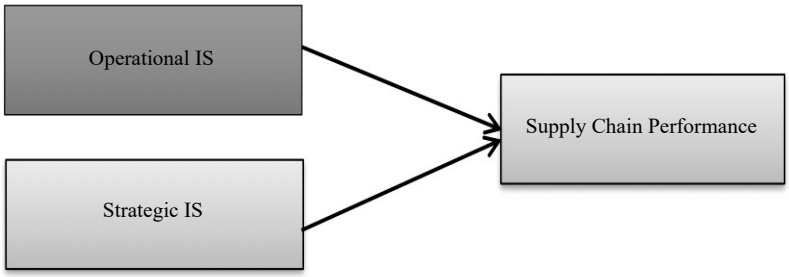

Figure 2. Research model

5.1 *Hypothesis development*

5.1.1 *Information sharing and cost performance*

Every SC prioritises to develop strategies to bring down their overall costs including SC costs as an important criterion for SCP enhancement (Ramayah & Omar, 2010). Uncertainties in SC lead to the amplification of ordering variability resulting in excess safety stock, increased logistics costs and inefficiency in capacity utilisation (Yu et al., 2001). Accurate information shared in a timely fashion amongst SC partners will reduce or mitigate bullwhip effect, prevent disruptions in the upstream/downstream SC, augment capacity utilisation and manage inventory to avoid over-stock and stock-outs (Li, Lin, et al., 2006; Li, Ragu-Nathan, et al., 2006; Yu et al., 2001). Improving these aspects of SC activities will provide significant cost savings to the overall SC. Hence, we postulate that:

H1: Sharing operational information with SC partners will positively affect cost performance.

H2: Sharing strategic information with SC partners will positively affect cost performance.

5.1.2 *Information sharing and quality performance*

Quality is a significant component of SCP which is determined by and focussed towards improved customer satisfaction (Neely et al., 1995). Product quality and service quality (fill rate, on-time deliveries, and backorder/stock out) should be improved significantly to meet the customers' expectations of the quality criteria.

While product quality and service quality, especially delivery service quality, are essential conditions under quality performance and are incorporated under the output measure defined by Beamon (1999), this study focuses on delivery as a separate performance measure due to its increased importance in the age of e-commerce. To improve quality, it is imperative to understand the customers' needs and requirements. When the upstream partner gets regular information about customer demands related to product quantity and specification, they can plan their production schedule so as to maintain their inventory and schedule their delivery. Similarly, when downstream partners receive information from the manufacturer such as a disruption in the manufacturing process, they can plan for an alternative way such that the quality of their products/service does not get affected. Hence, we postulate that:

H3: Sharing operational information with SC partners will positively affect quality performance.

H4: Sharing strategic information with SC partners will positively affect quality performance.

5.1.3 *Information sharing and delivery performance*

IS in the SC is a key strategy that supports vendor managed inventory, continuous replenishment programs and collaborative planning, forecasting and replenishment which are important initiatives towards SCM (Disney & Towill, 2003; Fliedner, 2003; Zhou & Benton Jr, 2007). The aims of these SC activities are mainly to enhance delivery practice and customer satisfaction. The two most important attributes of delivery performance are speed and reliability (Milgate, 2001). When SC partners receive reliable information about customers' needs and requirements, they can plan their inbound and outbound logistics which will eventually affect delivery performance. Hence, we postulate that:

H5: Sharing operational information with SC partners will positively affect delivery performance.

H6: Sharing strategic information with SC partners will positively affect delivery performance.

5.1.4 *Information sharing and flexibility performance*

Uncertainty in the SC makes flexibility an essential criterion to excel towards improved SCP (Beamon, 1999). While flexibility and agility are used interchangeably, flexibility is just one element of agility along with responsiveness, speed, quality and cost and is usually located at the operational level (Abdelilah et al., 2018). Hence, this study only focuses on flexibility as a performance measure. SCs face unanticipated situations caused by upstream (e.g., supply)/ downstream (e.g., demand) uncertainties, manufacturing unreliability, or technological uncertainty. In order to overcome these problems and to meet SC goals, it is imperative that SC firms prepare themselves for such uncertainties so as to meet customer demands. For a firm to act quickly in response to SC uncertainties, they need timely information about changing customer demands, manufacturers' production schedule and the inventory levels of all the SC members. Hence, we postulate that:

H7: Sharing operational information with SC partners will positively affect flexibility performance.

H8: Sharing strategic information with SC partners will positively affect flexibility performance.

6. Research methodology

There are 3 sections in the survey questionnaire that comprised of a variety of question types suitable for the study. Questions related to the respondents' company profile are included in Section A (Table 2). Sections B and C consist of questions built on IS and SCP respectively. The constructs used in this research are social science constructs which are difficult to measure directly. Considering the unavailability of suitable existing measurement instrument for this research, a survey questionnaire was planned and developed combining the a) relevant literature; b) authors' interpretation of the constructs; and c) adaptations of some constructs from extant studies to achieve the goal of this study (Maskey, 2018). Hence, each underlying construct was represented by multiple items as indicators. The aim was to first find the scales verified by previous studies. In case when such scales were not available, items based on prior

studies were developed. The scale items used to measure each construct are listed in Table 3. The items measuring operational and strategic IS were altered from Moberg et al. (2002). For SCP scale, some items were adapted from Doney and Cannon (1997), Baihaqi and Sohal (2013) and some of them were developed by the author based on Beamon (1999). Six academics from related fields reviewed the initial questionnaire and based on their comments and feedbacks further changes were made.

Table 2. Respondent's profile

Key References	Demographic Variable	Percentage
Main Business		
Supplier	17	13.0
Producer/Grower	8	6.1
Manufacturer	73	55.7
Dealer/Distributor	35	26.7
Wholesaler	11	8.4
Retailer	12	9.2
Transport/Logistic Service Provider	22	16.8
Respondent's Position		
CEO/President/Owner	21	16.0
Director/Managing Director	20	15.3
General Manager/Manager	66	50.4
Other	24	18.3
Years of Company Establishment		
Less than 5 Years	15	11.5
5 - 10 Years	25	19.1
11 - 20 Years	32	24.4
More than 20 Years	58	44.3
Number of Years in this Position		
Less than 5 Years	47	35.9
5 - 10 Years	48	36.6
11 - 20 Years	22	16.8
More than 20 Years	13	9.9
Number of Employees		
Less than 50	51	38.9
50 - 99	17	13.0
100 - 199	16	12.2
More than 200	47	35.9
International Trade		
Yes	105	80.2
No	26	19.8

To test the research framework, a survey was carried out in Nepal among the members of the Federation of Nepalese Chamber of Commerce & Industries and Nepal Freight Forwarders Association. The membership list of these two organisations consists of suppliers, growers, manufacturers, dealers/distributors, wholesalers/retailers and logistics service providers which were the target respondents. From each company, the aim was to select an individual that has

the potential to answer the survey questions such as the business owners, managing directors, chief executive officers and managers. Before administering the data collection, ethics approval and authorisation was obtained by submitting all the necessary documents.

Based on Hair et al. (2003), 215 was calculated as the target sample size before contacting the participants. The sample for the survey was selected through probability sampling technique. Using Microsoft Excel, a random number table was created and used to select the first 215 potential participants that represented a simple random sample of the population (Creswell & Clark, 2011; Fowler, 2009; Maskey et al., 2019). The respondents were provided with the option to select hard copy, electronic version or online version of the survey. While there was a total of 135 firms who participated in the survey, four were deleted from further analysis due to incomplete responses. A total of 131 responses were used to test the research framework. Data were analysed, first to test the validity and reliability through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) and then to test the effect of IS on SCP.

While all the procedure was followed in data collection, avoiding biases of one sort or another was almost impossible. Common method bias (caused by item ambiguity, respondents not answering truthfully either knowingly or unknowingly causing the distortion of measurement or common medium used for data collection) and non-response bias (caused by the unavailability of key informant, reluctance to participate due to company policies, lack of knowledge in SCM) are frequent sources of bias which may distort the data obtained or the inferences drawn (Podsakoff et al., 2003; Salant & Dillman, 1994; Zikmund et al., 2010). Attempts were made to control such biases. To control the item ambiguity bias, different approaches for conceptualising and framing the items were used (Maskey, 2018). The instructions and questions in the survey instrument were carefully designed for clarity and understandability. Before approving the final version of the questionnaire, industry experts and academics were invited to participate in a pre-test and their feedback and was taken into consideration. Distortion of measurement may be caused by various reasons which can be intentional or unintentional such as to demonstrate personality (like intelligence, likability) or hesitancy to reveal personal information, or simply due to the format and content of the questions (Podsakoff et al., 2003). To reduce such response bias, efforts were made to ensure privacy and anonymity of respondents, refining the questionnaire to avoid sensitive questions and to ensure the logical and organised layout and the flow of the questions (Maskey, 2018). As a measure to control the bias caused by the use of common medium for data collection, measures of independent and dependent variables were assessed to uncover and exclude any commonalities (Podsakoff et al., 2003). To avoid non-response bias, reminder emails were sent and telephone calls were made. When possible, direct visits were also made.

7. Analysis and results

7.1 *Measurement validation*

Before assessing the research model, it is imperative to evaluate the measurement instrument in terms of reliability and validity to ensure that it is measuring the underlying constructs. All constructs were subjected to Cronbach's alpha test, EFA and CFA. EFA and CFA were performed to establish the unidimensionality, discriminant validity and convergent validity of the indicator variable (Ahire & Devaraj, 2001; Cheng, 2011; Cortina, 1993; Lee et al., 2010; O'Leary-Kelly & Vokurka, 1998). Two EFAs and CFAs, one for IS and the other one for SCP were conducted to overcome the limitation of small sample size (Maskey et al., 2019; O'Leary-Kelly & Vokurka, 1998; Sezen, 2008).

EFAs (principle component analysis) were conducted with Varimax rotation in Statistical Package for the Social Sciences (SPSS) version 22. To be considered suitable for factor analysis, Bartlett's test of sphericity (statistically significant at $p < 0.05$) and the Kaiser-Meyer-Olkin measure of sampling adequacy (> = 0.6; 0.769 and 0.746) were assessed (Pallant, 2002; Tabachnick & Fidell, 2007). The EFAs resulted in two (operational and strategic IS) and four (flexibility, delivery, quality and cost performance) components respectively, consistent with the number of underlying dimensions. Factor loadings below 0.5 were all discarded (Comrey & Lee, 1992; Field, 2013; Maskey et al., 2018; Meyers et al., 2013). In addition, to calculate the factor scores needed in the following analyses (path analysis in this study), all the items with cross-loadings were also discarded. Following these criteria, three items were deleted, one from operational IS, one from flexibility performance and one from quality performance. The Cronbach's alpha test for reliability showed that all the constructs resulted in alpha values ≥ 0.7 (Nunnally, 1978) except operational IS and cost performance. Operational IS and cost performance resulted in $\alpha = 0.66$ which was acceptable for research purpose

according to Meyers et al. (2013). The results of EFA and Cronbach's alpha test are presented in Table 3.

Table 3. Reliability and exploratory factor analysis Results (Maskey, 2018)

Item Description	Factor Loading	Alpha	Eigen Value	% of Variance
Strategic IS				
Distribution Plans	0.851	0.75	3.016	37.694
New Product Development	0.833			
Upcoming Promotions	0.711			
Pricing	0.504			
Operational IS				
Delivery Schedule	0.876	0.66	1.544	19.304
Order Status	0.805			
Inventory Level	0.517			
Changing Customer Demand	0.506			
Total Variance Explained (%)				**56.995**
Flexibility Performance				
We cope well with our *capacity* to meet customer needs	0.842	0.80	3.963	33.029
We cope well with *delivery requirements*	0.780			
We cope well with *uncertain customer demand*	0.778			
We cope well with *storage/warehousing* facility	0.669			
Delivery Performance				
Our partners' deliveries are *reliable*	0.830	0.80	1.758	14.647
Our partners deliver orders at our *preferred time*	0.827			
Our partners' deliveries are always *accurate*	0.805			
Cost Performance				
Our *operations costs* are kept at a minimum level	0.845	0.66	1.333	11.109
Our *logistics costs* are kept at a minimum level	0.814			
Our *inventory costs* are kept at a minimum level	0.610			
Quality Performance				
Our partners' products have *low defect rate*	0.895	0.73	1.226	10.219
Our partners' product *damages/loss* on arrival is very low	0.829			
Total Variance Explained (%)				**69.006**

CFA was conducted with maximum likelihood estimation method IBM SPSS AMOS (version 22). Operational and strategic IS each with four indicator variables were factor analysed resulting in all the indicator variables loading significantly on their underlying constructs. Similarly, the factor analysis for flexibility, delivery, cost and quality performance each with four, three, three and two indicator variables respectively, resulted in all the indicator variables loading significantly on their underlying constructs. Different fit indices were considered to test the fit of the model and a model was considered to have acceptable fit when any two of the fit indices (Stage et al., 2004) met the minimum requirements. The minimum recommended or acceptable values (critical values) for each fit index and the model fit indices for each model are presented in Table 4 (Baihaqi & Sohal, 2013; Cheng, 2011; Du et al., 2012; Lee et al., 2010; Meyers et al., 2013; Schreiber et al., 2006). The EFA and CFA outputs resulted in all the items loading under their underlying constructs confirming unidimensionality, discriminant validity and convergent validity.

Table 4. Model fit indices

Model	SRMR	χ^2 / DF	GFI	CFI	RMSEA
Critical Values	< 0.08	< 3.0	≥ 0.9	> 0.9	< 0.08
IS	0.0968	2.547	0.914	0.886	0.109
SCP	0.0588	1.646	0.913	0.938	0.070

7.2 *Path analysis*

To analyse the theoretical research model, path analysis, a case of structural equation modelling was performed in IBM AMOS 22. A popular method for social science analysis, path analysis is an extension of linear regression where the fit of the model is tested along with the test of significance of the relationship between two variables (Garson, 2008; Stage et al., 2004). The assumptions of path analysis that includes multicollinearity and singularity, outliers, normality, linearity and homoscedasticity (Field, 2013; Meyers et al., 2013; Tabachnick & Fidell, 2007) were carried out to make sure that the data is appropriate for path analysis. To test the adequacy of the theoretical model, five fitness indices were used and a model was considered to be acceptable if any three of the five indices were within the acceptable range. The minimum recommended or acceptable values for the five fit indices were as same as CFA and are presented in Table 5. In the model, causal paths between IS and the four components of SCP was given a direction based on our hypotheses.

Table 5. Goodness of fit indices for path analysis

Fit Index	Critical Value	Goodness of Fit	
χ^2		3.610	
df		6	
χ^2 / **df**	< 3.0	0.602	
p	> 0.05	0.729	
SRMR	< 0.08	0.0311	Good
GFI	≥ 0.9	0.991	Good
CFI	> 0.9	1.000	Good

The chi-square (χ^2) of the model was 3.610 with six degrees of freedom (df) and $p = 0.729$ (> 0.05) indicating that the hypothesis of exact fit is plausible (Byrne, 2010). In addition, stand-alone fit indices of the model also exhibited a good fit with SRMR = 0.0311, GFI = 0.991 and CFI = 1.000. The model fit summary is presented in Table 5 above. After confirming the fit of the model, it was further used to address the hypotheses developed in Section 5 above.

7.3 *Results*

Figure 3 depicts the path diagram for IS-SCP Model with standardised regression weights (β) and squared multiple correlations (R^2). The path analysis directed towards the results to verify the hypotheses which are summarised in Table 6. According to the results, hypotheses H5, H6, H7 and H8 are accepted whereas H1, H2, H3 and H4 are rejected.

H1 was related to the effect of operational IS on cost performance which was not significant ($\beta = 0.083$, $p = 0.340$) and hence it was rejected. H2 postulated the effect of strategic IS on cost performance. The analysis suggested this relationship to be non-significant with $\beta = 0.144$, $p = 0.095$. The data does not support that operational and strategic IS will positively affect cost performance. The third hypothesis H3 stated that sharing operational IS with SC partners will

positively affect quality performance. This relationship was also not supported with β = 0.058, p = 0.509. Under the fourth hypothesis H4, it was postulated that strategic IS will positively affect quality performance. The analysis showed that this relationship was not significant (β = 0.017, p = 0.843).

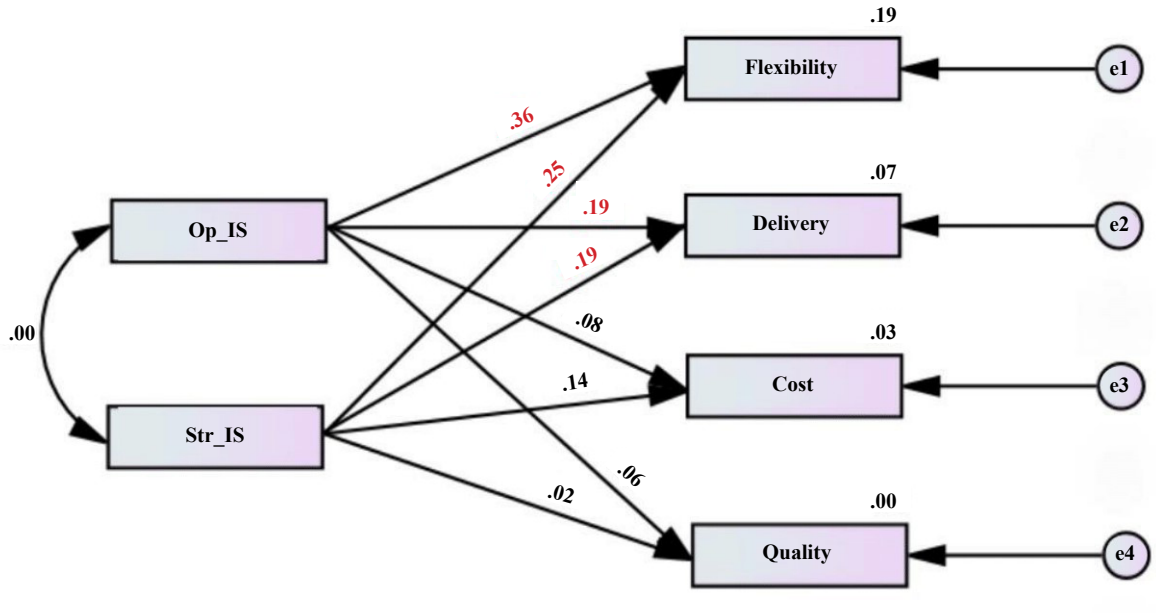

Figure 3. Path diagram for information sharing and supply chain performance

Table 6. Summary of test statistics for the effect of information sharing on supply chain performance

Path	*P*	Standardised Path Coefficients (β)	Decision	R^2
H1: Operational Information Sharing → Cost	0.340	0.083	Reject	0.028
H2: Strategic Information Sharing → Cost	0.95	0.144	Reject	
H3: Operational Information Sharing → Quality	0.509	0.058	Reject	0.004
H4: Strategic Information Sharing → Quality	0.843	0.017	Reject	
H5: Operational Information Sharing → Delivery	0.024	0.191	**Accept**	0.071
H6: Strategic Information Sharing → Delivery	0.027	0.187	**Accept**	
H7: Operational Information Sharing → Flexibility	***	0.364	**Accept**	0.193
H8: Strategic Information Sharing → Flexibility	0.002	0.246	**Accept**	

**All the highlighted paths are significant at either $p \leq 0.05$ or $p \leq 0.01$ or $p \leq 0.001$.*

H5 and H6, which postulated a positive relationship between operational and strategic IS and delivery performance and was supported by our data with β = 0.191 and 0.187, p = 0.024 and 0.027 respectively. This result suggests that sharing operational and strategic information with SC partners will enhance delivery performance. The seventh and eighth hypotheses stated that sharing operational and strategic information with SC partners will positively affect flexibility performance. H7 (β = 0.364, $p < 0.001$) and H8 (β = 0.246, p = 0.002) were backed by our data suggesting that flexibility performance can be improved through IS. Our findings further show that our model accounts for 19% of the variation in flexibility performance and 7% of the variation in delivery performance. The effects of IS on cost and quality performance

were negligible as shown in Table 6 and Figure 3.

8. Discussion

This research, with an aim to understand the effect of IS on SCP, was carried out in the context of a landlocked developing nation, Nepal. While some authors considered SCP as a dependent variable without any individual performance measures (Baah et al., 2021; Li et al., 2019; Ramayah & Omar, 2010; Sanders et al., 2011), others considered individual performance measures such as cost, quality, market and financial (Baihaqi & Sohal, 2013; Topal & Sahin, 2018), delivery performance (Sanders et al., 2011; Topal & Sahin, 2018), efficiency and effectiveness (Li et al., 2014; Ye & Wang, 2013) and resource, output and flexibility performance as dependent variables (Wu et al., 2014; Yigitbasioglu, 2010) to study the effect of IS. Furthermore, there were few studies that categorised IS into two separate groups (Lee et al., 2010; Ramayah & Omar, 2010). Some researchers found that the relationship between IS and SCP was not direct but facilitated by the level of collaboration (Baihaqi & Sohal, 2013; Wu et al., 2014), integration (Kaliani Sundram et al., 2016) and coordination (Li et al., 2019) between SC partners and information utilisation (Jonsson & Myrelid, 2016). While this study confirmed the literature on the existence of positive relationship between IS and SCP (Baah et al., 2021; Lee et al., 2010; Ramayah & Omar, 2010; Sanders et al., 2011; Topal & Sahin, 2018; Yigitbasioglu, 2010; Zelbst et al., 2010), it added to the existing knowledge by empirically illustrating the effect of operational and strategic IS on the four aspects of SCP.

The results show that cost performance is not affected by IS. The total cost of a company is related to its logistics costs, inventory costs and operations costs. Important SC decisions related to inventory management, order placements, capacity allocations and production and material planning can be made wisely with IS. Bullwhip effect is a common SC phenomenon which causes mismatch between supply and demand leading to an increased overall cost. To mitigate this effect leading to significant cost reduction, SC partners need to share important strategic information such as sales estimate and marketing strategies. The importance of IS in reducing SC cost has been clearly explicated in the literature (Table 1). However, the context of Nepal shows otherwise. Being a mountainous landlocked country, Nepal lacks direct access to sea, increasing its dependence on neighbouring nations (such as India) and resulting in uncertain and unreliable transport delivery and with higher damage/defect rates. Owing to its inadequate sea connectivity, Nepal faces significantly high trading costs such as due to increased duration to ship goods between nations (Arvis et al., 2010; Maskey, 2018; Mirza & Bacani, 2013) and high cargo insurance premium to cover the damage/defect (United Nations Conference on Trade and Development, 1977). It is essential to reduce cost in parallel to reduce the risks caused by unreliable and untimely delivery. While choosing an alternative mode of transportation like by air or increasing their inventory levels may prove to be a viable solution to provide better delivery, it may further increase the already escalated logistics expenses (Arvis et al., 2010; Hall & Saygin, 2012). With limited choice in hand, firms in developing countries like Nepal may find the latter option more favourable as they may get volume discounts and transportation discounts. As a consequence, they end up accumulating high inventory level, possibly comparable to a year's projected sales (Arvis et al., 2010; Fafchamps et al., 2000). Hence, because of its geography and lack of sea links, firms in Nepal may find it very difficult to bring down their cost despite sharing information with their SC partners.

To promote IS between SC partners, IT plays a major role and hence, firms' investment to support better IT resources and linkages might have caused their cost to increase (Zhang et al., 2019). While firms may have made some cost savings through IS, the cost of IT investment might have exceeded this cost, showing no clear indication of cost reduction. Furthermore, firms may not have observed an indirect decrease in cost because of timely and accurate information shared by their SC partners. For example, a manufacturer can make alternate supply arrangement and avoid short supply of raw materials based on the information provided by their supplier about supply disruption which may have been caused due to labour strike or machine breakdown or transport issues. At a glance, the manufacturer's cost seems to have increased because of the time required to find a replacement supplier and the new supplier (short-term transaction) charging more and this increase in cost may be more noticeable. However, the manufacturer may not have realised how much more it would have cost him due to the shortage in raw materials if his/her regular supplier had not alerted him on time (Maskey, 2018).

Another significant outcome of this study is the relationship between operational and strategic IS on quality performance. It is crucial to share significant customer-related information such as their expectations, demand and

specifications about products and services in the SC to fulfil and exceed customers' quality expectations. As an indication of enhanced quality, it is critical to make sure that the products desired by the customers are available where and when they desire and are delivered without any damage or defects. A well-managed transport and logistics system becomes important to meet the above quality expectations. Modernised infrastructure such as roads, highways, channels, railways, trucks, barges, trains, customs loading and unloading procedures and warehousing facilities play a critical role in avoiding cargo damage/defect problems (United Nations Conference on Trade and Development, 1977). However, in the context of Nepal, because of its geographical position, fulfilling these expectations might be challenging. Minimising damage/defects to maintain the quality of products are vastly affected by transport and logistics management. Due to the lack of direct sea access, Nepal largely depends the Indian ports such as the Kolkata Port for most of its seaborne cargoes. This need to transit through a foreign territory before they reach their destination results in a lengthy procedure with too many documents to be filled up causing significant delays in delivery and goods being frequently damaged, stolen or spoiled (Earley, 2018; United Nations Conference on Trade and Development, 1977). Furthermore, damage/defect may also be caused by the inland transport mode due to poor road conditions, frequent strikes and natural calamities. This results in higher cargo insurance premiums for landlocked countries (United Nations Conference on Trade and Development, 1977). The consequences encountered because of such delays, damage/defect and unpredictability are production setbacks which will affect product availability in stores causing customers to try to find alternate products or buy it from competitors. Hence, the benefit of IS may not have been realised in terms of quality because of the impact of logistical challenges which might have outweighed the effects of shared information.

Firms can make use of appropriate information to identify and understand customer needs from the perspective of cost or quality and develop strategies to accomplish those expectations. Nevertheless, the trade-off between cost and quality (quality may be compromised when firms focus on reducing cost) is evident and firms may have to make compromises to achieve a balance between the two. In the context of an emerging nation like Nepal, the demand to reduce the cost might be far-reaching than the demand to enhance the quality (Maskey, 2018). Producing cheaper and affordable products may be of greater priority to manufacturers for greater profitability than making high quality, luxurious products. Consequently, the association between IS and quality performance was not apparent.

According to Beamon (1999), delivery performance is also incorporated under output measures. However, in this study, delivery is considered as a separate measure because of its increased importance in today's globalised world. Many well-known companies, such as DELL, Ford and Wal-Mart, regard delivery as a major factor that affects their SCP and competitiveness (Zhou & Benton Jr, 2007). Furthermore, the context of this study is Nepal, a landlocked country with many logistical challenges. The results of this study confirmed that operational and strategic IS had significant effect on delivery performance. The results further show that operational and strategic IS have almost same effect on delivery performance as illustrated in Table 6 by similar standardised path coefficient (β). To meet customer's conditions for fast, correct and reliable delivery, SC firms should disseminate the relevant information, such as customers' need, accessible mode of transportation, the duration for delivery, tracking and tracing and disruptions or delay if any, with other chain members (Maskey, 2018). Moreover, information disseminated by the upstream members, such as production planning, inventory and capacity information increasing SC visibility can prove to be crucial in enriching delivery performance (Li et al., 2014). For businesses operating in a country like Nepal, the necessity to share such information with their trading partners becomes more evident considering the high logistics and transport uncertainties. With the availability of such information, firms can make necessary efforts to plan in advance including looking for alternate solutions when needed (Maskey, 2018). Furthermore, as discussed above, due to its logistical challenges, firms in Nepal may accumulate inventory for better delivery service while incurring higher inventory costs.

The growth of e-commerce in Nepal can be observed undoubtedly like other countries as people find it convenient when their shopping is delivered to their doorsteps. Due to Coronavirus (COVID-19), the demand for online shopping has increased greatly. The number of e-retailers in Nepal is growing such as *Thamel.com, Muncha.com, Daraz.com.np,* and *Sastodeal.com*. In addition, many new small-scale retailers are flourishing in Nepal selling their products electronically by advertising them on various social media platforms. Despite the size and scale of business, IS becomes critical for such companies as they need correct product and delivery information to serve their customers well.

Operational and strategic IS both had a significant and positive effect on flexibility performance. With the highest standardised path coefficients (β), the impact of operational IS followed by strategic IS on flexibility performance was substantial. The existence of uncertainty in the SC caused by the supply-side, demand-side and technological factors

makes flexibility an essential SC capability that all firms should possess. Flexible SCs will be able to meet customer demands and lower down the number of unhappy customers, respond to and accommodate demand fluctuations, production and delivery uncertainties, and introduce new products to markets (Beamon, 1999; Maskey, 2018). Flexibility is a capability that is enabled through information such as production and capacity planning, delivery estimates, tracking and tracing, supply or logistics disruptions and varying customer requirements shared by upstream and downstream SC partners. Natural calamities and political instabilities are the major sources of environmental uncertainties that are common in Nepal and are the main causes of the logistics and SC disruptions discussed previously. For example, in 2015 Nepal went through a major crisis caused by a massive earthquake which was exacerbated by a blockade from the Indian border. Hence, a proper risk management plan is crucial for firms in Nepal to deal with such uncertainties in the SC for which IS is a prerequisite.

The study conducted by Yigitbasioglu (2010) illustrated that the effect of IS was the strongest on output performance. However, this study demonstrated the strongest association between IS and flexibility performance. The possible explanation to this contrasting outcome could be the context of and the time difference between the two studies which might have changed the priorities of SCs or the customers (Maskey, 2018). With the advancement in technology and customer demands, the pressure for new product development, with a range of options in terms of colour, size and functionalities, has escalated immensely. SC firms are already made aware of the customers' expectations regarding quality products and better, faster and reliable delivery, it is now shifting towards flexible products and services that they spend their money on. The role of IS once again becomes crucial for SC members to deal well with unanticipated customer demand, changing product specification, capacity and the delivery requirements.

9. Conclusion

With cost, quality, delivery and flexibility considered as SCP metrics and IS considered as two distinct variables, this study examined how IS affected SCP. The results of path analysis concluded that IS significantly affected SCP with the model explaining 19%, and 7% of the variation in flexibility and delivery performance respectively. With negligible R^2 (R^2 = 0.028 and 0.004 respectively) value, the results also showed that cost and quality performance were not affected by operational and strategic IS. Furthermore, this study also concluded that the role of operational and strategic IS towards delivery performance was indistinguishable. In addition, it demonstrated that the effect of IS was strongest on flexibility performance.

9.1 *Contribution*

Towards the aim of accomplishing customer satisfaction via IS, this study established the connection between IS and the four main components of customer satisfaction. The literature consists of limited studies, especially in the context of developing countries, that looked at the relationship between IS and SCP. Out of those studies, different authors considered different aspects of performance with none looking at cost, quality, delivery and flexibility simultaneously. In addition, very few of them have considered IS as a multidimensional variable. Hence, this study presented empirical evidence for the effect of operational and strategic IS on cost, quality, delivery and flexibility.

It is noteworthy that operational IS had stronger effect on flexibility performance than strategic IS. This type of precision was accomplished in this study by considering IS as well as the SCP as multidimensional variable (Moberg et al., 2002). This result supports and accentuates Moberg et al. (2002) proposition that IS should be continued to be measured as a multidimensional variable in future research.

Considering the effect of increasing SC uncertainty, this study considered flexibility as one of the performance metrics and was able to ascertain that flexibility of a SC firm is what is affected the most by IS. While the role of flexibility has not been recognised well in SCs (Beamon, 1999), this study emphasised the need of being flexible as the topmost criteria for firms to stand out from the crowd. This study also provided an indication that SC participants' preferences have swerved more towards improving delivery and flexibility performance as a countermeasure of customers' increasing demands towards faster delivery and flexible products or services.

9.2 *Limitations and direction for future research*

Although this study achieved what it tended to achieve, there were some limitations that might have an implication on the results. The first limitation was the lower response rate than desired even though the composition of respondents represented the targeted companies. The second limitation was that the alpha value for operational IS and cost performance was low ($\alpha = 0.66$), even though it has been deemed acceptable for research purpose. However, according to Moberg et al. (2002), low reliability value have a tendency to limit the rationale to explain the results which are non-significant in a particular study while it has strong theoretical support in the literature. It is imperative to improve the reliability of operational IS and cost performance measures and hence, future research should consider reframing the items to increase the value of the research. The third limitation is that study focuses only on flexibility even though flexibility is just an element of agility that helps SC firms to be agile. The final limitation is that the majority of the respondents were manufacturers (56%) while this study targeted SC members from all sectors. This might have impacted the association between IS and cost performance as most of the manufacturing companies in Nepal are large companies compared to other sectors and must have a good control over their cost. This might have caused them to provide imprecise information related to cost.

Conflict of interest statement

We have no conflict of interest to disclosure.

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