Could supply chain technology improve food operators’ innovativeness? A developing country’s perspective

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The developing economies’ food industry is undergoing a rapid transformation in response to the evolving consumer demands and intensifying competition. Firms in this sector are increasingly developing their innovative capabilities by adopting supply chain technology in order to sustain their competitive advantage. This study develops a framework which captures the impact of the supply chain technology on firms’ innovativeness, more specifically the level of product, process and relational innovation. This framework was empirically tested using cross-sectional data collected from both upstream and downstream perspectives of firms positioned at different nodes. The findings demonstrate that such supply chain technology has a significant impact on firms’ relational innovation performance, while its effect on process innovation is only marginal. Product innovation however, is not associated with supply chain technology adoption.

Introduction
The food industry in many developing countries is increasingly recognised as one of the sectors that could generate significant economic benefits. Despite the evidence of rigorous growth, increased globalisation, rapid urbanisation and stringent regulations concerning food safety and regulations have resulted in intense competition (Lowe, Phillipson, & Lee, 2008; Wilcock, Pun, Khanona, & Aung, 2004). In emerging economies, the logistics and distribution processes pose greater challenge owing to unpredictable environment, weaker infrastructure and uncertainty in the availability of basic necessities such as power and water. In India for instance, 35–40 per cent of fresh fruits and vegetables are wasted due to inadequate and inefficient storage and poor logistics infrastructure (Joshi, Banwet, Shankar, & Gandhi, 2012). A high margin of product losses offers a significant opportunity for improvements and advocates for technology and research advancement within this domain. Over the past few decades, the emphasis has been on supply chain technology as a strategic initiative, in which firms could develop innovative capabilities in various areas such as new product and process development, service delivery, capacity planning and market expansion to gain sustainable competitive advantage (Karkkainen, 2003; Keleporis et al., 2007).

While the role of technology in synergising the logistics and supply chain management is well comprehended in the literature, little empirical evidence exists in the food industry. Within the food and technology literature, few studies (Karkkainen, 2003) have outlined the potential use of RFID in reducing the food spoilage through enhanced distribution and efficient logistics process. The technologies which can be utilised to track and trace the movement of products from farm to table not only help firms to maintain fresh produced, yet could be exploited to prevent food safety incidence such as the recent horse meat scandal from occurring, which in return could facilitate firms in retaining consumer confidence. By meeting customer requirements and inspiring consumer confidence, firms can proactively safeguard their businesses and gain competitive advantage. Other scholars have explored the use of information gathered at Electronic Point of Sales (EPOS) in developing knowledge on consumer behaviour and purchasing patterns. Despite the importance of these existing studies, their contribution depends on the extent to which they are empirically tested since qualitative study approach limits the extent to which the findings could be generalised. Moreover, the majority of these studies are conducted in developed countries, particularly in the UK, Greece

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and the U.S. The validity of a theory developed relies on the extent to which it can be generalised to other international settings, which have unique economy, culture and social behaviours. The developing economy’s food industry specifically is confronted with distinct issues along with different consumer purchasing patterns affected by various cultures and ethnicity (Shamsudin & Selamat, 2005), which may prevent substantial development in the sector. For example as opposed to the developed country such as the U.K. the Malaysian food industry has fragmented supply chain with distribution channel is separated from the production systems, which may influence the findings.

In this paper, we extend the existing knowledge by investigating the practicality of supply chain technology in enhancing food operators’ innovativeness, with Malaysia being an example of a developing nation. In order to better understand this issue, this paper developed a conceptual model explaining the impact of supply chain technology on relational, product and process innovation at the firm level. Cross-sectional data from Malaysian businesses involved in food supply chain were collected to validate the conceptual model. Successive research could potentially use the insights to implement proper supply chain technology to achieve innovative capability.

**Literature review**

**Innovation in the food industry**

Innovation refers to the generation, acceptance and implementation of new ideas, processes, products or services, which provide improvement to the adopting organisation as well as customers (Damanpour, 1991). For the customers, the value is reflected in lower cost products or services with improved attributes, while for firms the value is indicated by higher returns, increased market shares, new customers or markets (Schumpeter, 1949). Innovation is increasingly recognised as one of the main source of organisational success, high performance and survival of a company, regardless of its size and the industry it belongs to. While extant literature traditionally regards food industry as a sector that is relatively mature, slow growing and display low research intensity (Costa & Jongen, 2006), innovation has increasingly becoming one of particular interest.

Recent socioeconomic developments have resulted in a change in performance requirements for food supply chains, forcing firms to enhance innovativeness. New product development is often recommended as a strategy to help maintain growth. Consumers push the product innovation process by their wants and needs as well as knowledge gain from education and media. Owing to the significant changes in lifestyles and values, as well as global character of food market, consumers are becoming more heterogeneous, which makes their food choice harder to understand and predict. Hence it is not wise to assume that consumers share the same preferences and taste. They demand unique flavours and health promoting diet which are closely tailored to their individual needs (Costa & Jongen, 2006).

While recent general advances in areas such as biotechnology, nanotechnology and preservation technology offers various opportunities for added value applications in the food industry; consumers are becoming more concerned over the food additives such as preservatives and colouring (Sarkar & Costa, 2008). Environmental and sustainability policies have also brought changes to the innovation process in the food industry. Consumers are becoming increasingly interested in buying food from environmentally sound production and comply with animal welfare principles, inspiring international organizations to include these attributes in their works towards improvement of quality standards (Pullman, Maloni, & Carter, 2009). Recent controversies involving horse meat scandal has further forced authorities to enforce stringent regulations involving food adulterations. This incidence results in more sceptical consumers demanding for greater traceability, requiring manufacturers to start looking at their supply chain holistically to avoid future reproach (Premanandh, 2013). This demands them to invest in modern tracking methods that could improve the product traceability.

These changes and developments in the food industry, as well as the nature of the product characteristics, have clearly indicated an essential need for firms to improve their organisational innovation capabilities. The advancement of information technologies in managing the supply chain and logistics operations is seen as a catalyst for firms to build their innovative capacity. By exploiting the technologies, they would be able to optimise their production and distribution process, reduce their operational costs, develop good relationships with trading partners, improve the quality of products produced and satisfy the diversifying customers’ demands. Examples of such technologies include Electronic Data Interchange (EDI), data loggers, Reeser Gensets and Radio Frequency Identification (RFID) (Hill & Scudder, 2002, Regattieri, Gamberi, & Manzini, 2007).

**Impact of information technology on firms’ innovativeness**

Various empirical evidence suggest that supply chain technology has a positive effect on innovation performance; in which it allows firms to develop innovative capabilities in various areas such as new product development, process improvement, service delivery, capacity planning and market expansion (Li, Kehoe, & Drake, 2005). In this study, the impact of supply chain technology on firms’ innovativeness was examined in terms of relational, process and product innovation.

Relational innovation refers to the ability of firms to expand into new markets, strengthen the business networks and improve their relationships with suppliers and customers (Lefebvre, Cassivi, Lefebvre, & Leger, 2003). Supply chain technology offers a new communication medium and creates an opportunity for food operators to establish interactive relationships with supply chain partners through
information sharing. For instance, the deployment of e-procurement systems enable firms to exchange operational data such as level of inventory, new order, payment status, invoice and transportation schedule (Angeles & Nath, 2007). Other supply chain technologies such as an electronic marketplace, provide businesses opportunities to identify suppliers or customers, compare prices, terms and negotiation, as well as conduct basic commerce transactions online (Eng, 2004; White, Daniel, Ward, & Wilson, 2007). This technology allows companies to expand globally and enter new markets that were previously limited due to geographical barriers. Notwithstanding these, the adoption of information technology could also facilitate in meeting the customer requirements and inspiring consumer confidence, leading to the industry sustainability. For instance, the deployment of RFID technology in the EU food industry to determine whether the food products contain genetically modified organisms (GMO) increase consumer safety by providing detailed information about the product’s components, origins and processing history (Regattieri et al., 2007). This provides market leverage that food businesses could exploit to gain business advantage over competitors. It is apparent therefore, that IT could serve as an important enabler for the relational innovation at the firm level. Based on this argument, this study posits that:

**H1. Supply chain technology adoption is positively related to a firm’s relational innovation performance.**

Process innovation is typically introduced to improve operational efficiency, reduce costs, increase flexibility, responsiveness and performance of production and distribution activities (Jusoh & Parnell, 2008; Prajago, Loasirihongthong, Sohal, & Boon-Itt, 2007). There is substantial empirical evidence to support the importance of technology in process innovation (Hill & Scudder, 2002; Kelepouri, Pramatari, & Doukidis, 2007). The adoption of supply chain technology has the potential to enhance the speed, quality and quantity of information exchanged (Wu, Yeniyurt, Kim, & Cavusgil, 2006). Timely and accurate information flows enable firms to reduce uncertainties and improve operational efficiencies. For example, the integration of vendor-managed inventory (VMI) systems with electronic data interchange (EDI) and identification system such as scanners and bar-code in supermarkets grant suppliers access to their customers’ real-time inventory data and replenish stock on a proactive basis (Disney & Towill, 2003). By allowing firms to access the real-time data rather than forecast data, buffer inventories can be removed, resulting in reduced inventory costs. Organisational investment in supply chain technology devices such as RFID, which can facilitate in product tracking, offer firms great opportunities for the efficient traceability process in the supply chain from harvest through transport, storage, processing, distribution and sales at significantly reduced labour costs (Attaran, 2007; Opara, 2003). In the agri-food sector, farmers utilise the technology to capture information such as soil type and conditions, which are important in determining the quantity of pesticides used on a specific crop leading to a better environmental impact (Aubert, Schroeder, & Grimaudo, 2012). This is pertinent issue since there is increasing concern that pesticides may affect non-target organism and contaminate soil and water media, as well as residues in food supply. Drawing upon this literature, this study therefore hypothesises that:

**H2. Supply chain technology adoption is positively related to a firm’s process innovation performance.**

Product innovation can be referred to as the introduction of new goods or services into the market and enhancing the quality of existing products (Jusoh & Parnell, 2008; Prajago et al., 2007). Some studies demonstrate that information technology adoption has a positive effect on a firm’s product innovation performance (Dobbs, Stone, & Abbott, 2002; Fearne & Hughes, 1999). The integration of bar-coding, electronic point of sales (EPOS) and data warehousing technologies allows firms to gather and manipulate information for developing knowledge about consumers’ purchasing behaviours. This ability has ultimately enabled firms to engage in new product development that could satisfy the diversified customers’ demands. The development of new ingredients for instance, has been underpinned greater knowledge that tailors to the individual requirement. In addition, the implementation of supply chain technology, such as Time-Temperature Integrator can result in an improved quality of food products. The technology provides firms the ability to monitor the temperature of perishable food at each stage of the supply chain and reveal any abusive storage conditions that may affect the product attributes (Sahin, Babai, & Dallery, 2007). Following this trait, this study asserts that:

**H3. Supply chain technology adoption is positively related to a firm’s product innovation performance.**

Following the extant literature, a research framework was developed. The framework posits that supply chain technology adoption in food operations has a positive influence on organisational innovativeness comprising product, process and relational innovation (Fig. 1).

**Research methodology**

**Operationalisation of constructs**

The constructs used in this study are measures from the literature which were adapted to the context of this study. The independent variable—supply chain technology adoption, was measured using two items adapted from Zhang and Dhaliwal (2008) and Ranganathan, Dhaliwal, and Teo (2004). Respondents were asked to indicate the percentage of transactions conducted electronically with suppliers and customers. Based on Moore (1998), Lefebvre et al. (2003) and Aramy, Ondersteijn, and Kooten (2006), nine items were adopted to measure the level of a firm’s relational, product and process innovation performance. These items assess the extent to which the technology adoption in
Food supply chain operations has increased a firm’s capability to produce a variety of new products, improve the quality of food produced, enhance the logistics and distribution process and improve the relationships with trading partners. Respondents were asked to rate their perceptions on the level of their firm’s innovative capabilities in relation to technology adoption on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

Survey administration and sample

This study employed a survey method, using a questionnaire, to test the conceptual model and hypotheses developed. The questionnaire was pilot-tested with a sample of twenty-seven organisations in the food industry. Feedback from the pilot test was used to refine the questions for the larger study. The sampling frame for this study was drawn from the list of companies involved in the Malaysian food industry registered with Malaysian External Trade Division Corporation (MATRADE). They included input suppliers, agricultural producers, food manufacturers, wholesalers, import and export agents, distributors and retailers. In order to avoid a case in which some members of the population were significantly under or over represented by the sample, this study utilised a stratified random sampling, which was made based on the size and organisations’ position in supply chains. Only firms that have adopted supply chain technologies (i.e. ERP, EDI) were included in the sampling frame. A questionnaire, including a cover letter, self-addressed and stamped envelopes was mailed to the CEO, managers or owners responsible for IT-related decision making in the firm. Of 1200 questionnaires mailed out, 253 questionnaires were returned, which resulted in a 21% response rate. Table 1 presents the sample characteristics. The results reflect a fair distribution of sample across sizes and sectors.

Fig. 2 presents the forms of collaboration through IT applications adopted by the organisations in their supply chain operations. The most widely used technologies among the responding firms were e-marketplace and e-procurement systems. Although EDI has been in the market for a long time, the uptake of this technology implementation was low among the firms surveyed. The inter-organisational standard on document format and structure may make such technology difficult to follow (Iacovou, Benbasat, & Dexter, 1995). In addition to the e-procurement and e-marketplace, a fairly large number of firms also adopted bar-coding technologies. This is expected, as most items purchased today in the local supermarkets and grocery stores are bar coded. Although Radio Frequency Identification (RFID), data loggers and time-temperature integrators provide enormous opportunities in the food supply chain operations (Salin, 1998), these technologies were not implemented as much as expected. These could be due to the high initial setup costs (Attaran, 2007). The Malaysian food industry is characterised by small and medium enterprises, which cannot afford the investment, maintenance and technology upgrade costs. Further, more advanced technology such as RFID is still in an early phase of implementation in Malaysia. Lack of awareness, benefits and market leadership may prevent firms in the industry from pursuing the technology adoption.

Analysis and findings

This study employed structural equation modelling (SEM), with a two-stage model estimation, as recommended by Anderson and Gerbing (1988). In this approach, a confirmatory factor analysis (CFA) was first conducted, followed by a structural model analysis. By employing this approach, the source of poor model fit can be identified easily. The model fit was evaluated based on multiple fit indices, which include p-value for chi-square index, Goodness-of-Fit Index (GFI), Standardised Root Mean Square (SRMR), Root Mean Square Error of Approximation (RMSEA), Tucker—Lewis Index (TLI) and Comparative Fit Index (CFI) (Bollen & Long, 1993; Schumacker & Lomax, 2004). Iterative modifications were made to

Table 1. Profile of respondents.

<table>
<thead>
<tr>
<th>Position in the chain</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input supplier</td>
<td>30</td>
<td>11.8</td>
</tr>
<tr>
<td>Agri-producer</td>
<td>34</td>
<td>13.4</td>
</tr>
<tr>
<td>Packaging supplier</td>
<td>37</td>
<td>14.6</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>42</td>
<td>16.5</td>
</tr>
<tr>
<td>Wholesaler/agent/importer/exporter</td>
<td>41</td>
<td>16.1</td>
</tr>
<tr>
<td>Logistics and transportation</td>
<td>30</td>
<td>11.8</td>
</tr>
<tr>
<td>Retailers</td>
<td>39</td>
<td>15.4</td>
</tr>
<tr>
<td>Total</td>
<td>253</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual sales revenue (in Ringgit Malaysia)</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 250 thousand</td>
<td>39</td>
<td>15.4</td>
</tr>
<tr>
<td>250 thousand–1 million</td>
<td>53</td>
<td>20.9</td>
</tr>
<tr>
<td>1 million–10 million</td>
<td>63</td>
<td>24.8</td>
</tr>
<tr>
<td>10 million–25 million</td>
<td>53</td>
<td>20.9</td>
</tr>
<tr>
<td>More than 25 million</td>
<td>45</td>
<td>17.7</td>
</tr>
<tr>
<td>Total</td>
<td>253</td>
<td>100</td>
</tr>
</tbody>
</table>
improve the model fit statistics by observing the standardised residual covariance matrix, modification indices, sample correlations and regression coefficients (Byrne, 2001). Only one item was altered at a time to avoid over-modification of the model (Joreskog & Sorbom, 1989).

Measurement model test

A measurement model, comprising all the constructs of interest, was evaluated. The data fit the model well, $\chi^2 (39) = 79.49, p = .08$, implying that the data fit the model sufficiently. Furthermore, both incremental (GFI = .95, RMSEA = .06, SRMR = .04) and absolute fit indices were within acceptable levels (GFI = .95, CFI = .98, TLI = .98).
TLI = .98 and CFI = .98) and absolute index (RMSEA = .06 and SRMR = .04) achieved their cut-off values.

Two psychometric tests - validity and reliability were further conducted on the full measurement model. As shown in Table 2, all the constructs had composite reliability values of greater than the threshold point of .60 (Bagozzi & Yi, 1988). In addition, the average variance extracted (AVE) of these constructs achieved the cut-off point = .50 (Hair, Anderson, Tatham, & Black, 1998). Using Fornell and Larcker (1981) approach, the discriminant validity was tested; and all the scales had a substantially higher AVE value compared to their correlation with other constructs, providing evidence of discriminant validity (Table 3). Additionally, all the factor loadings of items tested were significant at p < .001, demonstrating a good convergent validity. In summary, the measurement model satisfies various validity and reliability criteria. Therefore, constructs developed in this measurement model could be used to test the structural model and the associated hypotheses (Table 4).

Testing the structural model

Assuming that the measurement model satisfied the psychometric assessment, a structural model was constructed based on the results of the measurement model. The analysis resulted in $\chi^2$ (43) = 84.60, $p = .09$, implying that the model fit the data well. Additionally, all fit indices achieved the recommended threshold values (GFI = .94, TLI = .97, CFI = .98, RMSEA.06, SRMR = .04). The model explained 88 per cent of the variance in relational innovation. Both product and process innovation had a relatively low percentage of variances - 2.0 per cent and 3.0 per cent respectively. This result showed that supply chain technology had a large effect on the relational innovation as compared to process and product innovation.

The result of the structural model was used to test the hypotheses. The examination of the hypotheses was based on the t-value. A value which is greater than 1.96 represents a significant path. Supply chain technology was found to have a positive effect on the relational innovation ($t = 15.90; p < .001$), thus supporting $H_1$. On the contrary, this study found that Supply chain technology had a marginal effect on the process innovation ($t = 1.91; p < .057$), and a non-significant effect on the product innovation ($t = .70; p = .48$). Hence $H_2$ and $H_3$ were rejected.

Discussion and findings

The structural model tested provides some evidence that relational innovation of a firm is dependent on the supply chain technology. As predicted in $H_1$, the greater the supply chain technology adoption in business transactions, collaborations and communications among the food operators, the greater the relational impact on a firm. This is expected, as an analysis of the technologies deployed (Fig. 2) shows the majority of responding firms participate in e-marketplace, which enabled them to expand into new markets and strengthen networks with supply chain partners. Consistent with previous research (Eng, 2004; White et al., 2007), investment in supply chain technology such as e-marketplace may generate structural bonds among partners, thus enhancing relationships.

Previous studies have indicated that supply chain technology would lead to process and product innovation in firms (Kelepouris et al., 2007; Li, 2005). Nevertheless, in this study, technology emerged as an insignificant factor. Specifically, we conclude that greater supply chain technology adoption is not related to a firm’s ability to improve the performance of production and distribution activities as well as introduction of new goods or services into the market. The volume and types of technology deployed might offer some insight into this finding. A closer investigation on the types supply chain technologies used between firms in the sample (Fig. 2) reveals that the use of sophisticated and advanced IT tools such as RFID is still beyond the means of some developing economies’ food businesses such as Malaysia. As suggested in previous studies, while resources such as technology could serve as competitive advantage, firms are only able to enjoy the improved

<table>
<thead>
<tr>
<th>Constructs</th>
<th>SD</th>
<th>Mean</th>
<th>RI</th>
<th>PC</th>
<th>PD</th>
<th>SPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relational innovation</td>
<td>.30</td>
<td>4.22</td>
<td>.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process innovation</td>
<td>.24</td>
<td>4.91</td>
<td>.15</td>
<td>.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product innovation</td>
<td>.65</td>
<td>3.34</td>
<td>.04</td>
<td>.01</td>
<td>.70</td>
<td></td>
</tr>
<tr>
<td>Supply chain technology</td>
<td>.67</td>
<td>2.43</td>
<td>.74</td>
<td>.10</td>
<td>.05</td>
<td>.70</td>
</tr>
</tbody>
</table>

Note: The numbers in bold in the diagonal row are square roots of the AVE, SD = Standard Deviations.

<table>
<thead>
<tr>
<th>Path</th>
<th>Standardised coefficient</th>
<th>t-value</th>
<th>p-value</th>
<th>S.E</th>
<th>Hypotheses</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>RI ← SPT</td>
<td>.84</td>
<td>15.90*</td>
<td>.00</td>
<td>.06</td>
<td>$H_1$</td>
<td>Supported</td>
</tr>
<tr>
<td>PC ← SPT</td>
<td>.16</td>
<td>1.91</td>
<td>.06</td>
<td>.06</td>
<td>$H_2$</td>
<td>Not supported</td>
</tr>
<tr>
<td>PD ← SPT</td>
<td>.05</td>
<td>.70</td>
<td>.48</td>
<td>.04</td>
<td>$H_3$</td>
<td>Not supported</td>
</tr>
</tbody>
</table>

$x^2 = 84.60, p < .00$, Bollen-Stine $p = .09$, RMSEA = .06, SRMR = .04, GFI = .94, CFI = .98, TLI = .97

Note: RI = Relational Innovation; PC = Process Innovation; PD = Product Innovation; SPT = Supply chain technology.
performance in the short term. In order to sustain these potentials over time, firms need to find resources that are costly to imitate and difficult to substitute. Simply adopting the off-shelf technologies may not necessary induces competitiveness, unless the firms combine these technologies with additional complimentary resources. Additionally, the lag effect of IT implementation may also be responsible for the contradicting result. While researchers have emphasized that technology investment are made with long-term goals, this study do not test the sustained effect of IT investment.

Conclusion and implications

This study offers theoretical and practical contributions by demonstrating how supply chain technology adoption in food supply chain operations can impact a firm’s capability to innovate. This research offers a theoretical view to improve the knowledge of technology adoption in food supply chains by uncovering the different impacts of IT in distinct sectors and economic settings. To the best of our knowledge, this has not been empirically tested before in the context of food supply chains in a developing nation.

Our study implies that the adoption of supply chain technology in the emerging economies’ food industry is still at infancy stage and renders much attention. In contrast from the developed nations, Malaysian food businesses are unable to reap the benefits from the technology deployed. Unlike Malaysia, food operators in developed countries such as U.K. have been able to benefit directly from this strategy through strategic alliances, which are based on mutual advantage. They have created a web of inter-firm alliances and network which becomes a platform for them to share various new product ideas from suppliers, manufacturer and packaging firms. Behind this, firms in the U.K. claimed to have long-term relationship, which are based on trust, encouraging them to develop and disseminate knowledge throughout the innovation network. On the other hand, innovations in developing countries such as Malaysia, remains a highly challenging and complex process owing to the attributes of the local food network which are fragmented, with agribusiness activities conducted in isolation from marketing and distribution systems. In order to leverage these on-going innovation processes through supply chain technology adoption, firms therefore should establish close, long-term relationships and develop trust with their suppliers and customers as this is crucial for open communications and high degree of information sharing. IT adoption in supply chains can generate information that helps build innovation capabilities to the extent that information and knowledge is shared. Further, they should also contemplate on entering alliances with their supply chain partners as this would allows them to share the costs of large IT investment and acquired additional knowledge that add to their organisational innovation performance. This is beneficial particularly for SMEs, as they are constrained by limited resources.

Managers need to keep in mind the importance of expanding linkage and performing more transactions using advanced supply chain technologies with suppliers and customers to enhance the overall innovation capabilities. Major attention should be given on the modern tracking IT systems that could improve the product traceability as this could facilitate firms in tackling the issue of food quality and safety, which is important for local food businesses in order to stay abreast and maintain the international demands for their products. While the implementation of traceability technology may represent an expensive investment, such initiative may become potential source of competitive advantage mainly in logistics processes (Montanari, 2008). Although the utilisation of mature technology such as bar-code, by food operators in the emerging economy has undoubtedly allowing firms to gain operational benefits, these might prevent them from attaining substantial innovative capacity as time goes by. Although the investment in the technology can enhance the opportunity to innovate, yet a proactive collaboration among chain partners is required. As for future trends, it is believed that the food businesses in the emerging economy may successfully adopt numerous supply chain technologies not only in managing relationships with different actors in the network, yet to better satisfy the heterogeneous requirements of customers. For instance, the use of e-marketplace may not only restricted to expand into new markets and strengthen networks with supply chain partners, yet it can also use to record and review ideas from external sources, particularly in developing new products.

While this study may provide useful insights on the impact of supply chain technology on a firm’s innovative capabilities, there are some limitations which need to be addressed. First, since this study was conducted in Malaysia, it may limit the generalisability of the results to Malaysian-based organisations. There may be particular characteristics of Malaysian organisations that might not apply to other developing countries. Secondly, further research should considers incorporating additional variables such as leadership and managerial skills as these may affect the impact of supply chain technology adoption on firm innovative capacities. It is also recommended that future studies should consider a larger sample size. Ideally, a larger sample size would provide a clearer understanding of the relationships between the variables. Despite the limitations of the study, it is believed that this study offers important implications for supply chain research and practice by providing information on the relationship between supply chain technology adoption and organisational innovative capability in a food industry of developing nation.

Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.tifs.2014.04.003.
References


