Determinants of ICT Investment Intensity: A study of Food Processing Industry in India

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Abstract

Information and communication technology (ICT) is a general purpose technology (GPT) that has the potential for significant impact on many industries in an economy. Adoption of ICT can benefit the firms in the industries in terms of efficiency, effectiveness, innovation, growth and competitiveness. For India, food processing is as an important industry in terms of its contribution to gross domestic product (GDP), employment and investments. Hence, the objective of the present study is to identify the determinants of ICT investment intensity for the firms belonging to the food processing industry in India. Secondary data is collected from the Prowess database provided by Centre for Monitoring Indian Economy (CMIE). The time period is four years from 2011 to 2014. Panel data regression technique is used for the analysis. Preliminary results indicate that capital intensity is the most important determinant of ICT investment intensity in this industry. Other factors like age of the firm and size of the firm are also statistically significant in select econometric models.

Introduction

Information and communication technology (ICT) contributes substantially towards any nation's economic development (Kyobe, 2011). ICT is a general purpose technology (GPT), that is, it is an idea or technique that has the potential for significant impact on many industries in an economy (Guerrieri et al., 2011). ICT improves the economic competitiveness by reinforcing the connection between economic and social activities. ICT is also considered as a key tool to participate in global market, encourage political accountability and improve the delivery of services and local development opportunities (Tiago et al., 2007). Many studies (Vu, 2005; Takahito and Kazuyuki, 2007; Hawash and Lang, 2010; Farhadi and Fooladi, 2011) have found a positive impact of ICT on economic growth of a country. Takahito and Kazuyuki (2007) studied the role of information technology on economic growth in Japan and Korea during 1985 to 2004 using growth accounting framework. The result of the study shows that the contribution of information technology is important for the growth of gross domestic product (GDP) in both Japan and Korea. The study also revealed that IT-producing sector contributes significantly to total factor productivity (TFP) in both the countries.

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Vu (2005) noted that information and communication technologies have a significant impact on most of the countries in terms of communication, working and learning. By considering 50 major ICT-spending countries, including both developing and developed, the study analyzed the contribution of ICT on economic growth. Result of the study revealed a positive contribution of ICT. The study also noted that products based on ICT are superior to those based on non-ICT for improving the efficiency of output growth. Further, higher the level of ICT, higher the output growth rate. Thus information and communication technology is important for the growth of an economy.

Adoption of information and communication technology is important for different industries as ICT benefits them in terms of efficiency, effectiveness, innovation, growth and competitiveness (Consoli, 2012; Kannabiran and Dharmalingam, 2012). Lal (2004) noted that ICT is a pervasive technology since it is used not only for the shop floor processes but also for non-production processes like product design, marketing and after sales support. The study also stated that adoption and use of ICT with e-business reduces the coordination costs and leads to efficient markets.

Information and communication technology also is considered as a fundamental tool for a firm's growth (Limbu et al., 2014). The technology brings changes to the process of business by modifying the storage, retrieval, processing and dissemination of information (Apulu and Ige, 2011). Some studies (Moriones and Lopez, 2007; Alam and Noor, 2009; Mouelhi, 2008; Kalkan et al., 2011; and Yildiz et al., 2013) have found a positive impact of ICT on firm's performance in terms of productivity, profitability, market value and share, efficiency, service quality, cost savings, organizational and process flexibility and customer satisfaction. Use of ICT provides businesses an opportunity to compete globally by not only improving their efficiency, but also establishing closer relationships with their customers and suppliers (Alam and Noor, 2009).

Kossai and Piget (2014) noted that firms invest in ICT to become successful in competitive markets. Hence ICT is considered as an important factor of progress. ICT also serves as a vehicle of innovation by encouraging the firms to invent in new products and services. Kossai and Piget (2014) examined the relationship between adoption of ICT and performance of Tunisian electrical and electronic industry. They found that the use of ICT is associated with better performance of the industry. The study found a positive impact of ICT on firm performance. Tarute and Gatautis (2014) observed that ICT improves the overall financial and operational performance if it is used properly. The study confirmed that the use of ICT

improved both internal and external communication and also improved the innovation performance of small and medium enterprises (SMEs).

To summarize, adoption of information and communication technology by the firms is important for growth and performance from the point of view of economy, industry and the firm itself. Hence the aim of the paper is to identify the factors which influence the adoption of information and communication technology in food processing firms operating in India. The following section gives an overview of food processing industry in India and the role of ICT in the industry.

Food Processing Industry

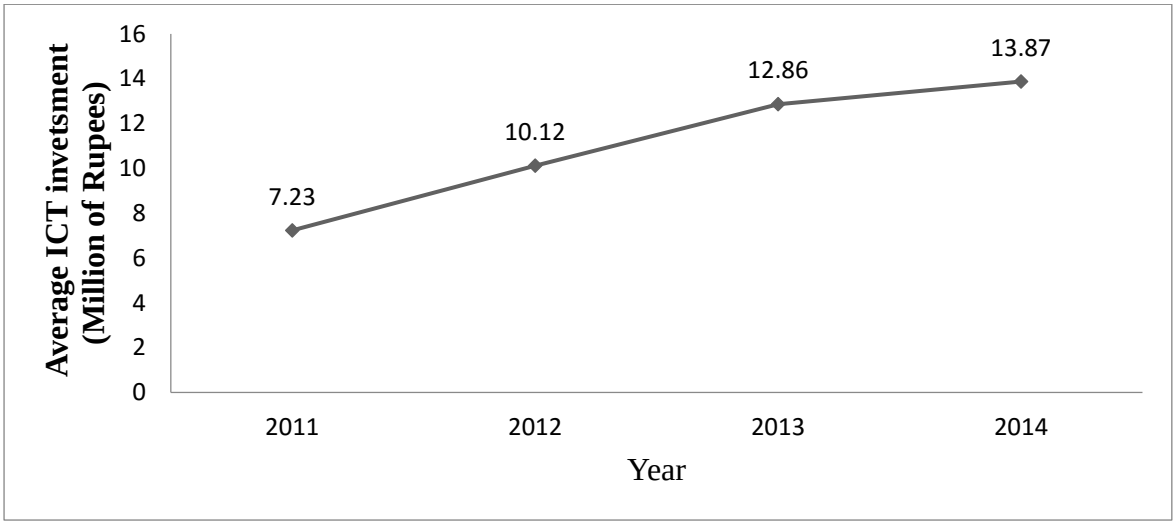
India is a richly endowed agricultural nation. Food processing industry is ranked fifth in India in terms of production, consumption, export and expected growth (Rais et al., 2013). Food processing is the transformation of raw ingredients into food by taking clean, harvested crops butchered animal products to produce attractive, marketable and long shelf-life food products. It is considered as a sunrise industry across the world because of its large potential for growth and socio economic impact (Rais et al., 2013). This industry has the responsibility of serving safe, readily available, affordable and quality food products to its consumers (Lehmann et al., 2012).

The food processing industry is viewed as one of the most promising sectors for creating jobs. It employs about 13 million people directly and 35 million people indirectly (Rais et al., 2013). In the last few years, the food processing industry is growing faster than agricultural sector. It is considered as an important industry of Indian economy in terms of its contribution to gross domestic product (GDP), employment and investment. During the last five years ending 2012-13, food processing industry sector was growing at an average annual growth rate (AAGR) of around 8.8% as compared to around 3.3% in agriculture and 6.6% in manufacturing (MOFPI, 2014). Food processing industry needs to be efficient in order to build on an appropriate organization, control the processes and give assurance to its consumers on the safety and quality of the food products. To become efficient and sustainable, the industry should use information and communication technology like global networks, the internet, networked devices, sensors, and communication intelligence (Lehmann et al., 2012).

Information technology adoption in food processing firms or agri-food firms is important since it offers them wide range of benefits like reduction in transaction cost, easy entry to

global market, improvement in transaction speed, maintenance of better relationship with firm's suppliers and customers, and improvement of firm's overall efficiency and performance. Figure-1 shows the average amount of ICT related investments undertaken by the firms in the present study sample during 2011-2014. Here ICT investment includes net investments on software, computers and information technology systems and communication equipments apart from software charges and information technology enabled services charges. The graph shows an increasing trend in ICT investments. Thus, for the sample firms, the average ICT investments have almost doubled in four years from Rs. 7.23 millions in the year 2011 to Rs. 13.87 millions in the year 2014.

Figure 1: Average ICT investments by the firms in the present study sample



Source: CMIE Prowess data on 111 sample firms

There are some studies which have examined how information technology is essential for food processing firms. Baourakis et al. (2002) have identified that adoption of e-commerce in agri-food firms reduces the transaction cost and helps the firms to easily enter into an international market. They also found that e-commerce gives four important competitive advantages to the firms, namely, reduction in intermediate costs associated with wholesale and retail activities, reduction in purchasing costs, aid in selection and processing of information and help in expansion of the market share. In the case of dry food packaging industry, Sadrzadehrafiei et al. (2013) noted that implementation of enterprise resource planning (ERP) is necessary for a firm to better integrate and coordinate the business functions like manufacturing, inventory and assembly between all locations. It also helps industry to track the production costs and quality during the manufacturing process.

Supply chain management is an important aspect of food industry. Firms need to coordinate the information effectively with the supply chain members for better performance. Use of information technology helps firms to bring efficiency in the process of supplying products to the customers. Hill (2000) observed that use of electronic data interchange (EDI) is suitable for food industry since the industry has large volume and variety of products. EDI also increases the cooperation among supply chain members and reduces the flow of inaccurate information. Another study by Hill and Scudder (2002) examined the use of EDI for supply chain coordination in the U.S. food industry. The study noted that use of EDI with supply chain management techniques improve efficiency within the food industry's supply chain. They noted that firms that use EDI for frequent and routine transactions, invoices and purchasing orders have improvement in firm's operational efficiency. Akkerman (2008) developed a decision support tool and examined how this tool helps in reducing product losses in the food-processing industry. The study found that decision support tool helps the food processing manager to reduce the planning related losses by nearly 20%. The tool also helps in improving interaction between processing, packaging and intermediate storage.

To stay competitive and survive for a long period, it is important for firms to maintain good relationship with their suppliers, customers, and the government. Mavridis et al. (2008) noted that food and beverages firms use ICT to improve internal and external communications, to increase the speed of access to information, to simplify business processes, to improve business efficiency and to reduce operational costs. In the context of pork processing industry, Han et al. (2009) noted that use of information technology in supply chain not only improves the quality and reduces the delivery time and cost but also improves the firms' competitiveness leading to further growth. Another study by Domenech et al. (2014) noted that adoption of ICT technology is a key innovation for firm's internal operations and to maintain relationship with external actors.

To summarize, adoption and use of ICT technologies is very important in food processing industry in order to reduce the operational costs, improve the speed of transactions, maintain better relationship with external actors, improve the supply chain management, improve firm efficiency, performance and to survive in a competitive industry. The following section attempts to identify the factors that influence investments on information and communication technology in firms in general.

Factors Influencing Adoption of ICT

Age of the firm

Age of the firm is considered as an important factor that represents the experiences and insights gained by the firm over time (Narayanan and Bhat, 2009). Age helps the firm to discover what they are good at and learn how to do things better. When the firm becomes experienced, they find the ways to standardize, coordinate, and speed up their production process as well as reduce costs and improve the quality (Loderer and Waelchli, 2009). Experience makes the firm to take proper decision in information technology investment.

There are some empirical studies that have analyzed the impact of age of the firm on information technology investment. Dunne (1994) examined how the technology use varies by plant age and size in U.S. manufacturing plants. The study found that plant age and technology use are comparatively uncorrelated. The study noted that both old and young plants use advanced manufacturing technology at similar frequencies. Lal (1996) also found a negative impact of firm age on information technology adoption in the context of electrical and electronic goods manufacturing in India. He stated that the new firms could challenge the old firms with superior technology and models.

More recently, Das and Das (2012) examined the factors influencing the adoption of information technology in north Indian micro, small and medium enterprises (MSMEs). The result of the study showed that there is a statistically significant relationship between information technology adoption and age of the firm. Established firms are more likely to use website in their businesses than the younger firms. Alderete and Gutierrez (2014) analyzed the determinants of information and communication technology (ICT) adoption in Colombian services firms using micro-level data. The results showed a positive relationship between age of the firm and the use of ICT.

Thus, most of the recent studies have found experience to be important positive factor in determining IT adoption. Hence, we formulate the following hypothesis.

Hypothesis 1: Age of the firm has a positive influence on ICT investment intensity.

Size of the firm

Size of the firm is one of the important factors that determine the technological profile of the firm (Giunta and Trivieri, 2007). It plays a major role in the adoption of information technology by a firm. There is a general belief that large firms invest more on information

technology than the small firms because large firms have adequate resources. Large firms may also have in-house information system (IS) support to create the awareness, initiate and facilitate the adoption of other technologies (Premkumar and Roberts, 1999). Many studies have found positive relationship between firm size and technology adoption (Dunne, 1994; Lal, 1999; Premkumar and Roberts, 1999; Giunta and Trivieri, 2007; Bayo-Moriones and Lera-Lopez, 2007; Bruque and Moyano, 2007; Pan and Jang, 2008; Arpanutud et al., 2009; Gomez and Vargas, 2012; and Ashrafi et al., 2014).

Lal (1999) analyzed the determinants of adoption of information technology in the context of Indian electrical and electronic goods manufacturing firms using ordered probit model. The study found a positive impact of size on the adoption of information technology. Lal (1999) noted that firms with strong financial resources invest more on information technology. Giunta and Trivieri (2007) also examined the determining factors influencing information technology adoption in the context of Italy using ordered probit analysis. The study found that larger the size of the firm higher is its probability of using information technology.

In contrast, there are a few other studies that do not find a positive relationship between size of the firm and adoption of ICT. For example, Jeon et al. (2006) in the context of Korea studied the factors that influence the adoption of e-business by SMEs. The result of the study found that there is no significant difference in business size between adopters and non-adopters of e-business. The study concluded that business size do not seem to play an important role in e-business adoption by SMEs in Korea. Similarly, Al-Gharbi and Ashrafi (2010) in the context of Oman examined the factors that contribute to the slow internet adoption in 60 Omani private sector organizations using survey questionnaire. The study found that one third of the large organizations in Oman have not yet adopted internet in their businesses. The study concluded that there is no direct relationship between size of the organization and internet use.

Thus, the results are mixed with respect to the relationship between size of the firm and ICT adoption. However, since most of the studies have found the effect of size to be positive we hypothesize the following.

Hypothesis 2: Size of the firm has a positive influence on ICT investment intensity.

Labor intensity

Adoption of information and communication technology in the firm generally necessitates the up gradation of skills of the employees (Fabiani et al., 2005). In other words, appropriate

skills of the employees are very important to get the maximum benefit from the adoption and use of information technologies. More qualified workers increase the firm's probability of readiness to new technologies and innovative techniques. Use of sophisticated technologies requires high skilled workers because the advanced technology (e.g. enterprise resource planning system, customer relationship management system, etc) are difficult to handle (Bayo-Moriones and Lera-Lopez, 2007).

In the context of India, Lal (1999) noted that the skill intensity of the workers influence the adoption of information technology by the firms. He found that firms with higher skill intensity are more capable in adopting advanced technologies. Adoption of information technology requires changes in the organization and redesigning of production processes to take the full benefit from them. Thus, development and designing of more sophisticated processes and information technology tools demand employment of more skilled workers.

The adoption of new technology by firms and workers is represented as an important part of the process of technological diffusion and advancement. The diffusion of new technology is associated with uncertain returns and up-front costs of adoption. The quick adjustment of employees to the new technological change depends on their knowledge of new technology. Martins and Oliveira (2008) examined the determinants of information technology diffusion at the firm level in Portugal. They noted that information technology skill of the employees is important for a firm to develop information technology applications successfully. The study found a positive impact of employee's skill on information technology use.

Riddell and Song (2012) analyzed the causal effect of education on new technology use and adoption. The study found that education increases the probability of using computers in the job. Employees with more educational level have longer work experience in using computers. However, the study found that education does not influence the use of computer-controlled and computer-assisted devices.

In general, higher level of expenses on salaries and wages indicates the higher proportion of managerial, technical and skilled employees who are required to use ICT technologies efficiently (Malhotra and Singh, 2007). Hence in this study we have the following hypothesis.

Hypothesis 3: Labor intensity (as a proxy for skills of the employees of the firm) has a positive influence on ICT investment intensity.

Capital intensity

Capital intensity is the amount of money invested in order to get a dollar worth of output. A firm which invests more on capital, that is, more capital intensive, has improved quality and on time production (Shahee and Malik, 2012). Capital intensity is representative of a firm's operating leverage. Malhotra and Singh (2007) examined the determinants of internet banking adoption by banks in India. They stated that a firm which incurred high expenses for premises and fixed assets adopted internet banking as a means to reduce expenditure devoted to maintaining a branch network. Lee (2010) suggested that capital intensity may either increase firm's risk or it may reduce the risk. However, the study found that capital intensity negatively impacted firm's performance.

More recently, Bagale (2014) studied the determinants of MSMEs e-commerce adoption in India. He stated that cost is a critical factor that influences firm's activities since adoption of e-commerce requires high investments on hardware, software and employees' training. Firm's infrastructure is also important in adopting e-commerce. Firm's existing infrastructure should match with the new innovations. To adopt e-commerce, proper technology infrastructure, computer infrastructure, technical skills and appropriate hardware and software are required (Shaharadin, 2012; Rahayu and Day, 2015). Hence we hypothesized the following.

Hypothesis 4: Capital intensity has a positive influence on ICT investment intensity.

Export intensity

Exporting firms may face more competition in international markets. Giunta and Trivieri (2007) stated that export activities are information intensive and therefore export oriented firms use new market oriented technologies. Export propensity influences the use of information technology because it reduces the international transaction costs by presenting firm's product in the market, identifying and communicating with commercial partners and financing international transactions. The study found a significant relationship between export activity and information technology adoption.

Arpanutud et al. (2009) found a positive relationship between the export sales and food safety management system (FSMS) adoption. The study noted that food manufacturing firms in Thailand adopt FSMS when they are interested in accessing foreign market. Gomez and Vargas (2012) stated that export intensive firms are more likely to adopt new technologies to

face the higher level of competition. The study confirmed that export is positively associated with adoption of technology in Spanish manufacturing firms.

In the context of India, Lal (1996) identified a positive relationship between firm export and technology adoption. He stated that use of information technology provides a firm an opportunity to access market and information networks. However, in another study, Lal (2002) found insignificant influence of export-intensity on the adoption of e-business.

Thus, most of the studies suggest that export activity of the firm has a positive effect on information technology investment. Therefore, the following hypothesis is formulated.

Hypothesis 5: Export intensity of the firm has a positive influence on ICT investment intensity.

Data and Methodology

This section discusses the data and methodology used in this study. The study is based on secondary data drawn from the Prowess database provided by the Center for Monitoring Indian Economy (CMIE). Prowess is a database of financial performance of Indian companies. Annual reports of individual companies are the main source of this database. Sample for the study is extracted based on the National Industrial Classification (NIC-2008). As per the NIC-2008, the food processing firms are categorized under Division-10, namely, "Manufacture of food products".

The present study tries to understand the factors that affect the adoption of information and communication technology in food processing firms in India using panel data. In panel data the same cross-sectional unit is surveyed over time. Panel data method is best suited to study the dynamics of changes. This method also gives more informative data, more variability, less collinearity among variables, more degrees of freedom and more efficiency (Gujarati, 2013).

The panel data in the study are those food processing firms that have regularly invested in information and communication technology during 2011 to 2014. In other words, the firms that have not invested on information and communication in any of the four years are excluded from this study. Thus, the total number of firms in the present study is 111.

Data on net expenses towards software, net investment on computers and IT systems, communication equipment, software charges, IT enabled service charges, sales, firm size, year of incorporation, expenses on firm's exports (fob) and expenses on salaries and wages

have been collected from Prowess database for the analysis. The details of the variables, their symbols and definitions are given in the Table 1.

The dependent variable is information and communication intensity (ICTI). It is defined as the sum total of net investments on software, computers and IT systems, communication equipment, and software charges and IT enabled services charges as a percentage ratio of sales.

Table 1: Variables, their symbols and definitions used in the study

Variables	Symbol	Definition
Information and communication technology intensity	ICTI	Sum total of net investments on software, computers and IT systems, communication equipment, and software charges and IT enabled services charges (in Rs. Million)/Sales (in Rs. Million)*100
Age of the firm	AGE	Year of observation – Age of Incorporation
Size of the firm	SIZE	Logarithm of Sales (in Rs. Million)
Labor intensity	LABI	Salaries and Wages (in Rs. Million)/Sales (in Rs. Million)*100
Capital intensity	CAPI	Net Fixed Assets (in Rs. Million)/Sales (in Rs. Million)*100
Export intensity of previous year	EXPI_1	Exports (in Rs. Million) of previous year/Sales (in Rs. Million) of previous year *100

Labor intensity (LABI) is percentage of salaries and wages to sales. In general, firms which spend more on salaries and wages are considered to be more labor oriented. Further, as mentioned earlier, in this study it is assumed that companies which invest more on salaries and wages are likely to be employing more of skilled labor.

Age of the firm (AGE) represents the experiences of the firm. Size of the firm that denotes the amount of resources of the firm is defined as logarithm of sales. Capital intensity (CAPI) is measured as a percentage of net fixed assets by sales.

As per literature review firms which are export oriented adopt more of information and communication technologies. At the same time, the firms may invest more on ICT in a given year to increase the exports in the year. Hence, to avoid the simultaneous endogeneity problem between export intensity and ICT adoption, in this study we have taken export intensity of previous year (EXPI_1) to measure the export orientation of the firms. Here, export intensity is measured as a percentage ratio of exports to sales.

There is evidence that firms affiliated to business groups may be able to get support, especially in financial terms, from other firms in the group (Gopalan et al., 2007). Hence, in this study the econometric models have been estimated for full sample, affiliated sub-sample and the unaffiliated sub-sample. Here, the affiliated firms are the ones that are affiliated to either business houses or government or foreign firms.

Results and Discussions

The mean, standard deviation, minimum and maximum values for the variables used in this study are presented in the Table 2. As it can be seen, the average ICT investment intensity is only around 0.2 percent with a maximum of around 4 percent. The average ICTI is higher for affiliated firms (0.240 percent) than for the unaffiliated firms (0.168). Again it can be seen that affiliated firms are more capital intensive than unaffiliated firms with the former having a mean value of around 64 percent, almost double that of the latter.

However, the unaffiliated firms are comparatively more export intensive than affiliated firms with average export intensity in the previous year at around 14 percent, almost double the export intensity of the affiliated firms.

The age of the firms in this sample ranges from 3 years to 101 years with the average in thirties for both affiliated and unaffiliated firms. The average labor intensity is around 6.6 percent in this industry suggesting that the firms may be using more capital intensive technologies.

Table 2: Mean and standard deviation of the variables used in the analysis

Sample	Variables	Mean	Standard Deviation	Minimum	Maximum
Full Sample	ICTI	0.201	0.447	0.001	4.121
	AGE	33.554	22.735	3	101
	SIZE	7.904	1.747	2.407	12.475
	LABI	6.578	8.518	0.031	42.970
	CAPI	46.886	257.659	0.683	5399.099
	EXPI_1	10.799	24.102	0	90.85
Affiliated	ICTI	0.240	0.533	0.001	4.121
	AGE	35.68	23.146	3	98
	SIZE	8.281	1.709	2.407	12.475
	LABI	7.227	8.703	0.031	41.290
	CAPI	64.363	381.663	1.011	5399.099
	EXPI_1	7.408	16.703	0	88.52
Unaffiliated	ICTI	0.169	0.359	0.002	2.847
	AGE	31.811	22.289	10	101
	SIZE	7.595	1.719	3.086	11.083
	LABI	6.046	8.343	0.102	42.970
	CAPI	32.561	35.792	0.683	230.409
	EXPI_1	13.579	28.518	0	90.85

Total number of observations: Full sample = 444, Affiliated = 200, Unaffiliated = 244

Table 3 shows the correlation matrix between the variables used in the study. As can be seen, size of the firm (SIZE) is negatively correlated with ICTI. This implies that smaller firms invest more on ICT than the larger firms. This is in contrast to the general belief that the larger firms invest more on ICT as larger firms have sufficient resource to invest. Both LABI and CAPI are positively correlated with ICTI. The correlation between LABI and SIZE is high at around -0.5191. However, the correlation coefficients between other explanatory variables are small.

Table 3: Correlation matrix between ICTI and independent variables

Variable	ICTI	AGE	SIZE	LABI	CAPI	EXPI_1
ICTI	1.0000					
AGE	-0.0730	1.0000				
SIZE	-0.1249*	-0.0324	1.0000			
LABI	0.1949*	0.2746*	-0.5191*	1.0000		
CAPI	0.1776*	-0.0092	-0.1962*	0.2286*	1.0000	
EXPI_1	0.1026	-0.1729*	-0.0030	-0.1008	-0.0181	1.0000

* represents 1 percent significance level.

Table 4 presents the findings of panel regression analysis for ICTI as dependent variable and AGE, SIZE, LABI, CAPI and EXPI_1 as independent variables. Hausman specification test accepted random effects model at 1% significance level for all the three models, that is, full sample, affiliated sub-sample and unaffiliated sub-sample.

Table 4: Determinants of ICTI

Variables	**Symbols**	**Model-1 Full sample**	**Model-2 Affiliated**	**Model-3 Unaffiliated**
Constant	-	0.320 (1.67)	0.380 (1.16)	0.466 (2.57)
Age of the firm	AGE	-0.002 (-1.26)	-0.0009 (-0.35)	-0.003 (-1.78)[c]
Size of the firm	SIZE	-0.016 (-0.78)	-0.027 (-0.73)	-0.036 (-1.78)[c]
Labor intensity	LABI	0.010 (2.23)[b]	0.002 (0.41)	0.010 (2.18)[b]
Capital intensity	CAPI	0.0002 (4.75)[a]	0.0002(3.81)[a]	0.001 (2.07)[b]
Export intensity of previous year	EXPI_1	0.0008 (0.72)	0.0106 (3.51)[a]	-0.0006 (-0.90)
Wald Chi^2	-	60.8[a]	38.95[a]	39.73[a]
Number of Observations	-	444	200	244

[a, b, c] represent 1 percent, 5 percent and 10 percent significance level, respectively.

Capital intensity (CAPI) is statistically significant with positive sign in all the three econometrics models (Table 4). This indicates that CAPI is one of the major factors that

influence adoption of ICT in food processing firms. Food processing requires technologies such as quality management system (QMS), food safety management system (FSMS) and hazard analysis of critical points (HACCP) system in order to produce quality and safety food products. Hence, firms should hold higher level of capital to provide proper computer infrastructure, hardware and software to maintain these technologies. For example, Tricom Fruit Products Limited is one of the firms with high capital intensity in the present study. It processes a variety of fruits in the form of puree, puree concentrate and frozen clear juice concentrate. The company has invested in high quality machinery manufactured by Alfa Laval, Blue Star, Linde and J.N. Marshall. The annual report of the company shows that it has spent Rs. 16,00,378 on computers and equipment. Similarly, ANS Industrial Limited is another company which manufactures frozen fruits and vegetables using Individual Quick Freezing (IQF) technology. The annual report of the company shows that company has spent around Rs. 3,184 on computers and around Rs. 1,16,640 on communication equipments.

Labor intensity (LABI) is also seen to be a positive factor affecting ICT intensity in econometric Model-1 and Model-3 in Table 4. In general, firms which have more educated, skilled and technical employees tend to invest on technologies including ICT. As mentioned earlier, technical skills of the labor is important for efficient use of ICT. For example, B&A Limited is one of the labor intensive firms in this study. The company has engaged large number of personnel in its offices. The annual report of the company states that company has 3955 permanent employees. Salaries, wages, bonus and gratuity of the company is Rs. 29,45,77,426. The report also revealed that company has adopted some technologies which result in increased productivity and cost reduction through optimization of input. B&A limited has spent Rs. 11,03,828 on computers. The firm seems to have adopted ICT to increase its productivity.

In the case of unaffiliated firms (Model-3) the coefficients of age of the firm and size of the firm are also statistically significant, however with negative sign. It means unaffiliated firms which are young and small invest more on ICT than the experienced and large ones. For example, VRS is relatively young firm incorporated in 1996. VRS uses modern management systems and IT intervention which involves use of automatic milk collection unit. It also adopted HACCP to test the quality of milk. Similarly, Lotus Chocolate Company Limited is one of the relatively small sized food processing firm in this sample. The company has invested around Rs. 28,51,590 to install computers in its business. Another example is Prima

Agro Limited which offers animal feeds, edible oil solvent extraction, oil refining and oil packaging. The company has invested around Rs. 27,33,454 in order to install computers.

Lagged export intensity (EXPI_1) is found to be statistically significant with positive sign only in case of Model-2. It indicates that, in the case of affiliated sub-sample, those firms which are oriented towards export adopt more ICT to export their products to global market. In order to face the severe competition in the global market, food processing firms need to adopt ICTs. Global Green Company Limited, a subsidiary of Avantha Group, is one of the high export intensive firms in the present study sample. It is a producer of processed vegetables and fruits and serves customers in more than 50 countries. The company has in-house brand called Tify, which offers its consumers a range of premium gourmet foods through business to business (B2B) and business to consumers (B2C) e-commerce channel. Tata Global Beverages is another export oriented company and recognized as the second largest player in branded tea in the world with a significant presence in 40 countries. The company has invested in information systems to improve its business efficiency and to share knowledge. The company uses information technology to communicate with the customers. Its subsidiary company Tetley's Farmers First Hand uses social media, that is, Facebook to communicate directly with the people who grow, harvest and produce tea.

Conclusion

Food processing industry is one of the most important sectors in Indian economy since the contribution of food processing industry to an Indian GDP is more than an agricultural sector. Adoption and use of ICT becomes very vital for food processing sector to provide better quality and safe products. Hence, this paper tried to identify the factors that influence regular investments on ICT in food processing firms operating in India. The sample consisted of 111 food processing firms for four years from 2011 to 2014. The results of the econometric analysis clearly indicate that capital intensity of the firm is an important factor that has a positive influence on ICT intensity. Information and communication technology can be successfully utilized only with the help of strong infrastructure support like electricity backup and network facilities. This is possible only for the firms with high capital intensity.

In the case of affiliated firms, export orientation of the firm also determines high ICT intensity. Affiliated firms may be able to compete in the domestic market without much of the ICT support. However, firms with global operations require efficient information and communication technologies to be successful.

At the same time, in the case of unaffiliated firms, the relatively young, small and labor intensive firms have higher ICT intensity. These are likely to be the firms that are trying to establish themselves in the industry both domestically and internationally.

Government can play a role here by providing the small and young unaffiliated firms, who are interested in global markets, the required funds and incentives to install and use information and communication technologies. Government and the information technology industry players can also provide training to the employees of these food processing firms so that they can acquire appropriate skills to successfully adopt latest ICT technologies for their successful operations.

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