

Informatics in Food Industry in Cukurova Region of Turkey

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Abstract: The purpose of the study is to determine the level of information technology use, perceptions and future plans about e-commerce in food companies in Çukurova Region. Research findings are very encouraging in respect to number of computers and web site availability, high rate of computer literate staff, powerful web sites which can be accepted as being the beginning stage of e-commerce and willingness for investment on informatics and e-commerce in near future.

Key words: Information technologies, internet, agriinformatics, e-commerce, food industry

INTRODUCTION

Developments of countries are getting faster and faster in information age. Countries must use information technologies in every sector of the economy to win the competition. Electronic commerce (e-commerce) is relatively new to the agricultural industry and affects such aspects of the organization as its strategy, processes, customer relationships, information technology and business culture^[1]. E-commerce involves business transactions carried out electronically between a company and other companies (B2B–business to business), companies and consumers (B2C–business to customer) and the public sector and consumers^[2]. Another short but very clear definition of e-commerce is the buying and selling of information, products and services via computer networks^[3]. The Internet reduces transaction costs for business firms and provides consumers with more choices, more control over purchasing decisions and lower prices, in some cases. By automating purchasing functions, companies can eliminate mistakes and costs associated with data entry of paper invoices^[4]. Further, the availability of information through automated systems also improves product flows, forecasting for product demand and input supply and overall business management.

As agribusiness firms turn to the Internet for a new channel of business transactions, insight into its usage is important. Today, businesses view the movement of products and services through a supply-chain management lens. The supply-chain performs seven functions i.e., processing or manufacturing, negotiations, transaction, logistics, promotion, financing

and information^[5]. As agribusiness firms engage in e-commerce, these functions guide its implementation.

As a result of the growth in Internet user population, many businesses have been lured into planning for Internet marketing. Agribusiness firms, like all other firms, face the challenge of changing their business model and practices to account for the rapid growth of e-commerce. According to the U.S. Department of Agriculture (USDA), over 42 percent of online market activity in 1999 involved purchasing crop inputs and online buying was related to farm size. Between 1997 and 1999, the number of farms having Internet access increased to 29 %; in 1999 15 % of US farms and ranches conducted e-commerce transactions^[1].

As Stiglitz expounded years ago, information is pervasive in society. All of the economy's activities are based around the amount of information that is available. The Internet has been an extremely important tool in disseminating information in the United States and beyond. The ease with which it allows information transfer over space has not yet been equaled. Two developments facilitated the adoption of the Internet beyond university settings. First, in 1989, the development of the World Wide Web provided a user-friendly interface for transmitting and receiving information. Then, in 1995, the National Science Foundation (NSF) backbone was shut down. All NSF subsidies to the Internet were eliminated along with barriers to commercial traffic. Since then, an Internet presence has become nothing less than a survival requirement for many businesses^[6].

The study of economic development is motivated by the desire to better understand the transition out of

poverty. This transition can be aided by appropriate technology^[7]. The Internet provides potential to connect some low-income countries to world markets and information that were previously unavailable. Knowledge gained from access to this information empowers people to make more rational production and marketing decisions. This information can also decrease risk in the decision-making process. The knowledge and information that the Internet can provide are essential if countries ever expect to enter global markets. While the Internet holds much potential for economies, its adoption has been slower than expected. As the adoption process is better understood, policies may be put in place to encourage use of the Internet thereby speeding its adoption^[6].

Çukurova Region consists of four provinces which are Adana, Mersin, Osmaniye and Hatay. The region is one of the most important agricultural regions in Turkey in terms of irrigation, technology use especially internet technologies and agrofood industry. Agrofood industry is like a bridge between agriculture and industry. Therefore the extension of informatics in agrofood industry is very crucial for the future developments in agricultural sector in the same area. There have been very few studies for computer adoption in agriculture in the region and also outside the region in Turkey. But in terms of agribusiness firms there has been no study conducted in the field of internet and e-commerce adoption in the region. Therefore, in this study, an attempt has been made to evaluate information technologies infrastructure of agrofood companies in Çukurova Region of Turkey. More specifically this study focuses on e-commerce adoption and reasons and factors for it.

Some of the relevant studies can be summarized as below:

A study was conducted on e-business and distribution channel strategies in agribusiness industries^[8]. They found out that firms with greater levels of existing communication with either customers or suppliers and with managers perceiving greater ability of e-business activity to improve inventory management and logistics issues have higher levels of expected Internet sales.

Four major technologies were mentioned most frequently: global positioning systems, geographic information systems, biotechnology and the Internet in the study by Weick^[9]. Ingwesen^[10] says in his study "Internet is shaking up the food chain" e-commerce is still in its infancy in the food sector but experts say it could soon revolutionize the vast supply chains that bring food to the marketplace by linking farmers to retailers through scores of intermediaries. Ehmke *et al.*^[11] gave research findings on agriculture and information technology and management challenges of e-commerce.

McFalane *et al.*^[1] conducted a research on Internet adoption and use of e-commerce strategies by agribusiness firms in Alabama. They analyzed the factors influencing agribusiness firms' desire or need to adopt the Internet and employ e-commerce strategies. Brent *et al.*^[12], made a study on the usefulness and influence of information sources on U.S. commercial farms with sales in excess of \$100,000. The results indicated that the types and number of different commodities that the farm produced, as well as internet use, are the most consistent predictors of attitudes toward various information sources.

Stroade and Schurle^[6] searched for the factors influencing technology adoption and made a comparison among 91 countries to determine the factors affecting internet usership such as gross domestic product, population, telecommunication investments, number of telephone main lines and average cost of local call.

Williams^[13] studied on "E-commerce and the Lessons from Nineteenth Century Exchanges" and evaluated AgEx.com in his paper. E-revolution on the farm is another research conducted by Peterson^[14]. In his paper he said that farmers, who tend to be fiercely loyal to their local dealers and bankers, have been slow to warm to e-commerce.

The purpose of the study is to determine the level of information technology use, perceptions and future plans about e-commerce in food companies in Çukurova Region which is located in southern part of Turkey and has a significant place in terms of production of food products and processing industries. Agriculture is the major sector in the Region.

MATERIALS AND METHODS

Data collection and characteristics of sample: The main material for this study was formed by the information obtained from the agrofood manufacture and service firms in Çukurova Region. The list of these firms was obtained from the Chambers of Commerce in the provinces (Adana and Mersin) in which these firms intensively available in Çukurova Region of Turkey. This list was classified into groups according to the sectors and from this list, an adequate sample size representing the population was interviewed. In this context, 50 food firms were called and finally 40 firms accepted to interview.

In this study, the firms are classified into three groups according to scaling of KOSGEB (Small and Medium Industrial Enterprises) in order to make comparisons of them. Small (1-50 staff), medium (51-150

Table 1: Sample size according to sectors

Sectors	Small size	Medium size	Large size	Total
Catering	4	0	2	6
Fat	1	2	1	4
Cornstarch	0	0	3	3
Fruit juice	4	3	1	8
Citrus fruits packing	2	1	0	3
Cereals packing	5	2	0	7
Milk	2	1	0	3
Others	4	2	0	6
Total	22(55%)	11(27.5%)	7(17.5%)	40

staff) and large (151 and above staff) sized food enterprises were investigated by conducting a survey. The survey method was face-to-face interview.

Fifty five percent of the firms interviewed are small scaled, 27.5% are medium and 17.5% are large scaled firms (Table 1). Some of the firms in the sample were unable to get response, so there are some absences in sectors. 42% of them are limited, 50% are anonymous and the rest consists of different types. The firms interviewed have been working in the food sector for a range from 3 to 57 years.

Survey design and data analysis: The data obtained from the firms by questionnaire was evaluated by calculating means, relative values and by establishing cross tabulation between the variables. The questionnaire applied to the firms was formed with three sections according to the study's aims. In the first section, there are questions about the general business characteristics (number of employee, capacity usage rate, manager's age and experience etc). In the second section, the questions aimed to determine the usage level of information technology of the firms. As for the third section, the questions are driven to the firm applying e-commerce. Descriptive statistics were used to assess pattern of responses to the interview items and the chi-square test and variance analysis were used to investigate differences among the firms small, medium and large scaled.

In addition, web sites of the firms whose have one were visited to evaluate it in terms of different aspects. In order to evaluate that, some criterions are benefited from literatures and the opinions of the computer specialists and ranking table was established^[4]. For some of the tables' creation Likert scale was used and the points were calculated.

RESULTS AND DISCUSSIONS

Fifty five percent of the firms interviewed are small, 27.5% are medium and 17.5% are large scaled firms. According to the sizes of the firms, the number of the permanent workers was found significant at the 5% confidence level. But for the number of temporary

workers, it is significant at 10% confidence level. Comparing the capacity usage rates, small and medium scaled firms show similarity (62.79-64.00), this number is higher in the large scaled firms. Average capacity usage rate is found as 64.32. The average number of the engineers working in the food firms in the region is 1.62 in the small scaled firms, 5.91 in the medium scaled firms, 16 in the large scaled firms (significant at 5% confidence level). The average age of the managers interviewed changes between 41 and 44 by scale. Experience of the managers is found 14.55 years for all firms in average. Number of engineers is increasing significantly by scale since the scale is related to number of employees. Average life of the firms investigated is also calculated as 15.31 years (Table 2).

Looking at the information technology use in Table 3, the average number of computers is determined as 7.29 for the small scaled firms, 22.78 for the medium scaled firms and 91.29 for the large scaled firms. More than half of the staffs employed in investigated firms are computer literate. This is the highest for the medium scale firms. The average number of computers connected to internet is found as 3.09 for small scaled firms, 25.29 for large scaled firms and it is significant at 5% confidence level. Investigating how long the firms have had a web site, we see that the averages of small and medium scaled firms are close to each other (2.38-2.83) and this rate increases twice (5.33) for large scale firms (significant 10% confidence level).

Table 4 presents some of the major indicators of information technology use in the investigated firms. According to the results, 89.5% of the firms have e-mails and this rate is the highest for medium size firms (100%). Since e-mail use is the most common way of Internet use, these figures indicate a high adoption of Internet technologies in the firms. Internal use of e-mails is another important indicator for informatics and this rate is 73% for all firms. The rate of internal e-mail use is getting higher as the firm size gets larger (66.7, 77.8 and 85.7%, respectively).

The availability of electronic data and information circulation in the firms seems quite high (70.3% for all firms). Small size firms have the lowest rate (61.9%). Web site availability in the firms has a significant share in total (79.0%). This rate is 100% for medium scale firms. Internal network use largely depends upon the scale of the firms. Average rate is 75.7% and it is 100% for large scale firms. Asking to the firms if they have a computer unit, we found out that almost half of the firms (48.6%) have computer units in their firms. The rate is significantly low in small scale firms (30%) (Table 4).

Table 2: Descriptive statistics of the firms by scales

Variables	Scales (Mean ± SD)			
	Small	Medium	Large	All
Number of firms	22	11	7	40
Number of permanent workers (average-person)	27.5±14.17*	76.55±21.92*	221.83±116.99*	71.23±82.07
Number of temporary workers (average-person)	56.71±65.82**	187.50±163.09**	25.00±7.07**	104.80±127.89
The capacity usage rate (%)	62.74±57.9	64.00±26.17	79.67±30.17	64.32±49.57
Average age of managers (year)	40.38±9.8	40.45±6.93	43.67±12.27	40.92±9.31
Experience of managers in the sector (average-year)	13.64±9.73	17.4±8.77	13.17±6.85	14.55±9.04
Number of engineers employed (average-person)	1.62±1.2*	5.91±4.5*	16.00±16.78*	5.13±8.41
Activity duration of firms in the sector (average-year)	13.68±13.3	15.00±10.62	20.68±18.39	15.31±13.60

* significant at 5% confidence level, ** significant at 10% confidence level

Table 3: Some basic statistics related to information technology use in the food industry firms

Variables	Scales (Mean±SD)			
	Small	Medium	Large	All
The number of computers (average)	7.29±6.26*	22.78±12.44*	91.29±149.33)*	26.95±69.33)
The share of computer users in whole staff (average %)	54.29±39.06	64.78±35.06	50.83±35.27)	56.33±36.83)
The number of computers connected to the internet (average)	3.90±4.47*	16.89±15.20*	25.29±17.96)*	11.31±14.05)
Web site availability (number of years in average)	2.38±1.76**	2.83±1.17**	5.33±4.04)**	2.91±2.16)

* significant at 5% confidence level, ** significant at 10% confidence level

Table 4: Some indicators of information technology use of the firms

Some indicators of information technology use	Percentages by scales			
	Small	Medium	Large	All
Availability and use of e-mail	85.7	100.0	85.7	89.5
Internal use of e-mail	66.7	77.8	85.7	73.0
Electronic data and information circulation in the firm	61.9	88.9	71.4	70.3
Web site availability	71.4	100.0	71.4	79.0
Internal network use	61.9*	88.9*	100.0*	75.7
Availability of computer unit	30.0**	75.0**	71.4**	48.6
Providing computer training for staff	52.4	55.6	71.4	56.8
Planning of computer training for the near future	66.7	66.7	66.7	66.7
E-commerce application	4.8	22.2	0.0	8.8

* significant at 10% confidence level χ^2 test ** significant at 5% confidence level χ^2 test

Table 5: Some indicators of internet use and managers' perceptions in investigated firms

Internet use and perceptions	Points by scales			
	Small	Medium	Large	All
Internet use to obtain market information				
Likert scale: 4= very sufficient...0= definitely insufficient	1.81	2.44	2.17	2.03
Willingness for subscription to a web site to get market information				
Likert scale: 4= definitely yes...0= definitely no	2.33	1.56	2.71	2.21
Budget separated for informatics for future				
Likert scale: 4= will increase...0= will decrease	2.57	2.78	2.43	2.59
Level of information technology use of the firm in managers' viewpoint				
Likert scale: 4= very sufficient...0= definitely insufficient	1.52	2.56	2.43	1.95
Demand for e-commerce (19)				
Likert scale: 4= strongly yes...0= strongly no	2.67	2.63	2.14	2.56

Questions were asked to indicate on a 5-point Likert scale to which the statements indicate sufficiency of the criteria where the numbers are explained in the left column.

According to the results of the firms investigated, it is shown that the computer training rate is increasing, as the size of the firms is getting bigger while 71.40% of the large scaled firms provide computer training to their personnel, only the 52.40% of the small scaled firms provide this feature. More than half of the firms already provided computer training for staff and the highest rate is obtained in large scale firms (71.4%). Two-third of the firms want to provide computer training for the near future and there is

no difference among the firms in that respect. Finally, e-commerce application situation of the firms were asked and the result is quite low (8.8%).

Language used for web pages is very important in terms of foreign trade of the firms. According to the results of this question, 80% of the firms prepared their web page both in Turkish and English. The rate of web pages in Turkish only is 13.3%. Besides, there are also German and French web pages (2 firms).

Table 6: Evaluation of investigated firms' web sites

Criteria	Definition	Point by scales			
		Small	Medium	Large	All
C ₁	Contains technical information about products sold	3.21	3.92	5.00	3.64
C ₂	Provide pricing information about products sold	1.21	1.58	3.50	1.54
C ₃	Provide background information about company	3.21	3.92	5.00	3.64
C ₄	Provide a dealer directory (information where products are sold)	2.50	3.00	4.50	2.86
C ₅	Provide links to industry trade associations	1.36	1.75	3.00	1.64
C ₆	Provide links to other data/information sources	1.50	2.17	3.00	1.89
Average	Average score for content related criteria	2.17	2.72	4.00	2.54
T ₁	Allow for online ordering, but use traditional means of payment	2.07	3.08	3.50	2.61
T ₂	Allow for online ordering and payment	1.07	1.33	3.00	1.32
T ₃	Include online communities (chat rooms, bulletin boards etc.)	1.50	2.42	3.50	2.04
T ₄	Include areas with content customized to different individuals	2.07	3.25	5.00	2.79
T ₅	Include password protected areas, only accessible to registered	1.07	1.17	1.50	1.14
Average	Average score for web technical criteria	1.56	2.25	3.30	1.98
Average	Average score for all criteria	1.89	2.51	3.68	2.28

Questions were asked to indicate on a 5-point Likert scale to which the statements indicate sufficiency of the criteria where 5 = very sufficient and 1 = not available
 C = Content related criteria T = Technical criteria

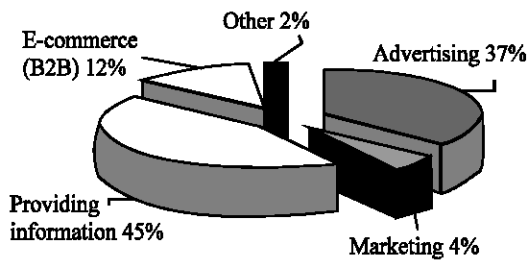


Fig. 1: The purpose of the firms for having a web site

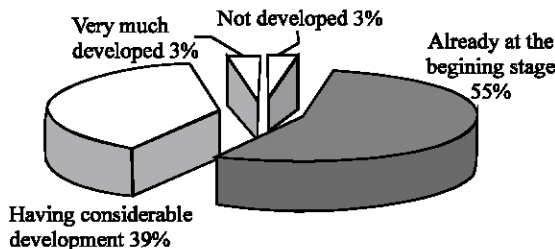


Fig. 2: Opinions of respondents about level of e-commerce in Turkey

The position of responsible staff for informatics in the firms is another good indicator for the level of information technology use in food industry. "Deputy General Manager" (10.3%) is the highest position in the firms investigated in terms of information technology responsibility. "Manager" responsible for information technology (48.2%), "Chief" (6.9%) and "regular staff" (6.9%) are the lower following positions. Some of the firms do not employ any staff for informatics and have service from "consultant firms" (27.6%).

Table 5 gives some information on Internet use and perceptions of firms' managers interviewed. The information in this table is formed as a result of question asked to indicate on a five-point Likert Scale. The second

row of the table shows the level of internet use to obtain market information. In average 2.03 means moderate for the firms. This point is lower than average for small scale firms and this is quite normal if the indicators above tables are considered. Willingness for subscription to a web site to receive market information (2.21 for all), their planning to increase the budget for information technologies for future (2.59 for all) and demand for e-commerce applications in their firms (2.56 for all) seem quite good indicators for the future of Turkish food industry. The managers interviewed were asked about their opinion about the level of information technology use of their firm. The average point is 1.95 and this is the lowest for small scale firms (1.52). In the last row of the table demand for e-commerce seems a bit high (2.56 for all) and this gives us hope for the future.

Another question asked during the interviews was about the necessary steps for e-commerce progress for the firms. The answers were grouped in three categories. The first one includes updating web sites, employing experts on web site development (42%). The second one is that it is necessary to make investments on computer hardware and software (35%) and the last one is to give internal computer training periodically (23%).

Figure 1 shows the purposes of having a web site for the firms. Providing information to customers take the highest percentage (45%). Advertisement (37%), e-commerce (12%), marketing (4%) and other (2%) are the following reasons for having a web site. More than half of the firms investigated (55%) think that Turkey is already at the beginning stage of e-commerce (Fig. 2). Thirty nine percent of the respondents have opinion that Turkey is having considerable developments in terms of e-commerce. Extreme opinions have very little share (very much developed or no developments in e-commerce).

Most of the firms investigated (79%) have a web page. Firms having a web page were evaluated in terms of some criteria in Table 6. The results are presented as five point Likert Scale. Criteria starting with label C mean content related criteria while criteria starting with label T mean more web technical criteria. For all of the criteria, the larger the firms, the more points they receive which indicate more powerful web sites. Content related criteria get higher scores (2.54) than technical criteria (1.98) which means web pages of the firms investigated have better content comparing with technical sides. This is a good indication of Turkish food industry firms being at the starting point of e-commerce.

The most important outcome of Table 6 is that web site quality in terms of both their contents and web techniques increase significantly by scale. The last row of the table gives a summary for all criteria indicating this reality. Especially criteria T_1 and T_2 are good indicators for e-commerce and this is very much bounded by scale of the firms.

This study is a contribution to the researches related to information technology use in food industry which we feel lackness about in Turkey. The findings are a kind of baseline data for later studies. The findings are also very couraging in terms of informatics and indicate that some of the firms adopted e-commerce in their business and most are ready for progress in the near future.

This kind of studies is recommended to conduct all over the country to see the whole picture and develop right policies to make further progress in informatics in food industry. As for the firms, more investments on information technologies must be made, computer units must be established and computer literate staff must be employed more. This is a must for whole firms in this sector to compete all over the world.

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