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Article *in* Journal of Foodservice Business Research · July 2010

DOI: 10.1080/15378020.2010.500262

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Journal of Foodservice Business Research, 13:268–281, 2010

ISSN: 1537-8020 print/1537-8039 online
DOI: 10.1080/15378020.2010.500262

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A Comparative Examination of Information Technology Usage in the Restaurant Industry

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Contingency theory suggests that there is no universal information system that is applicable to all organizations in all circumstances. In this study, segment, ownership type, sales level, and financial success were all examined for their relationships to information technology usage in the restaurant industry. Restaurant owners and managers (n = 243) across three restaurant segments (casual service, quick service, and family style) were asked about what types of applications they used. First, a classification scheme emerged from the data as a result of factor analysis consisting of five categories: cost analysis, sales and forecasting, administrative, service, and advanced technologies. Second, analysis of variance supported the contingency theory for three of the four factors investigated. The segments of casual service, quick service, and family style, as well as chain versus independent restaurants, use systems differently from each other to meet their specific industry needs. Sales volume, however, did not correlate with systems use, but perceived financial success did correlate with the number of applications used by managers. The implications of this study suggest that generic, canned information technology solutions may not be the optimum solution for the restaurant industry. To enhance

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competitiveness, information technology solutions should address the specific needs for each restaurant firm.

KEYWORDS restaurants, information technology, trends, technology use

INTRODUCTION

The foodservice industry plays an important role in the economy of the United States. It is a $538 billion industry generating 4% of the gross national product (National Restaurant Association, 2007). It is also noted that the industry has experienced real sales growth over the last nine years and is projected at 3% in real terms over the next year. The restaurant industry is also the largest non-governmental employer of individuals, including teenagers. Furthermore, the restaurant industry has become an integral part of American life, with over half of all adults eating out one meal a day (Deloitte & Touche, 2000).

Restaurant operators face complex market forces as they compete for market share (Muller, 1999). An increasingly competitive environment is made up of the rivalry among existing firms, contending with new firms entering the market and new substitutes being offered to consumers such as grocery stores offering "meals to go." Because of these market forces, operators must pay close attention to their competition and to consumer wants in order to maintain market share.

Given the competitive nature of the industry, foodservice operators are also continually seeking ways to improve their sales and profitability. Controlling food and labor costs often leads to increased profitability (Reynolds & Biel, 2007). Technology, often utilized as a means to automating processes, is another way to improve efficiencies. Automation can occur in both the preparation of food and the mechanizing decision-making processes. Foodservice equipment, such as ovens and fryers, can be automated for cooking times, quantities, and temperatures. Decision-making processes, such as forecasting or ordering, can be automated through the use of information technology (IT).

As companies seek to build competitive advantages in the new digital economy, firms often rely on their IT departments to help design, develop, and deploy on-line solutions (International Quality and Productivity Center, 2001). Today companies are using IT to connect to their stakeholders—customers, suppliers, employees, and management—through applications such as e-mail, on-line ordering, and on-line bidding. Part of the IT solution also involves the use of accounting information to add competitive value to its users. Since IT can require a high level of financial and human investment, research on IT can provide valuable insights to restaurant operators on how to improve their competitive position (Ham, Kim, & Jeong, 2005).

Purpose of the Study

One purpose of this study was to determine the current usage of various types of IT being used in operating units of the restaurant industry. It sought to determine the types of technology used and frequency of use. In addition, the contingency theory suggests that there is no universal information system that is applicable to all organizations in all circumstances. This study sought to examine if there were differences in IT usage by segment (casual, quick, or family style), ownership type (independent and chain), or by the sales levels in order to offer restaurant operators advice on how to best design future systems.

LITERATURE REVIEW

Management Information Systems

IT and management information systems (MIS) are often used as interchangeable terms (Kearns, 1997). IT is comprised of a set of interrelated computerized components that work together to collect, retrieve, process, store, and distribute information for the purpose facilitating planning, control, coordination, analysis, and decision-making in organizations (Laudon & Laudon, 1998). In the foodservice industry, IT is commonly used for order processing, marketing, accounting, and site selection of new restaurant units. Whether a small independent restaurant or part of a large chain, almost all restaurants use point-of-sale (POS) systems and accounting packages to process their financial data.

In the late 1990s, the industry entered a stage of IT proliferation with a growing number of technologies available. Improved technologies such as increased bandwidth, DSL, and satellite links were changing the way the industry did business. The use of e-commerce, e-mail, intranet, and extranet development are now commonplace among restaurant chains (Edelstein, 2007; Grossbauer, 2001).

Technology Usage in the Restaurant Industry

The use of technology is diverse in the foodservice industry, ranging from minimal to extensive use. Survey research in hospitality has shown that IT usage is the highest in the clerical arena, medium in integrated usage, and lowest in tactical usage (Ellison & Mann, 2000; Whitaker, 1986). Chien, Hsu, and Huss (1998) found that the most highly utilized software packages were office products (word processing and spreadsheets) and accounting packages (over 80%). Less than half of the independents used POS systems, time and attendance systems, and recipe costing. Even fewer operators used more advanced applications such as employee scheduling (28.9%) or food

production forecasting (21.1%). These findings support the notion that most restaurants use technology as a data processing tool to process sales and accounting data. Integration with other processes, such as ordering from vendors, is limited, and the strategic use of systems is underutilized.

Stages theory (Gibson & Nolan, 1974) suggests four stages of IT development within firms—initiation, expansion, formalization, and maturation. Huber and Pilmanis (2002) found that this theory also applied to the restaurant industry. Firms in the initiation stage used lower levels of technology, such as word processing packages or spreadsheets. Firms at the expansion stage (or beyond) used IT for all aspects of the restaurant operations, including table management, wireless headsets, and pagers. Technology is so fundamental to the industry today, many firms are adopting emerging technologies in the attempt to operate more effectively and efficiently (Ham et al., 2005). Technology can help eliminate mistakes and miscommunication, thereby improving speed and service quality (Saarinen, 1996; Zmud, Blocher, & Mofi, 1986).

Based on the discussion of IT usage in the foodservice industry, this study extends the understanding of IT usage in the foodservice industry. Since the contingency theory (Lawrence & Lorsch, 1967) suggests that there is no universal information system that is applicable to all organizations in all circumstances, this study will examine usage by design (sales, food cost control, labor, financial reporting, service quality, office, and communication software) for various segments (casual dining, family, and quick service) and by type of ownership (independent or chain). The following research questions are examined in this study:

- Does IT usage differ among the restaurant segments of casual dining, family, and quick service?
- How do chains and independently owned restaurants differ in their usage of technology?
- What is the relationship between IT and the perceived financial success of a restaurant?

METHODOLOGY

This study uses survey research, where questionnaires with reply return envelopes were mailed to all central Ohio general managers. The sample used two mailing lists: (1) the members of the Central Ohio Restaurant Association (CORA) and (2) the restaurants listed in the Columbus, OH, yellow pages as reported *Info USA's Business Mailing Lists* software package. In order to improve the response rate, the researcher made personal visits to any restaurant brand that had not mailed back its survey after the two weeks.

The Powell and Dent-Micallef (1997) instrument was examined and modified to be applicable for this study. There were 19 IT applications selected in the areas of financial reporting, sales management, office management, communications, inventory and food cost management, human resources management, and service quality. Demographics were also collected, including the manager's level of education, number of hours worked per week, number of years in the foodservice industry, age, and gender. Demographics on the restaurants were gathered, asking the average sales volume, average guest check, financial success of the restaurant, and industry segment. Managers were also asked to rate their firm's use of IT (industry leader, close follower, middle of the pack, somewhat behind, or laggard) and their restaurant's financial success (not successful to highly successful). Finally, restaurants were classified into three categories: casual- or full-service restaurants with checks of $15 or higher, family-style restaurants with table service and check averages of less than $15, and quick-service establishments.

RESULTS

From the 1,718 surveys distributed, responses from 243 (14.1%) restaurants were collected. This sample was comprised of 102 casual-service restaurants, 94 quick-service restaurants, and 47 family-style restaurants. Included were responses from 51 national and regional brands, 14 local brands, and 73 independent restaurants. Thirty of the country's "top 100" brands are included in the study. Given the breadth of the sample, this sample appears to be representative of the restaurants in central Ohio region. Since the sample also included the results of 51 national brands, this sample might also be considered somewhat representative of the national population. Non-response error was also checked by comparing late respondents to early respondents. Late respondents are assumed to be similar to non-respondents. Since no differences are found, the generalization of the population is supported.

Respondent and Restaurant Characteristics

Respondent demographics and restaurant characteristics are summarized in Table 1 and 2, respectively. The majority of the respondents in the study were male (69%). The casual and family segment managers were predominantly male at 71% and 79%, respectively. The quick-service segment employed the most female managers (36%) with males making up 64% of the managerial sample. Analysis of the data revealed that most managers have some level of college education. The levels of education for the sample were reported as high school (17%), some college (29%), associate degree (10%),

TABLE 1 Respondent Demographics

Manager demographics	Casual	Family	Quick service
Age (mean)	37	43	39
Gender			
Male	71 (71%)	37 (79%)	59 (64%)
Female	28 (28%)	10 (31%)	34 (36%)
Education			
High school	13 (13%)	7 (15%)	20 (22%)
Some college	24 (24%)	14 (30%)	31 (33%)
Associate degree	13 (13%)	5 (11%)	7 (8%)
Bachelor degree	44 (44%)	19 (40%)	28 (31%)
Graduate degree	6 (6%)	2 (4%)	7 (8%)
Average years of experience	15.8	18.6	14.8
Average hours work per week	55.3	53.5	52.5

TABLE 2 Restaurant Characteristics

Restaurant characteristics	Casual	Family	Quick service
Number of restaurants	102 (42%)	47 (19.4%)	94 (38.6%)
Average no. employees	50 SD = 27.6	42 SD = 28	21 SD = 17.9
Average guest check	$20.22 SD = $11.96	$7.73 SD = $3.04	$5.97 SD = $2.25
Sales volume			
Under $100K	5 (5%)	0 (0%)	5 (5%)
$100–$250	5 (5%)	1 (2%)	13 (14%)
$250–$500	6 (6%)	7 (15%)	24 (26%)
$500–$1m	18 (18%)	42 (39%)	30 (33%)
$1m–$2m	42 (42)	12 (26%)	15 (16%)
$2m–$5m	23 (23%)	8 (17%)	5 (5%)
Over $5m	1 (1%)	0 (0%)	0 (0%)
Ownership			
Franchise	10 (10%)	1 (17%)	50 (53%)
Independent	42 (42%)	24 (51%)	20 (21%)
Chain owned	49 (48%)	22 (47%)	24 (26%)

bachelor degree (38%), and graduate school (6%). Of the three segments, the casual segment had the most highly educated managers, with 50% possessing a bachelor degree or higher. Family style was second with 44%, and quick service was the lowest at 38%.

Managers in all segments worked more than a typical 40-hour work week, with the average being 53.7 work hours per week. Family-style managers were oldest and most experienced, with an average age of 43 years and experience averaging 18.6 years in the industry. Quick-service managers were the least experienced, averaging 14.8 years with a mean age of 39.1 years. The casual service managers were the youngest managers, averaging 37 years of age with an average of 15.3 years experience.

For the 243 restaurants participating in this study, 42% (102) were identified as casual-service restaurants (having table and bar service, average check >$15), 38.6% (94) were identified as quick-service restaurants (limited service, drive through), and 19.4% (47) were identified as family style (with table service, family-oriented, no bar service, average check <$15). Of the total group participating, 194 restaurants had POS and back office systems, 22 had back office or home office systems only, and 27 had no computer systems. The ownership structure of establishments varied greatly. The quick-service segment was highly franchised, with over 50% of the restaurants operating as franchisees. Franchising among the casual-service and family-style segments was minimal (10% and 2%, respectively) for the sample. Most of the casual-service and family-style national brands were corporate owned, sometimes with the manager serving as an operating partner. Independent restaurant owners were most prevalent among the casual-service (42%) and family (51%) segments. Only 21% of the quick-service restaurants were independently owned.

The average guest check for the total sample was $12.17. Casual-service restaurants had an average guest check of $20.22 compared to the lower guest check averages of the family-style segments and quick service, $7.73 and $5.97, respectively. Analysis of sales volume revealed that casual-service restaurants had the highest average sales volume. The most noticeable contrast was between quick service and casual service. The majority of quick-service restaurants (79%) had sales below $1 million. On the other hand, the majority of casual-service restaurants (67%) had sales above $1 million. The majority of family-style sales (64%) were between $500,000 and $2 million.

Table 3 presents the results of the use of various types of software applications available to the foodservice industry. The results are presented by segment and overall prevalence of use. As might be expected, sales analysis, labor costing, and the category of bookkeeping and financial reporting were the most often used applications. Video monitoring and pager notification were the least used across all categories.

Factor Analysis

The survey contained questions to assess software usage. Managers were asked to indicate which of the 19 different computer applications they used. Many schemes have been developed over the years to classify application use. A principal component analysis was used to explore which, if any, factors would emerge. A six-factor model explaining 65.05% of the variance emerged. Table 4 displays the rotated varimax solution. The latent root criterion (eigenvalues greater than one) was used to determine how many factors to extract. Loadings greater than 0.50 were considered as practically significant. The Bartlett test of sphericity (which tests for multi-collinearity) was significant, and the measure of sample adequacy (MSA) was rated as

TABLE 3 Software Usage Percentage by Segment

Applications	Casual % used	Family % used	Quick service % used	Overall % used
Sales analysis	92.0	92.1	91.2	91.8
Labor cost	76.1	81.6	83.8	80.0
Bookkeeping/financial reporting	80.7	73.7	57.4	70.8
Inventory tracking	62.5	55.3	80.9	67.2
Food cost	64.8	55.3	73.5	65.6
Sales forecasting	55.7	60.5	70.6	61.5
Word processing/spreadsheets	75.0	50.0	51.5	61.5
Labor scheduling	51.1	63.2	64.7	58.5
E-mail	64.8	63.2	48.5	58.5
Variance analysis	50.0	57.9	67.6	57.4
Server performance	62.5	55.3	29.4	49.7
Food production scheduling	36.4	31.6	47.1	39.0
Menu development	46.6	39.5	27.9	38.5
Vendor pricing	30.7	31.6	50.0	37.4
Training employees	35.2	31.6	38.2	35.4
Customer loyalty/tracking	18.2	15.8	29.4	21.5
Service delivery times	15.9	15.8	42.9	25.1
Video monitoring	1.1	7.9	19.1	8.7
Pager notification	3.4	5.3	2.9	3.6
	$N = 62$	$N = 94$	$N = 47$	

TABLE 4 Factor Analysis

Factor analysis	1	2	3	4	5	6
Inventory tracking	0.73					
Food cost	0.72					
Labor cost	0.69					
Variance analysis	0.63					
Vendor pricing	0.55					
Sales forecasting		0.84				
Labor scheduling		0.67				
Food production scheduling		0.66				
Sales		0.50				
Employee training		0.36				
Word processing/spreadsheet			0.83			
E-mail			0.77			
Menu/recipe analysis			0.67			
Bookkeeping/financial reporting			0.48			
Customer history/loyalty				0.76		
Remote video monitoring				0.68		
Service delivery times				0.63		
Pager notification					0.77	
Server performance						0.88
Eigenvalue	4.18	1.90	1.56	1.37	1.17	1.04
Percent of total variance explained	23.24	10.57	8.07	7.60	6.50	5.80
Cumulative	23.24	33.81	42.51	50.11	56.61	62.41

at 0.76, which is considered almost meritorious (Hair, Anderson, Tathem, & Black, 1998).

Segment, ownership type, sales level, and financial success were all examined in regards to application use. It was expected that restaurants with table service would use server performance analysis, whereas the quick service segment would track service delivery times. Based on prior research, it was also expected that full-service restaurants would use administrative applications (word processing, financial reporting, and menu analysis) more than the quick-service segment. ANOVA was used to statistically test if usage among industry segments differed. In fact, this study did find significant differences (at 0.05 levels) among industry segments for several applications: server performance, inventory tracking, service delivery times, word processing, bookkeeping, and video monitoring.

The Tamhane post hoc analysis (which does not assume equal variances) was used to determine where the differences were between segments. Differences in usage applied to six software applications. As expected, analysis of server performance was utilized among casual and family-style restaurants, but not in quick service. Service delivery times, however, were tracked predominantly by the quick-service segment, not the casual and family-style segments.

Interestingly, inventory tracking and vendor price comparisons were utilized by quick service more than the other segments. One possible explanation might be that more quick-service restaurants used POS systems with automated inventory ordering systems that might have the ability to compare vendor bids. After analyzing the POS data, however, this was found not to be the case. Only 26.5% of quick-service restaurants had automated inventory ordering, the least of all the segments. A more likely explanation for the differences might be linked to the menus. Quick-service menus are usually limited and involve simpler recipes than the other segments. As a result, programming a computer to track inventory would be easier for the quick-service segment. Further limited menus might lend better to shopping for the best price.

Other differences between the segments were in the use of office products, word processing, and bookkeeping. Casual-service managers utilized the office products more than the quick-service managers. Finally, video monitoring from a remote location, although not widely utilized in the industry, was used by quick-service managers more often than the other segments.

National chains have more financial resources to invest in systems development than independently owned restaurants. To examine the differences between chains and independent restaurants, *t*-tests were used. Indeed, differences were found for 13 of the 19 applications. Restaurant managers from national chains used operational and forecasting applications (food cost, labor cost, variances, sales forecasts, food production schedules,

labor schedules, inventory tracking, customer history, vendor price comparisons, service delivery times, training, menu analysis, and monitoring) more than managers at independent restaurants. There were no major differences, however, between chains and independents on the use of sales tracking, server performance evaluations, word processing, bookkeeping, e-mail, and pager notification. Regarding the use of operational computer applications, the independents ranked the same as the chains but were behind in their use of almost every other type of application. The chains were reported to have better fitting systems than independents. The most likely reason for this finding is that the chains have the human and financial resources to devote to develop better-fitting systems. This supports the idea that IT departmental competence is also related to system success (Ross, Bearth, & Goodhue, 1996).

Additional analysis was used to further simplify the factor analysis. Training and sales (which had communalities below 0.50) were dropped from the classification scheme, server performance (which loaded on its own factor) was moved to the "service" category, and word processing was moved to the "administrative" category. Pager notification and video monitoring, rarely used by all of the segments, were combined into the "advanced technologies" category. As a result, a five-category classification scheme was developed (Table 5).

Competitiveness and Financial Success

Restaurant managers were asked to rate the competitiveness of their systems. They could rate their systems on a 5-point scale, from the high of "industry leader" to the low of "laggard." The chi-square statistic was calculated to investigate if there were differences among the segments. The Pearson chi-square was 16.125 with 8 degrees of freedom, significant at 0.041. Therefore, differences in ratings do exist among the segments. A contingency table was

TABLE 5 System Application Classification Scheme

Cost analysis	Forecasting	Administrative	Service	Advanced technologies
Food costs	Sales forecasts	Work processing/ spreadsheets	Customer history/loyalty	Pager notification
Labor costs	Food production forecasts	Bookkeeping/ financial reporting	Service delivery times	Remote video monitoring
Inventory tracking	Labor scheduling	Menu and recipe analysis	Server performance	
Vendor prices				
Variances				

TABLE 6 Difference among Segments for Strategic Orientation

Segment		Laggard	Somewhat behind	Middle of the pack	Close follower	Industry leader	Total
Casual service	Actual count	4	21	46	9	9	89
	Expected count	4.6	23.7	41.1	12.3	7.3	89
Quick service	Actual count	6	14	28	14	6	68
	Expected count	3.5	18.1	31.4	9.4	5.6	68
Family service	Actual count	0	17	16	4	1	38
	Expected count	1.9	10.1	17.5	5.3	3.1	38

used to analyze where those differences were located (Table 6). Casual service tended to have systems that were in the "middle of the pack." The quick-service segment had a majority of cases that were "close followers" and "industry leaders" over the other segments. The family-style segment had a stronger tendency to use systems that were rated as "somewhat behind." The competitive ranking of the system (industry leader, close follower, middle of the pack, behind, and laggard) implies that there is competitive value to systems (Porter, 1980). Therefore, systems might play a strategic role in a company's success.

Restaurant managers were also asked to rate the financial success of their restaurants. Less than 1% rated their restaurants as "not successful" and 18.8% as "minimally successful." Most of the restaurant managers rated their restaurants as successful (60.7%) or highly successful (19.7%)

An exploratory analysis was conducted to see if application use differed among the financially successful and unsuccessful restaurants. ANOVA was used to determine if there were significant differences in system use among the minimally successful, successful, and highly successful restaurants. There were significant differences among the groups. First, highly successful restaurants used food cost analysis, labor cost analysis, variances, and food production schedules more than the successful and minimally successful restaurants. In addition, minimally successful restaurants used sales forecasts, labor forecasts, service delivery times, and training less often than the highly successful restaurants. Significant differences were found among the restaurants based on perceived levels of financial success. Foodservice operators should note that the highly successful restaurants used seven more software applications than the minimally successful restaurants. The highly successful managers were given more tools, which may have helped them to better manage their restaurants.

CONCLUSIONS AND IMPLICATIONS

The level of use of IT in the restaurant industry is diverse and complicated. Restaurant operators are using technology to control their operations more efficiently, provide improved service to customers, and expand their marketing efforts. Traditionally, foodservice literature has classified applications according to evolutionary processes such as clerical, integrated administrative, and tactical (Ellison & Mann, 2000). This study presents a classification scheme focused on management decision-making: cost analysis, forecasting, administrative, service, and advanced technologies. The cost analysis category included applications used to control food and labor costs. The forecasting category included sales reporting and forecasting models. The administrative category included applications used in the office such as word processing, e-mail, and bookkeeping. The service category included applications related to service quality such as the tracking of server performance or service delivery times. The advanced technology category included emerging applications not readily used yet by the industry segments.

The findings also support the contingency theory, thereby having implications on information systems design. In order to best support manager decision-making needs, information systems need to be designed to include applications unique for each segment. Regardless of segment, the systems need to offer the basic POS and office applications. To be more competitive, however, higher-level applications need to be provided that support managers in decision-making processes. Managers at chains reported using IT to help them with operational decision-making and forecasting more than managers at independent restaurants. As a result, chain managers reported better fitting systems than independent managers.

Finally, the study found that in all categories, the more successful restaurants used technology for analysis more than the less successful restaurants. Competitive systems need to include operational (i.e., labor and cost analysis) and forecasting (i.e., sales and food production) applications. The appropriate use of technology will contribute to more effective cost management and profitability, thereby giving a competitive advantage to firms that provide higher-level applications in the five categories of decision-making.

While this study covered a variety of IT concepts, the number of responses and nature of those responses suggest that continued examination of technology usage in the restaurant industry is warranted. The study might be expanded to include other geographical and major metropolitan areas. This would increase the diversity of the subject pool. Additional questions might be asked to determine future applications and directions for technology use in the restaurant industry. Questions concerning the level of satisfaction with applications and their ease of use might be included. The reasons for lack of application use might be of value in determining the type

of products to be devised. Finally, case studies of successful IT use could also provide information that can assist firms in designing IT systems that provide optimal support for restaurant managers.

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