AN EMPIRICAL STUDY ON THE IMPACT OF COMPUTERS ON BUSINESSES IN A DEVELOPING COUNTRY

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Abstract

The results of a study on the impact of computers on eighty-four businesses in Turkey are discussed. First of all, the impacts on the different management functions are identified as perceived by the managers. Controlling, directing, and planning functions are affected most, whereas the organizing and staffing functions are not significantly affected. Secondly, the successful computer applications areas and the accrued benefits are listed. A number of application areas requiring computer implementation are given in priority order. Finally, the problems of incorporating a computer-based information processing system into an organization are discussed.

Introduction

In terms of computer usage, a country can be broadly classified as belonging to one of the following stages (11); (a) elementary level, (b) fundamental level, (c) productive level, (d) advanced level. Turkey is considered to be at the fundamental level and moving into the productive level. The impact of computers on businesses in a developing country can be quite different than in a developed country. This is mainly due to the relatively low cost of labor, lack of knowledge of managers concerning computers,

lack of experienced computer pesonnel, highly centralized organizations, lack of competition in the market place, etc. in a developing country. In this paper, we investigate the impact of computer on businesses in Turkey as perceived by the managers. First, the impacts of computers on the management functions (planning, organizing, staffing, directing, and control) are investigated. Second, the successful computer applications and the accrued benefits are listed. Third, the problems encountered in introducing computers and computerized information processing systems are discussed.

Previous work on the impact of computers on businesses can be classified as predictions and research findings. Since the publication of the classical article by Leavitt and Whisler (12) in 1958, many articles have appeared in the literature on the impact of computer on businesses. The articles giving the predictions of the "experts" (see (1), (5), (6), (7), (10), (12), (13) and (17) for some of the pioneering work) were later followed by empirical studies on the impact of computers (see (3), (6), (8), (9), (14), (16) and (19) for some of the pioneering work).

Recent research on the impact of computerized information systems on businesses emphasizes the effects of the implementation process of the system on the nature of impacts (2), (4), (15). Robey (15) classifies organizational impacts into accidental impacts and planned impacts. Accidental impacts are defined as those that are recognized only after the system has been implemented, hence surprising the system designers and managers. Planned impacts, on the other hand, are those managed by the system designers. The implementation process should anticipate and manage the longer term organizational changes (e.g., job design, changes in organizational structure) in addition to managing the technical changes.

In this study (18), a computerized information processing department is defined to include a minimum of one information processing manager, one systems analyst, one programmer, and one computer operator. The first computer system was installed in Turkey in 1960 at the State Highway Department and it was an IBM 650. In 1977, there were a total of 113 companies in Turkey with information processing departments. In this study, 84 of these companies were surveyed. Table 1 gives the business activities of the companies surveyed. Two-thirds of the companies were private/public companies while one-third were sateteowned companies. Business activities of the companies ineluded banking (17.9 %), in-

surance (9.5 %), electrical instruments industry (9.5 %), automotive industry (8.3 %), petroleum industry (7.1 %), textile industry (7.1 %), etc.

Table 1: Business Activities of The Companies Surveyed

Business Activity	Type of Company		
	Private / Public	State-Owned	Total
Agriculture	0	1	1
Minerals	0	2	2
Petroleum	3	3	6
Food Products	1·	0	1
Textile	5	1	6
Chemical	2	0	2
Phermaceutical	5	0	5
Rubber, Tire	2	· 0	2
Plastics	2	0	2
Cement	0	1	1
Glass	2	0	2
Steel	0	2	2
Electrical Equipment	8	0	8
Automobile Related	7	0	7
Electric and Water	0	2	2
Transportation	0	3	3
Construction	1	1	2
Banking	9	6	15
Insurance	7	1	8
Commerce	2	1	3
Military	0	2	2
Municipalities	0	2	2
TOTAL	56 (66.67 %)	28 (3.33 %)	84 (100.0 %)

The sizes of the companies in terms of the number of employees are given in Table 2. Note that more than fifty percent of the companies had more than one thousand employees. This is expected because automation of the payroll has been seen as one of the main advantages of electronic data processing by managers.

Table 2: Numher of Employees of The Companies Surveyed

Number of Employees	Percentage
Less than 250	19.05
251-500	11.90
501-750	8.34
751-100	4.76
More than 1000	51.19
Not reported	4.76

The questionnaire used in the survey was pretested on two different groups to improve its design. The response to the survey was high (84 out of 91, 92.3 %) due to the personal contacts with the respondents. The questionnaires were answered mainly by the information processing personnel of the companies. Table 3 gives the functions of the managers who responded to the questionnaire. Most of the respondents appear to be middle level managers. Only about 14 percent of the respondents were at the upper management level. In the following sections of the paper we analyze the responses to the survey.

**Table 3: Management Functions of The
Questionnaire Respondents**

Management Functions	Number of Respondents	Percentage of Respondents
Information Processing Manager	48	55.81
Automation Manager	9	10.47
Information Processing Coordinator	6	6.98
Systems Analyst or Programmer	5	5.81
Accounting or Finance Manager or Assistant Manager	5	5.81
Information Processing Assistant Manager	4	4.65
Automation Assistant Manager	2	2.33
Planning Assistant Manager	2	2.33
Administrative Manager or Assistant Manager	2	2.33
General Coordinator	1	1.16
General Manager Assistant	1	1.16
Facilities Manager	1	1.16
TOTAL	86	100.00

Impact of Computers on The Management Functions

The questionnaire had a set of questions designed to detect the impact of computer on the five management functions, namely; planning, organizing, staffing, directing, and controlling. The impact of computer on the planning function was based on eight possible impact areas. The managers were asked to rank the impact level of each of the impact areas of the planning function.

The eight impact areas considered were the following:

(1) Time required for planning has decreased.

(2) The use of scientific techniques in the planning process has been facilitated.

(3) Accuracy of forecasts has increased.

(4) Planning is more videly used in the company.

(5) The cost of the planning process has increased.

(6) The decision-making process of the management has improved.

(7) Centralization in decision-making has increased.

(8) The information required for decision-making has become easily accessible.

Table 4 gives the responses of the managers in five categories. By adding the percentages in the strongly agree and partielly agree columns of Table 4 (see the column labeled Total of Columns (i) and (ii), one can give a relative raking of the effects of the computer on the different aspects of the planning function. Note that all the impact areas except number five considered were significantly affected by computerization.

The ease of obtaining the information required for decision-making appears to have the greatest impact of computerization in the planning function.

Table 4 also indicates that about 21 percent of the managers, on the average, did not commit themselves positively or negatively on the effect of the computer on the impact areas of the planning function.

Table 4: Impact of Computers on The Planning Function of Management

Impact Agrees	Strongly Agree (i)	Partially Agree (ii)	Neutral (iii)	Partially Disagree (iv)	Strongly Disagree (v)	Total of Columns (1) and (ii)
	Categories of responses (%)					
1	43.90	28.05	21.95	2.44	3.66	71.95
2	56.10	23.17	18.29	2.44	—	79.27
3	54.88	23.17	21.95	—	—	78.05
4	56.10	18.29	23.17	1.22	1.22	74.39
5	19.51	21.95	29.27	13.41	18.85	41.46
6	43.90	30.49	21.95	2.44	1.22	74.39
7	30.49	36.59	20.73	10.98	1.22	67.08
8	67.07	21.95	10.98	—	—	89.02

The impact of computers on the organizing function of management was investigated based on the responses of the managers on six possible impact areas. The impact areas considered were the following:

(1) Organization structure has flattened and the managerial levels have decreased.

(2) Centralization in decision-making has increased.

(3) Some functions in the organization are eliminated while others are created.

(4) Decentralized activities have been standardized.

(5) A formal communication system has been established based onthe information flow requirements of the business.

(6) A management information system has been established.

The managers were asked to rank the impact level of each of the impact areas. Table 5 summarizes the responses of the managers. On the average, about 30 percent of the managers did not commit themselves positively or negatively on the effects of the computer on the impact areas of the organizing function. The majority of the managers agreed that the computers facilitated the establishment of a formal communication system in the company.

Table 5: Impact of Computers on the Organizing
Function of Management

Impact Areas	Strongly Agree (i)	Categories of responses (%) Partially Agree (ii)	Neutral (iii)	Partially Disagree (iv)	Strongly Disagree (v)	Total of Columns (1) and (ii)
1	15.85	24.39	36.59	13.41	9.76	40.24
2	24.39	29.27	30.49	13.41	2.44	53.66
3	34.15	37.80	20.73	6.10	1.22	71.95
4	37.80	24.39	36.59	1.22	—	62.19
5	56.10	26.83	17.07	—	—	82.93
6	26.83	32.93	32.93	6.10	1.22	59.76

The impact of the computer on the staffing function of management was investigated based on the responses of the managers on six possible impact areas. The impact areas considered were the following:

(1) Computerization of personnel records has been achieved.

(2) Personnel education and training have become more important.

(3) Promotion policies have been established within the company.

(4) Personnel evaluation process has improved.

(5) Humans have been replaced by machines.

(6) Payroll process has improved.

Table 6 summarizes the responses of the managers. Except for the impact area 6, improvement of the payroll due to auto-mation, computers do not significantly affect the staffing function. This is especially true for the establishment of promotion policies (impact area 3) and the personnel evaluation process (impact area 4). Table 6 also indicates that about 37 percent of the managers, on the average, were neutral on the effects of the computer on the staffing impact areas considered.

Table 6: Impact of Computers on the Staffing
Function of Management

Impact Agrees	Strongly Agree (i)	Categories of responses (%) Partially Agree (ii)	Neutral (iii)	Partially Disagree (iv)	Strongly Disagree (v)	Total of Columns (l) and (ii)
1	26.83	25.61	32.93	8.54	6.10	52.44

2	30.49	25.61	34.15	7.32	2.44	56.10
3	7.32	9.76	60.98	9.76	12.20	17.08
4	19.51	19.51	39.02	9.76	12.20	39.02
5	18.29	32.93	32.93	8.54	7.32	51.22
6	62.20	13.41	18.29	3.66	2.44	75.61

The impact of the computer on the directing function of management was investigated based on the responses of the managers on seven possible impact areas. The impact areas considered were the following:

(1) Necessitated the establishment of a formal system of directing and reporting.

(2) Increased the need for discipline and rules.

(3) Encouraged self-direction of subordinates.

(4) Facilitated full utilization of supervisors' talents and skills.

(5) Supported integration of the management activities such as sales, production, finance, and procurement.

(6) Brought a total systems point-of-view to the execution of the management activities.

(7) Increased information exchange among divisions.

Table 7 summarizes the responses of the managers. The impact of computer on the directing function of management appears to be significant for the impact areas considered. The least impact is on impact area 3, ability of subordinates for self-direction. Also, about 18 percent of the managers, on the average, did not commit themselves in a negative or positive way, on the effect of the computer on the impact areas of the directing function.

Table 7: Impact of Computers on The DIrecting Function of Management

| | | | Categories of responses (%) | | | |
Impact Areas	Strongly Agree (i)	Partially Agree (ii)	Neutral (iii)	Partially Disagree (iv)	Strongly Disagree (v)	Total of Columns (1) and (ii)
1	56.10	29.27	13.41	—	1.22	85.37
2	69.51	20.73	8.54	1.22	—	90.24
3	24.39	39.02	29.27	6.10	1.22	63.41

4	28.05	43.90	28.05	—	—	71.95
5	51.22	29.27	18.29	1.22	—	80.49
6	42.68	37.80	18.29	1.22	—	80.48
7	52.44	16.59	9.76	—	1.22	89.03

The impact of the computer on the controlling function of management was investigated based on the responses of the managers on five possible impact areas. The impact areas considered were the following:

(1) Facilitated the establishment of an effective reporting system.

(2) Facilitated the timely gathering of information for effective control.

(3) Increased use of quantitative techniques.

(4) Improved filing and storing of written data.

(5) Improved use of information feedback and quickness of corrective actions of upper management.

Table 8 summarizes the responses of the managers on the impact of computer on the five impact areas mentioned. The impact of the computer appears to be significant on ali of the impact areas of controlling considered. Only eleven percent of the managers, on the average, were neutral on the impact of the computer on the different impact areas of the controlling function.

The results shown in Table 4 through 8 imply that the impact of computers is mainly on the controlling, directing, and planning functions of management (average agreement levels of 87, 80 and 72 percent, respectively). The managers perceive the impact of the computer to be low on the organizing and staffing functions of management (average agreement levels of 62 and 49 percent, respectively).

Table 8: Impact of Computers On The Controlling Function of Management

| | | | Categories of responses (%) | | | |
Impact Areas	Strongly Agree (i)	Partially Agree (ii)	Neutral (iii)	Partially Disagree (iv)	Strongly Disagree (v)	Total of Columns (1) and (ii)
1	69.51	21.95	7.32	1.22	—	91.46
2	70.73	21.95	7.32	—	—	92.68

3	43.90	37.80	17.07	—	1.22	81.70
4	54.88	29.27	12.20	2.44	1.22	86.15
5	57.32	29.27	12.20	1.22	—	86.59

These findings mostly support the results of provious studies (see (19) for a summary) except that our study shows the directing function to be affected significantly by computerization.

The individual impact areas are listed in Table 9 in the order of computer impact level. Table 9 lists only the first twelve impact areas (all the ones with an agreement level of 80 percent or more) with their respective management function areas. Note that the controlling and directing related impact areas are the ones in majority in Table 9.

Table 9: Effects of Computers On The Impact Areas

Impact Area	Function	Effect (%)
Facilitated the timely gathering of information for effective control	Controlling	92.68
Facilitated the establishment of an effective reporting system.	Controlling	91.46
Increased the need for discipline and rules.	Directing	91.46
Increased information exchange among divisions.	Directing	89.03
Facilitated easy access to information required in decision-making.	Planning	89.02
Improved use of information feedback and quickness of corrective actions of the upper management.	Controlling	86.59
Necessitated the establishment of a formal system of directing and reporting.	Directing	85.37
Improved filing and storing of written data.	Controlling	84.15
Established a formal communication system based on the information flow requirements of the business.	Organizing	82.93
Increased the use of quantitative techniques.	Controlling	81.70
Supported integration of the management activities such as sales, production, finance and procurement	Controlling	80.49
Brought a total systems point-of-view to the execution of the management activities.	Directing	80.48

In the survey, the managers were also asked which management functions used the reports prepared by the computer. The managers

ranked the functional areas as directing, controlling, planning, staffing, and organizing (100, 83, 71, 44 and 14 percent, respectively). These results concur with the results given above in identifying the management functions most affected by the computerization at the business place.

Successful Computer Application Areas

One of the objectives of the survey was to identify the objectives of the managers in incorporating the computer into their companies and to recognize the most effective computer application areas within the companies. The objectives of the managers in incorporating a computer system into their company can be summarized in seven categories. The objectives are listed below in the order of importance as perceived by the managers:

(1) Reduce the office costs and automate the accounting process (20.83 %).

(2) Develop a management information processing system that will support an accurate and timely decisionmaking process (16.58 %).

(3) Scrutinize the business activities closely and aid the long-term planning process (16.03 %).

(4) Reduce the personnel costs (15.49 %).

(5) Effective management of production planning, inventory levels, procurement and sales activities (13.59 %).

(6) Increase the reporting areas and the number of reports submitted to management (13.32 %).

(7) Better service to customers, aid the solution process of the engineering problems, computerize monotonous tasks such as billing, and payroll, speed up the customer service in banks, etc. (4.62 %).

The managers also listed the most effective computer application areas and naturally there exists a high correlation between the successful application areas of the computer in the companies and the ojectives of the managers. Table 10 below shows the most effective computer application areas in the companies. Note the accounting, payroll, inventory management, and billing appear to be the areas where the computer is used most. Of the managers surveyed, 27.38 percent of the indicated that they have fully implemented the computer in their operations as they original-

ly planned. The remaining majority of the managers (72.62 percent) indicated that they have only partially implemented the computer in their operations as defined by their original plans. These managers indicated that the application areas that the computer is to be introduced includes cost accounting, inventory management, production planning, and others. Table 11 gives the application areas where the computer is not fully implemented yet. Note that there is some similarity in the ranking of the application areas in Tables 10 and 11, namely; accounting and inventory controi areas appear to be the two main application areas of computers in the Turkish companies.

Table 10: Application Areas of The Computer

Application Area	Percentile
General Accounting	88.10
Payroll	84.52
Customer Accounts	73.81
inventory Management and Controi	59.52
Billing and Invoicing	53.57
Sales Analysis	47.62
Receipt (Note-of-Hand) Tracking	47.62
Personnel Piles	33.33
Cost Accounting	30.95
Production Management and Controi	28.57
Production Planning	25.00
Sales Planning	23.81
Check Printing	21.43
Banking Applications	15.48
Distribution and Receivel	13.10
Insurance Processing	8.33
Engineering Calculations	7.14
Statistical Data Gathering	3.57
Quantitative Operations Management	2.38
Project Evaluation and Financial Analysis	2.38
Others	3.57

Table 11: Application Areas Requiring Full Computer Implementation

Application Areas	Percentage
Cost Accounting	15.48
inventory Management and Controi	13.10
Production Planning	10.71
Banking Applications	7.14
Personnel Files	4.76
Production Controi	4.76

Others (each less than 4.00 %)   44.05
  General Accounting, Receipt Tracking, Engineering
  Applications, Information Gathering, etc.

When the managers were asked to specify the benefits that their
companies accrued as a result of using computers, two of them (2.38 %)
indicated that the benefits were minor while eighty-two of them (97.62
%) gave the list of benefits shown in Table 12. Note that time savings in
general and the fulfillment of the information requirements of manage-
ment appear to be the most quoted benefits by the managers.

Table 12: Benefits Accrued From The Use of Computers In Business

Benefits	*Percentage*
Savings in time	89.02
Information to management	86.59
Effective reporting systems	78.05
Customer satisfaction	68.29
Savings in personnel cost	67.07
Productivity inereasse in office	59.56
Improvements in receipt tracking	51.22
Reduction in inventories	25.61
Reduction in production cost	23.17
Increase in the competitive position of company	18.29
Uniformity it production rates	15.85
Increase in sales	13.41
Others	12.20

Problems Encountered After The Introduction of A Computer Information System Into The Company

When the managers were asked about the problems that they en-
countered after establishing a computer information system in their com-
pany, only three of the eighty-four managers (3.57 %) indicated no prob-
lems at all. The rest of the managers (96.43 %) rank-ordered the prob-
lems that they encountered as in Table 13. Note that lack of qualified
EDP personnel, lack of training of users, and lack of knowledge of the
upper level managers on computers appear to be the large portion of the
problems encountered. Almost ali the problems are human related except
problem seven (physical limitations on space, electrical shortages, com-

puter paper shortage, and the insufficient maintenance of equipment) which is machine related.

Table 13: Problems Encountered With The Introduction of A Computer Information System In The Company

Problems	Percentage
Lack of qualified EDP personnel and wrong personnel selection	27.63
Plow of information is not well established, lack of cooperation between departments, lack of cooperation from data supply conters, data input errors.	23.68
Lack of training of the users and the personnel supplying the data. Information requirements not properly specified by the users and too much information demand from the users.	21.05
Lack of knowledge of the upper level management on computer applications, not being receptive to new technology.	18.42
Insufficient planning, insufficient training of personnel before starting the use of the computer, management of the computer information department is not properly systematized.	6.58
Not being able to hold on to internally trained qualified computer personnel due to low wages.	5.26
Space limitations, electrical shortages, computer paper and card shortages, insufficient maintenance of equipment	5.26
Lack of organization of the EDP department, interdepartmental relationships	2.63
Others Partial use of the information supplied by the system, working closely with the accounting department, not satisfaying the increased information requirements of different departments, etc.	13.84

Conclusions

In this paper, we investigated the impact of computers on 84 businesses in Turkey as perceived by the middle level managers. First, the impact of the computer on the different management functions are identified. It was found that the controlling, directing and planning functions of management are significantly affected by computers while the organizing and staffing functions are not.

Second, the most effective computer application areas were identified in the company. These included general accounting, payroll, customer accounts, inventory management and control, billing, sales analysis, and receipts tracking. A large percent of the managers indicated that they

have not fully implemented the computer in their operations yet. The managers experienced the benefits of the computer mainly in savings in time in general, timely information flow to management, effective reporting, customer satisfaction, savings in personnel costs, productivity increases in office, and improvements in receipt tracking. Third, the problems encountered as a result of establishing a computerized information processing department are classified. Most of the problems were human related organizational problems including the lack of qualified EDP personnel, lack of training of users and the data entry personnel, lack of knowledge of upper level management on computer applications, too much information request from managers and lack of use of available information, lack of organization of the EDP department and the lack of cooperation with the data input centers.

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