

MICRO-ANALYSIS OF THE TRANSFORMATION OF TASKS: COMMUNICATION AND ORGANIZATIONAL STRUCTURE IN A SMALL ENTERPRISE

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An increasing number of studies are focusing on the impact of new technologies in the workplace. Vallée (1986) has stressed that it is in the tertiary sector (goods and services) that we observe the biggest changes following the arrival of technology, primarily for accounting operations. Office automation is very often seen as a means to increase productivity and to reduce the complexity of information processing; but it may also radically change the working conditions. As such the impact on organizations of changes in communication practices becomes an interesting field of study.

The following study is based on the research of Blais (1990) on the impact of automation on accounting tasks within a small company offering plumbing goods and services in Quebec. It stemmed from a large GISCOR¹ project on the automation of franchises, sponsored by the Canadian Workplace Automation Research Center (CWARC). The case study employs a micro-perspective to analyze the impacts of automation on tasks, communications and other organizational variables.

THEORETICAL PERSPECTIVES

The Impact of Computers on Organizations

Many studies have tried the causal relations in the automation process, in order to facilitate systems planning and implementation. We will briefly outline below some guidelines that have emerged from research on the impact of automation on productivity, quality of life and structural conditions, especially in the context of small businesses.

Impact on Productivity. According to Olson and Lucas (1982), companies are attracted to automation for two reasons: first, in the hope to improve the managers' productivity; and second, as a miracle solution to the increasing complexity of decision making in organizations (see also Ito & Peterson, 1986), where information needs are constantly expanding. However, to evaluate the impact of automation on productivity, one must

take into account changes in efficiency (ratio of intrans and extrants) and changes in effectiveness (quality and appropriateness of the product). In the context of white-collar workers, performance is not easily measured since the quantity and quality of the product is difficult to assess. Even though profit can be measured in business, the quality of services may have long-term effects, which are difficult to separate from other environmental factors.

Many authors now doubt whether automation has a positive effect on productivity. Very often, the increased costs associated with automation, offset a general increase in productivity in the short term. In this view, only businesses that are already going well can improve performance through automation. Olson and Lucas (1982) report that while office technological costs have doubled, productivity has only increased by 4%. Taylor (1983), Taylor and Katambwe (1988) and Lyytinen (1987) report a number of studies that also cast doubt on the positive relation between automation and productivity.

Others report that the process of work is changed by automation (Bair, 1979; Culnan, 1983; De Blasis, 1986; Wybouw et al., 1986): processes are substituted, process itself is accelerated and some temporal modifications take place (time rescheduling). Dumais et al. (1988), who studied a large insurance firm, report that frequent tasks are accelerated (searching for client file), while infrequent tasks are decelerated by automation. These changes may affect both efficiency or effectiveness.

Quality of Life and Automation. According to "Quality of Life" approaches, productivity measures should take into consideration not only quantitative changes in productivity, but also qualitative changes in working conditions. Culnan (1983) postulates that automation has an impact on all the different functions of communication: information, control, motivation, emotion. If Gutek (1988) found no difference in interactions following automation, others (Dumais, 1988; Deschênes, 1987) report a diminution in communication.

For other qualitative changes, Gutek (1988) and Deschênes (1987), found that automation lessens the proportion of routine work and seems to be linked to an increase in the employees' self esteem, with the introduction of new and more diverse tasks. By contrast, subjects in the Dumais study reported that they experienced less challenge, lower job quality, less job diversity and less job satisfaction with the computer. It is clear that job quality impact varies depending on the way the structure of work is redefined with automation.

Other organizational changes. Automation does not radically alter existing structures, but it reinforces some tendencies for structural change in the organization (Taylor & Katambwe, 1988; Wybouw et al., 1987). Very often choices made at the time of automation orient design and implementation. Automation is also the occasion for the introduction of other organizational changes, such as modification of the environment and schedule, centralization, control (Olson & Lucas, 1982) and formalization of tasks (Fry & Slocum, 1984; Comstock & Scott, 1977).

Automation in Small Businesses

Few studies have been done on the impact of automation on small businesses. Lefebvre and Lefebvre (1987) have studied the use of computers in small businesses in Quebec and contribute some information on the managers' opinions of their effect. For businesses with less than 50 employees, managers appear to be satisfied with the introduction of the computer. They report that information is accessed faster, its quality is improved, and that control, quality of life and productivity have been improved by automation.

DeLone (1983) describes three types of factors affecting automation: fixed factors (duration of the implementation and previous experience), semi-fixed factors (vendors' knowledge of the domain of application, characteristics of the system, in-house knowledge and type of servicing), and controllable factors (implication of the manager, degree of support, quality of planning, degree of end-user control on their use of the system). In the case of small business, such conditions may have an effect on automation. For example, a better control of the system use or an in-house system can foster user satisfaction. Raymond (1985) shows similar results. He also finds that the more administrative functions are programmed, the greater the satisfaction.

Toward a More Complex Model of Impacts

One of the limitations of these studies of the productivity and quality of life dimensions (Markus & Robey, 1988) is that they try to reduce the process of automation to simple, monotonic causal relations. Automation is a process of adaptation where structural conditions play a role, but are also modified through, among other things, extraneous opportunities and individual reactions. To properly understand the change in the working conditions associated with automation it is important to examine it at a more individual level.

Markus and Robey (1988) and Mohr (1982) distinguish between causal and processual models of automation. They prefer processual models, which depict automation as a process where cause-effect links are only possible (not necessary), depending on user choice, opportunities and other random factors. In processual models, change may be explained through individuals, who experience and decide based on their reactions. This micro-approach based on observation is different from macro-approaches, which tend to hide interactions and the confounding effects of conditions. It is interesting to link this paradigm to the interpretative theory, which assumes a subjective reality of the organization and suggests that technology and its impacts are a social cognitive construct that is subjective and variable. Most macro measures of impacts are assessed using questionnaires or self-reports, which may increase the influence of such an interpretative vision of the technology.

In small business the process of automation might be more flexible, with organization and systems being more easily adapted to one another; so a processual approach may be particularly useful.

Objective Measures of Change in Tasks and Communications

One important limitation of studies on impacts is that most are based on subjective measures. If objective productivity measurement is difficult, without evacuating efficiency and quality of life dimensions, subjective measures, whether through questionnaires or self-report (Higgins & Safayeni, 1984) are vulnerable to problems of experimental bias, including the tendency to please the interviewer and to overvalue the time and money investment associated with automation. Another possible bias is the difficulty users have in recalling and reporting in detail what they do, with the result that shadow functions, process dimensions and operational rationality are hidden.

An alternative approach is to use observation and to categorize tasks. Though such a procedure is more time-consuming it permits a more detailed report on tasks, and a more precise account of shadow functions, which in turn provides a better measure of the impact of automation.

In order to also evaluate the impacts on quality of life in tasks, the taxonomy used for classification should include classes of social activities. The hypothesis was that productivity would increase as measured by the time/task ratio, but that the communications would decrease after automation. As a response to the acceleration of the process, the research also tested if new management tasks would be added and if other more qualitative changes were taking place, at an individual or organizational level. From the observations a processual model was extrapolated to explain the modifications in tasks and in communication patterns.

METHODOLOGY

The research studied the implementation of an accounting package in a small enterprise. Systematic observation of activities, and interviews were conducted with the employees and managers before and after automation.

Organization Studied

The study was limited to one expanding plumbing enterprise having ten office employees. The organization under study was a member of a franchise which was considering automation, but it alone decided to go ahead buying a computer in order to cope with its increasing needs for information processing.

Taxonomy for Tasks

A taxonomy for tasks and communication activities was established after observation and consultation with the employees in the accounting department. The observation centered around the three main activities: accounts payable, accounts receivable and payroll. It described in detail all aspects of the activities (starting parts of the tasks, correcting, waiting, talking, etc.), where each period of observation covered the complete accounting activity of the week. Categories of task were later grouped according to whether they were related to the main task, other tasks, or communications. A researcher had been present and observing in the department for some time,

so employees were accustomed to work in his presence. Activities and time were recorded manually² by the researcher during a complete session of each activity (one to three hours), before and after implementation. Not only were observations made of the employee doing his/her task, but all intervening activities were registered, as well as his/her interactions with others during the task. Even though the situation presupposed possible bias, the assumption was made that employees would not modify their behavior to any great extent to please the experimenter. In addition, the tasks are quite standardized, all shadow functions (disturbance by customer, missing bills, etc.) are not easily controlled and any effects of trying to show efficiency would be constant before and after automation. Though only one session was recorded, it was considered to be representative of the normal course of activities, both before and after the implementation. Many different cases are treated at each session, which together represent normal problems encountered in this activity. The research is essentially a case study. In order for more general conclusions to be drawn, more offices and many sessions of each task would have to be analyzed.

According to Higgins and Safayeni (1984) taxonomies must take into account the actors' point of view. It must render the dynamic dimension they perceive (order, beginning and end). Criticisms of task taxonomies are: first, that they tend to be interpretations that are not really validated by the actors; second, that they are not orthogonal; and third, that they cannot be used to design systems. Since in this case taxonomies are concrete and are not self-reported, possible misinterpretations do not appear to be a problem. Though the taxonomy is not completely adapted to report change in the process (activities were slightly different after automation), it is sufficient to describe activities pertaining to the main task versus other tasks or communications.

Observations and interviews were also used to investigate other qualitative changes associated with automation.

RESULTS

Table 1 presents the changes in task and communication activities following automation.

Table 1

Minutes spent doing the task and communicating before and after automation with percentage of change.

	task before	ask after	change com.	before com.	after	change
Payroll	120.95	48.75	-60%	69.08	0.5	-99%
Accounts receivable	112.95	104	-8%	16.75	28.5	70%
Accounts payable	118.75	69.3	-42%	21.25	4.1	-81%
Total	352.65	222.05	-37%	107.08	33.1	-69%

Diminution of Time to Execute Basic Accounting Activity

The first hypothesis (Blais, 1990) was that there would be a reduction in the time taken to accomplish each typical accounting task: payroll, accounts receivable, accounts payable. Figure 1 presents the time that was recorded for each activity. Results show that the time has diminished both in the payroll and the accounts payable. In the payroll, the diminution is due to the fact that the salary and deductions are now automatically calculated, therefore only the number of hours worked has to be written. For the accounts payable, it takes less time because the balance is now automatically accessible. In the accounts receivable, the diminution is smaller because this activity necessitates the treatment of much non-computerized information: bills which are handwritten have to be classified and verified (prices and labor cost).

As was anticipated, it seems that the computer processing of accounts is accelerated because information is accessed faster (salary, balance) or because processing of it is done automatically (deductions).

Diminution of verbal communications

The second hypothesis was that there would be a diminution of verbal communications among employees. Figure 2 shows verbal communications that were recorded before and after implementation. It is evident that there was a dramatic decrease in verbal communications, while doing payroll and accounts payable. During accounts receivable, communication had not diminished because this activity involves, as just mentioned, much activity independent of the computer: classifying bills, verification, etc. In fact, the employee, having more time after automation, was telephoning clients more often to collect payments.

Additions of tasks

As for the third hypothesis, only a few menial tasks were introduced with automation: changing the paper in the printers, moving the box of paper for the computer. Employees or administrators do not seem to take the opportunity of using the computer to do less monotonous tasks, like long-term analysis or complex reports on their activity. This had also been observed with others franchisees, who had already computerized their activity, but did not use complex analysis on sales.

The main difference in tasks appears to be using the gain in time to classify records, to verify accounts receivable and to call clients who have not settled their balance. The employees' activity now seems to be more regulated and calm. It is important to contrast this with the activity preceding the implementation: employees are no longer running after missing information and correcting errors; and they appear to be more in control of the whole process, which may contribute to their quality of life perspective. It seems that the automation may contribute to better management practices, even if it is not through planning activity; it does provide a clearer picture of what is happening and creates more time for day-to-day tasks.

Structural changes in the organization

First, as was noted by Olson and Lucas (1982) the implementation was the occasion for other structural changes. The accounting department was moved to the first floor, where it was now isolated from the selling area. This in itself may have contributed to reducing communications and distractions, thus improving efficiency, but also diminishing social aspects of work.

Automation seems to have brought a certain formality with it, as noted by Deschênes (1987). All the processing of information was restructured to interact better with the new system. Standards were developed for many aspects of the task (for example, procedures for rebates, collection of payments, etc.), to which even the manager had to adhere.

There was also changes toward greater specialization. This came naturally as it was easier to train only one person for each task, and also because it was thought easier for the employees to learn one new task on the computer and not to be distracted from it either by other tasks or by answering the telephone. So each task was assigned to one person and only one person became responsible for answering the phone.

What is interesting is that this led to a greater decentralization of operations; each task was assumed independently by one person. Though information was now centralized it was now more accessible to everyone, without having to depend on others. It is important to note that this would have been difficult with the old system, because the information was less organized and each person often had to be asked about the information he had received and processed. Each employee thus contributed to the design of the system, by suggesting modifications necessary for his work. This corresponded to a shift from a simple structure to a more bureaucratic one (Mintzberg, 1983), but the involvement of employees seems to have fostered acceptance of the change (Raymond, 1985).

Among other structural changes, some control of the access to information was installed after a short period, so data which was now accessible to everyone, would not be modified. One interesting thing about this control was that the manager himself was subject to it (he was now more constrained on giving rebates).

DISCUSSION AND CONCLUSION

The research is essentially a case study since only one organization was studied for a limited amount of time. However, it gives a micro-perspective on very revealing links between two dimensions of the change: changes relative to the task and changes related to the social aspects of it. It seems that there is in the observed data an interrelation of the two facets. The results illustrate how those links are interwoven in a more individual and processual dimension. The research also highlights positive aspects of the change in the context of a small but growing organization.

The decrease in time needed to accomplish a task appears to be linked to many factors: the disappearance of shadow functions associated with automation, the

specialization of tasks, which reduces the need for consultation among employees, thus reducing interruptions and errors, the automation of access to old information and the mathematical processing of it. Aspects of the task that remained were those linked to the input and output of data and the integration with non automated areas (eg., checking hand-written invoices).

Second, if the communication decreased it is not only because shadow functions diminished, but because of spatial reorganization and because the task itself is shorter, there is less need for interruptions for social activities. Also, the acceleration of procedure allows more time for more productive communications with clients. The reduction of communication during tasks might not be too critical since more time was now available between tasks.

Finally if one adopts a critical point of view regarding automation as a means of increasing productivity, it becomes clear that if processes are accelerated and the quality of work improves, there is no increase in productivity, probably because the amount of work is limited by the environment (the number of clients and employees stays the same). This cannot change instantly, but might over a longer period as the culture evolves and services are diversified. Also new tasks linked to computer use are not easily designed, which may be the result of a lack of experience with computers among the personnel in a small organization. Very often the technology, the design and adaptation of it are sufficiently costly, so that no provision is left for innovation. Also, political will may not be strong enough, since the outcome of such development cannot easily be anticipated, knowledge being the first step to innovation (Rogers, 1983).

From a more social perspective, it seems evident, as Deschênes (1987) observed, that the era of the computer, has lightened the tasks of people using them and brought about many spatial and recognition transformations. In the context of the study, moving the accounting away from the sales floor, the fact that employees using the computer were relieved of answering the phone, was viewed by the management as a recognition of the difficulty and importance of the task. That positive factor is certainly important as a reinforcement for innovation (Rogers, 1983).

Finally, interviews completed the study, showing that most employees and the management were quite happy with the change. During implementation, employees complained about missing features³ in the system and the manager agreed to pay for their addition. As shown by Raymond their satisfaction was increased by having more functionalities to the system. They reported having less stress and having more time to do their jobs after automation.

The manager, though he complained about having to pay for extras and was first reticent about having meetings with the personnel about automation, was finally very satisfied to see how quickly everyone adapted to it and how quickly everything was reorganized. He was forced not to make changes directly in the system, but he could now follow more easily what was happening.

Other questions, though, were left unanswered, especially those concerning long-term effects on the employees and clients and on the expansion of the business.

ENDNOTES

1. Groupe d'Intervention Stratégique en Communication Organisationnelle.
2. Part of the activity was silent so a tape recorder could not be used and a magnetoscope would have disturbed too much of the activity in the office.
3. Some, like the stock inventory, were supposed to be installed later, but the personnel insisted on contributing to its fast implementation.

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