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ERP and the capitalization of information production process and skills

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Our proposal is based on the results of a three-year research program concerning the relationship between organizational change and information system transformation in firms dealing with ERP implementation projects*. Our enquiries have mostly concerned the implementation process and its first results in the firm activities. Interviews have been conducted with members of project teams within the concerned firms (20 interviews), and with consultants specialized in ERP consulting and implementation (10 hours of recorded interviews with specialized consultants).

1- ERP and information production design

1.1- The 'scientific organization of labor' applied to 'ordinary' information and knowledge

ERP are based on data bases which are shared by the different functions and units of a firm: product data bases, client and provider databases, as well as data bases for all the resources required by the activities, including human resources. So as to be part of such data bases, information has to be standardized. It has to be codified according to a format which is often established in its final form at the firm level, the global level. This happens to be often fairly different from what happened previously, when various codes were used in the different units or entities, or according to the professionals: designers, or manufacturers, or sellers, or technicians in charge of the technical support, often had codified differently information, as they were concerned with different dimensions or points of view regarding this information.

Not only is the information standardized, but also the information production itself. The standardization logic is applied to the treatments which are carried out so as to identify information, and to process it, all along the linked activities. For example, a client order will go through several stages, and this will be specified.

This specification is usually done by 'expert users' who collaborate with the project team, which often include computer programmers. The information production 'model' described in such procedures will form the references for the ERP configuration, specifying what will become the necessary way of processing the concerned tasks.

This evolution contributes to a stronger industrialization of tertiary activities in firms, and more precisely of activities with intellectual dimensions, that were previously either not, or at an individual level, computerized. The 'scientific organization of labor' that Taylor promoted at the turn of the last century is therefore extended to information activities, and partly to intellectual tasks and skills.

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1.2- A focus on information which can be formalized, and on basic exchange of information

As mentioned earlier, 'expert users' are asked to specify the information required as an 'input' for the tasks they operate as part of their job, and to tell the treatment they proceed on this information before sending it to the following stages. The focus concerns the treatments by themselves. The analysis does not involve the knowledge and know-how required to identify the information, its meaning and usefulness for the on-hand activities, and to coordinate with other employees and departments for setting up a common point of view on the questions to be solved (Grabot, 2005). In this respect, it is a quite partial view of the whole information and communication tasks and knowledge required for carrying out the activities.

All along the specification process, the figure of a flow is applied on information production. Such an approach implies that communication is un-necessary, that a co-construction of the meaning of information is not required. The meaning of information and its possible use are supposed to be totally formalized in the information system (Levitan, 1982). An implicit statement, in such an approach, is that all that is necessary for conducting these tasks can be specified. This is not far from the scientific organization of labour: each task is designed in such a way that it fits with the following ones, and communication is un-necessary. If employees try to communicate with each other, it may be considered as hanging around.

Such an approach of information and communication standardization is questionable in firms dominated by flexibility, adaptability, and whose resources are maintained at their minimum level. In such firms, there is a great need for specifying what are the current priorities, what problems are to be solved. This recurrent identification of priorities is aimed at answering the different client requirements, taking into account the constraints both inside and outside the firm.

1.3- Inter-changeability of information producers

The arguments mobilized to justify ERP investment usually deal with upgrading productivity, reducing the costs dedicated to maintain software and local data bases, while increasing the speed and quality of reporting to headquarters. However, there is at least another goal, although rarely mentioned, which appears to be fairly important. That is the codification of information and of the information process which are required for all basic information activities in the firm, and their computerization. This dynamics contributes to a new type of capitalization of knowledge.

The perimeter of such a knowledge capitalization is quite different of what was meant by such a term in the 80^s, but it tends to be a very important stake in such a flexible firm type. When human resources have to be as flexible as other resources, the computerized information system tends to be the unique stable component of the information system. The substitution between employees has to be easy for the smooth running of the business. Firms have to make sure of the inter-changeability of information producers, considered as part of information sources and of information treatment providers.

2- ERP combined with business process re-engineering and business process outsourcing: re-designing the organization while transforming its information system

2.1- Value-adding versus non-value-adding activities

In order to specify what should be in the scope of the ERP, and what should rely on specific software, ERP consultancy service experts state a difference between activities which are supposed to provide the added value of the firm, and other activities. According to these experts, the first ones should be computerized with the support of specific software, so as to capitalize in the firm its core knowledge and skills, its main know-how, know-whom and

whatever knowledge which makes the difference with competitors. The second type of activities, which is not specific to the firm, is typically concerned by the ERP package.

The 'main stream' point of view has changed regarding this issue during the recent years. Previously, the main ERP editors were putting forward the 'best practices' design approach so as to argue that all the information system should be integrated under the same ERP.

The ERP hegemony has thus been criticized and the interest of developing links with specific software is recognized so as to maintain the competitive advantages of the firm.

However, one main question remains on the very possibility of identifying such differences between activities. How to make sure that certain activities provide the added value, and others are just ordinary ones, without specific added value? According to consultants, the managers do not always have a clear figure of what makes their efficiency and competitiveness. But consultants do not often have an expertise in their client firm domain: they first of all are experts in the ERP itself. Our observations show that their judgment concerning value-adding and not-value-adding activities reflects the shared ideas in the firm and its direct environments: it is often a mirror of usual thinking rather than an effective expertise. However, it may have very strong impact on firm re-engineering.

Suppose experts can manage with such identification. Anyhow, a lack of coherence may appear between the ERP standardized tasks and the other ones. Business is made of strongly interlinked routines and more ad-hoc activities. The fact of dividing them between two different sub-systems can develop contradictory factors which make the overall process inefficient.

The 'thin' firm, based on 'lean production', is sometimes not that far from anorexia, and the lack of redundancy can be quite risky in just-in-time organization. What we observed in the purchase services of an international firm tends to underline the inter-links between very usual information treatments, and the core tasks of employees, in such case, purchasers. The limits of the optimized process appear when nobody knows when such invoice will be paid, when nobody can tell what is the possible obstacle, and how concerned people could get round it.

2.2- Re-engineering, outsourcing, and the robustness of information process

ERP implementation is often linked to re-engineering and outsourcing. Once optimized, the information production process relies on a division of labour which combines internal and external resources, and units in different countries. The employees processing information at a certain stage do not necessarily know who will do the next treatment, who did the previous one, neither when or where. Part of the knowledge required for the information production and for the overall business can possibly be capitalized in the ERP data bases and procedures. Is it sufficient for carrying out the business, particularly in the current flexible economic environment? With such a division of information production labour, is the intelligence required for the activities still somewhere in the firm? One can express some doubts about it when observing at a detailed level the way this evolution is going on in firms.

3- Contradictory dynamics relying on local employees and on project teams

3.1- Project teams dealing with local versus global contradictory dynamics

The project teams in charge of the ERP configuration have to deal with complex dynamics which include contradictory components. They have to obtain the active participation of expert users so as to clarify the existing procedures and process. They also have to impose on the so-named 'final users' the standardized codes when confirmed by the management (global level). In internationalized firms, the local specifications are often discussed and finalized by the headquarter managers according to global priorities – namely, optimizing the reporting – and this can imply important changes in the formats defined at the local stage. When such a global standard is sent back to the units, project teams have to accompany final users in the

appropriation process, when they try to understand and use the renewed procedures (Orlikowski, 1992, 2000).

A. Giddens has pointed out the delocalization – relocalization process as one of the main dimensions of modernity (Giddens, 1994). The contradictory dynamics that project teams have to deal with can be analyzed within such an analytical framework.

3.2- The selection of 'expert users'

First of all, the question of who are the so-called 'expert users' has to be specified. In one of our in-depth field studies, the expert users were the persons in charge of the departments which were meant to be concerned by the ERP project. These managers had no direct practice of the activity, and they were relying on their guess concerning the way the activity was or should be carried out. The risk of a gap between their perception of the activity as the 'usual way it should go on', and its variety as a fact, was in such case fairly high.

Usually, expert users are employees who have a long experience in the concerned activity. This could be questioned also, taking into account the computerization logic combined with the flexibility of human resources and the constraint of employee substitutability. Employees who have carried out the activities for years master a whole set of implicit knowledge which is useful for identifying the meaning of information. They are able to distinguish the possible differences between current indicators or data and usual trend of activities. This may be not the case of new comers, who will just have the opportunity of relying on computerized process, without additional expertise for assessing the on-hand activities.

In other case, the expert users happen to be fairly recent ones. In the purchase department of one of the studied firms (Electronic), there was previously an important change which results in the fact that all the employees of the department were new comers when the ERP project was submitted. This has not been taken into account when deciding of who will compose the expert user team. These newly arrived employees were asked to tell what the procedures were.

Although the expert user role appears to be a very important one, it seems that pragmatism comes first when deciding of who will be part of this process, ignoring the risk linked to either too much or not enough expertise.

3.3- The 'expert users' : the gap between first hopes and final results

Our observations, as well as other research programs come to the same result: the 'expert users' collaborate quite actively to the codification process (Grabot, 2004). Managers present the investment in ERP as one of the 'naturalized constraints' of contemporary firm. ERP investment is talked about as an evolution that could not not happen (Durand, 2004). Therefore, employees focus on 'how to' rather than inquire on 'why'. Heavy constraints imposed on planning, with short delays and strong pressures for keeping in the framework, are participating to this viewpoint (Thine, 2005).

The ERP implementation goes through different steps: one deals with the process analysis. It is meant to identify the different tasks which take place all along the process under study. During this stage, the employees are asked to speak freely on the ways they perform activity and on the possible improvements. The project team is usually composed of employees working in different components of the firm, and the persons involved are often quite satisfied with such an opportunity of discussing of what they do, and knowing better on what other employees accomplish in other departments or functions.

The further step usually deals with knowing better of what the selected ERP will require for process specifications; and the following one is dedicated to make the process analysis converge on the ERP requirements. During these two stages, the expert users often do not

play an important role, and may even be totally absent. Consultants often play the main part. They have a propensity to rely on their previous experience of the ERP for specifying the computerized process in the current firm. Their investment in the firm meets heavy constraints, because of the high fees and the often short time that is funded for this project. What often occurs, according to different observations, is an important gap between the process analysis as specified with the expert users, and what is finally presented to them as the computerised process according to the ERP constraints (or, but this is not said, according to the consultant knowledge and the means devoted to ERP specification).

This gap engenders fairly high disappointments within the expert users, and through them, within the final users (Grabot, 2005). The feeling is that all these efforts have no result, that the complexity of work is denied, or even, that the process analysis was only a way of getting the employee involvement before organizing the convergence on an already defined goal.

Expert users, when involved at this stage looking for a tight fit between the process on hand and the ERP constraints, are mobilizing rudiments which are part of knowledge and competences associated to their job. Facing such a supposed-to-be unavoidable change, they try to make sure that they will still be able to carry out these tasks after ERP implementation. Short term issues tend to predominate over the risk linked to knowledge capitalization at the firm level, in a context where nobody really knows what will be his (her) job and employer in a few years or even months. However, as mentioned earlier, the capitalization process at the firm level tend to be limited to the basic data and treatment of such data, as long as the knowledge and know-how required for transforming data in information useful for action is not involve in the process.

4- Back to the definition of information and knowledge associated to ERP design

4.1- Knowledge management renewed through ERP projects

ERP projects aim at covering most of the functions and departments of the firm. Thus, they fulfil a hope which was mentioned since the 70s by information systems specialists: to get rid of specialized and isolated information sub-systems which were specific to departments, units or functions, and to set up a unified information system.

However, what is at stake do not only concerns the setting up of a single and integrated information system. One main issue is the extensive development of information computerization. For instance, in sales departments, sales representatives can be asked to record the characteristics of their clients, the needs expressed and the questions submitted, that is, very specific information which was previously stored in personal minds or on personal registers. Such dynamics sustains the formalization of different types of information, from the most quantitative to more qualitative ones. This formalization combined with computerization transforms personal information in shared information at an organizational level. Each employee is asked to produce information not only for him or herself, but for other employees, most of them they never meet and do not know. This information production gets a growing part in the overall tasks of employees (Grabot, 2005). However, it is often not taken into account in job description. On the other hand, employees often share a depressive point of view on information production, which is linked to boring administrative constraints, or to low level jobs (often combined to gender discrimination). This point of view can be straightened by the growing part of information production which has no local use, and thus can be looked at as un-necessary.

The formalization of information has begun far before ERP projects, but such projects sustain this evolution very steadily. Through ERP projects, firms are setting up a very basic and pragmatic form of knowledge capitalization. It is a rough type of KM, compared with the

highly sophisticated dedicated information systems that have been developed during the 80^s. This current 'ERP type' of KM could be in some way more efficient than the previous ones, because it is widespread and because it formalizes the quite usual information required for carrying out the functional tasks in the firm. However, its weakness results from the fact that it does not include the knowledge and know-how required so as to transform data into information, that is, meaningful basics which help understanding the complexity of on hand activity, and specifying the required decision. We will develop this argument further on; it concerns the misunderstanding of differences between data and information which is at stake in ERP implementation process methods.

4.2- The need for going back to definition: data, information and knowledge

ERP specialists usually refer to 'data', which are considered as the basic unit required for the ERP smooth running. Information in such approach is considered to be equivalent to data. It is considered as a 'raw material'. It is supposed to include all the dimensions required for its direct use. However, information and communication sciences have pointed out the fact that data have to be associated to existing knowledge in order to get some meaning, that is, become information. Existing knowledge is a contextualized one. To be meaningful, information has also to be linked to on-hand activity, be it material or intellectual. Thus, information is temporally and spatially situated. Data form a potential basis for information; they are not information by themselves.

Computer scientists have until recently often neglected the information and knowledge characteristics from the user point of view; they themselves tend to recognize it nowadays. The problem is even worse concerning ERP logics, because it is combined with the specific point of view associated to accounting uses.

ERP software has first of all been designed according to the model of accounting information. Accounting information has to be formalized in single data, which are supposed not to be modified as soon as they have been officially registered. These characteristics are very specific to such information domain.

The reporting to the head-quarters of the firm is often the main purpose of the ERP investment. To facilitate such a reporting, the priority is given to quantitative data. It is assumed that all information can be formalized according to accounting information rules. ERP design logic relies on the hypothesis that usual information mobilized for carrying out the activity presents the same characteristics than accounting information.

But in 'real firms', a great deal of information is recurrently transformed, reconsidered, adjusted according to the activity itself and to the environment evolution.

In conclusion, ERP design underestimates the situated knowledge required so as to transform data in useful information. From this point of view, it is still fairly far from a KM information system. But managers may think that it is similar to a KM information system, which is a fairly risky thought. They can guess that the flexibility of human resources can be managed through the data bases and standardized procedures, misleading the fact that this does not produce the intelligence required to pilot complex systems.

The second main result is that there is a disruption between the data in ERP software designed towards reporting aims, and the production of information and knowledge required for carrying out the activity. The very question of the meaning and possible use of information in a situated action is avoided, because the global logic (reporting) predominate on the local one (dealing with the activity under current constraints). What appears through our enquiries is that employees in charge of activities try to handle this gap. They try to deal with the various formal and informal information systems in order to make out, within existing information, useful meaning for solving the various problems that are induced by modern 'lean organization', just-in-time production and customized product requirements.

There is some doubt on the fact that employees will be able to deal with this gap for long. The wage agreements have been weakened by successive re-engineering process and they do not include any more long term commitment. The employee involvement in the firm is destabilized in such a social context.

Some researchers insist on the fact that ERP principles were specified in the 70^s. They assert that ERP incorporate a certain idea of organization and management as stated at that time (Gilbert, Leclair, 2004). Since then, firms have met tremendous organizational changes, and there could exist a great gap between ERP principles, and the firms they are supposed to fit in. Our findings, which are confirmed with other research program results, tend to underline the importance of the way ERP are put into service in the concerned firms. The way it is carried out may even have a stronger impact than the characteristics of ERP by themselves.

A linked issue deals with the timing of such organizational change. ERP projects are often presented as long term ones. In ERP advertising, the firm is often presented as an entity detached from space and time. But the current firms meet important changes within a short while. They can be split in different parts, or combined to other ones. Then, the previous choices regarding ERP specification may be totally or partly denied by the recent events. This has been observed in each of the firms under study. The question at stake concerns the resulting precariousness of information systems, and of the project teams in charge of ERP implementation.

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