

**FARGO - Centre de recherche en Finance, ARchitecture
et Gouvernance des Organisations**

Cahier du FARGO n° 1070601

**Automation of dashboards and the coherence of organizations: paradoxes and
ambiguities based on two particular case studies**

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Juin 2007

Abstract : This paper introduces the results of an exploratory field research dealing with the effects of the automation of dashboards on the coherence of representations in decentralized firms. The aim of this research is to answer questions concerning the influence of the implantation of business intelligence systems on the sharing of manager representations within organizations. Traditionally, dashboards contribute to the spread of the strategic management vision of the future. When they are automated, it may be less than evident that they enhance collaborative behaviour.

Keywords : dashboards; strategic management; organizational architecture

JEL Classification : M19 ; M41

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Introduction

In recent years, the rapid development of the implementation of ERPs and business intelligence in organizations has constituted a major event for management control. Indeed, the new possibilities offered by information and communication technologies allow for an increase in the ability to produce numbered and formal representations in order to control performance (Ducrocq, 2000; Meysonnier *et al*, 2006). They seem therefore able to enhance the evolution of control tools both in their conception and their uses and consequently in control practices. More particularly, the “tableau de bord” or dashboard, one of the traditional management control tools, is the subject of increased automation in decentralized companies. It is for this reason that our study focuses on the problems of the automation of dashboards and their effects on the evolution of dashboard user practices.

The automation of dashboards reflects the increase in adaptation, execution and spread of dashboards with applications operating without human intervention. In practice, automation means an upgradeable process which allows for the selection of relevant indicators, to automate their calculation rules and to inform them in more automated forms. It includes the increased automation of both the conception and the use of dashboards, two inseparable and complementary features. Therefore, it seems difficult to separate the automation of the content evolution and the processing evolution in dashboards. However, the dashboard automation process will be mainly studied from the viewpoint of the uses of dashboards.

Our problem therefore, is to find out if the automation modifies the interpretation and usage logic of dashboards.

The automation of dashboards allows us to consider information and communication technologies within the framework of a larger, more complete and more frequent collection and spread of indicators having a much greater number of users (Jensen and Meckling, 1992; Reix, 2004). From a managerial and theoretical viewpoint, the benefits are great: better quality in decision making, better sharing of available information, better coordination of local units and better control of activities.

However, the automation of dashboards raises two potential paradoxes. Firstly, the spread and the sharing of information should both enhance the centralization control through increased inspection but also decentralize it through auto-control practices. Secondly, the automation of dashboards would reduce ambiguity with more formalism and would standardize the responses but in the meantime would leave room to manoeuvre at a local level.

To study these paradoxes, we first use the organizational architecture theory. This theory stems from the positive agency theory following the work of Fama (1983), Jensen and Meckling (1976, 1992). The firm “set of contracts” is considered as consisting of three subsystems (the assignment of decision rights, the performance-evaluation system, the incentive system) whose coherence is a condition for the performance (Charreaux, 1999; 2001). These three sub-systems form the architecture of the organization in providing the global framework of the “rules of the game”, according to Jensen (1998). According to J.A. Brickley *et al*. (1997), ‘an efficient organizational architecture is an architecture that not only allocates the decisional authority to the individuals who possess the relevant information, but

also guarantees that decision-makers are subject to an adequate incentive system in order to make decisions that create value”. With regard to this approach, the information system appears as an explanatory variable of the modifications that may play a part in the elaboration of the internal rules of the game. Our theoretical framework fits in with the inter-subjectivist definition of the information system according to Mason and Mitroff (1973) and used again by Reix and Rowe (2002), as a “group of social actors who memorise and transform representations by way of information technologies and modus operandi”. This definition applied to our research question shows again that the conception and use of dashboards are difficult to separate. It is for this reason that our work, focused on the use of dashboards, will necessarily refer to the conception of dashboard problems.

This first theoretical approach allows us to formulate propositions. However, we consider this as insufficient. It justifies therefore, an exploratory field research that compares these propositions to observations made in two organizations, one from the industrial sector, and the other from the banking sector. This exploratory study allows us to indirectly call upon a second approach, the contingency theory that, although not directly explored, is present in the two cases which have been chosen and discussed. Indeed, the two firms have been chosen because they form real bureaucracies¹, sufficiently different and intricate (Bessire, 1998)² that they may illustrate the problem: it concerns, on the one hand an industrial firm located in a sector which is complex and evolutionary only to a small degree, and on the other hand a regional bank which operates in a strongly competitive and much more evolutionary sector.

The following two tables specify the process adopted to observe these two organizations:

Table 1: Main features of the studied firms

The studied firms	An industrial firm in the clothing industry	A regional credit establishment
2005 Turnover	70 million euros	195 million euros
Number of employees in 2005	600	1 100
Business intelligence	Implementation of a new automated dashboard system in 2003	Reorganization of the information system, implementation of new automated dashboards in June, 2004
Organizational structures	Decentralized hierarchical structure	Decentralized hierarchical structure
Data collection mode	About two hours dialogue semi-directive interviews	About one hour and forty minutes dialogue semi-directive interviews
Interviews dates	Between September, 2005 and December, 2005	November, 2005
Interviewed people	A Management Controller A Commercial Manager An Operating Manager Two Shop Floor Managers	A Management Controller A Commercial Unit Manager (several offices) An Office Manager

¹ In the sense that these organizations have shown in their operation mode a relative stability that allows for comparison.

² The two types of organizations differ in their environment (stability, human resources, and customer relation terms) but merge in the control tools that are set.

Table 2: The methodology of the research

The semi-directive interviews were carried out in the two entities following a structured guide that allowed us “to approach a set of pre-defined themes” (Thiétart, 2003). This guide is decomposed into main questions, investigation and implication questions according to Rubin and Rubin’s typology (1995).

The main question themes are as follows:

Firstly, we wanted to know if the automation of dashboards allows all the users to have access to more data and if this data is more complete, more relevant and identical for all users

Secondly, we asked the users about the finalities of the automation of dashboards: does it allow for better decision making (why, how) and a better understanding of the aims of the company?

A third theme concerns the use of automated dashboards insofar as a control tool from the angle of non-financial incentives (hierarchical control, auto-control, mutual arrangements) or financial incentives (bonus calculation, variable part of wage calculation).

A final theme concerns the correction process of differences connected to the automation of dashboards.

This exploratory research confirms that the paradox is between what is constant (the automation) and what is variable (the organization). This means that the automation of dashboards is problematic because it leads to more formalization and this poses an identification problem of coherence or harmonization of dashboards with the evolution of the organization. The main thematic that appears is that of coherence and particularly the relation between the formal coherence of data, indicators or dashboards and the organizational coherence. The formal coherence of data systems can be estimated according to the degree of use, sharing, completeness and continuity of data. We can assume that the increased formal coherence of data systems is potentially productive in organizational coherence, in other words, the sharing of representations (Walsh, 1995) and behavioural coherence.

Under these conditions, our theoretical question is as follows: can the automation of dashboards contribute to the coherence of the company? Can it, in other words, contribute to global and local performance improvement and allow a more effective and more efficient adaptation?

The supposed effects of the automation of dashboards will be then studied from the point of view of the coherence of representations. The search for the coherence of representations, studied from the angle of decision making, through the use of information and communication technologies seems particularly relevant in decentralized firms. In these firms, decentralization means that a power of delegation, in other words the capacity to allocate resources in a broad sense³, is given at a local level. According to this framework, the power

³ Or the allocation of decision rights in the Organizational Architecture Theory : To be complete, this allocation concerns also the power to locally control the use of these resources.

of delegation creates both benefits and costs that the new technologies may modify. There may be both an increase in benefits and a decrease in cost, as shown by the table below:

Table 3: The alleged influence of new technologies on costs and benefits of decentralized decision making (based on that of Brickley et al, p.292, 2001)

Increasing factors of benefits issuing from new technologies	Decreasing factors of costs issuing from new technologies
More effective use of local knowledge	Decrease in incentive problems
Conserving of the time of senior management	Decrease in coordination costs
Increase in training and motivation for local managers	Decrease in costs because of less effective use of central information

The specific knowledge is considered in the sense of Jensen and Meckling (1992), as knowledge that may not be transferable without cost (collection cost, understanding cost, bad decision cost). This difficult transferable feature then justifies permitting the person who possesses this knowledge, the allocation rights that allow him to effectively use it (for instance, to make the right decisions). If it modified the possession conditions of this knowledge, the automation would disturb the organizational configuration. What about this problem? So, the automation of dashboards would allow for an improvement in decision making and decision control, through giving all the actors much more data necessary to their decision making in a more complete and more stable data system, and through reinforcing the coherence of the incentive system.

I. The connections between the automation of dashboards and the stability and completeness of the management data

The idea of completeness and durability of the system of dashboards concerns the spatial and temporal coherence of the criteria, and the link between the frequency of the availability of dashboards and the improvement of the decision process. The automation of dashboards should allow for an increase in the frequency of treatment and the distribution of the information and thereby facilitate comparisons in time and space.

1.1 The automation and the completeness of the data

The automation of dashboards, as observed in both cases, allows us first of all to observe the development of a more complete data system than before, thus naturally strengthening the spatial coherence.

Thus there ensues a primary research proposition to be examined and discussed:

Proposition 1: The automation of dashboards allows the people in charge to have a better perception and to pursue the objectives of their company, and those of their function or service.

This proposition is clearly verified in both observed organizations. Indeed, the automated dashboards are perceived as an average determiner of the improvement of the communication

and calculation of the strategy therein. So, according to the people in charge of the bank "the automated dashboards were built according to a coherent pyramidal model which ranges from the strategic level to the operational levels (commercial units)". In the industrial concern, the people in charge of production perceive "dashboards as a means to translate the industrial strategy into figures and thus to verify its feasibility and its realism". In addition, according to the Sales Manager, "the automation of dashboards allows all the people in charge to have knowledge of the turnover, the profit margin and costs of the company" (this was not the case previously). The distribution of the automated dashboards allows those in charge to understand better the objectives of their function. For example, the Director of Production declared that he is now aware of his objectives in earning material and of the increase in importance of the efficiency of such a workshop. A person in charge of the workshop stated that because of the automated dashboard he has had to compensate in his workshop for a loss of efficiency in another workshop. On his part, the Sales Manager asserts that he is now conscious of his role in the drop in functioning costs and the attaining of the profit margin.

1.2 The automation of dashboards and the stability of the data

Indeed, the automation of dashboards is translated by a more stable system of data which contributes to strengthen the temporal coherence and can be interpreted, according to Dupuy (1984), as:

- The frequency of data capture relative to the criteria and observed indicators;
- The period of reference chosen for the calculation of these criteria of a predefined type.

Within the framework of automation and an acceleration in the distribution of dashboards, the question which then arises is to maintain the compatibility between the frequency of the seizures and chosen reference periods. It is, according to Malo (1992), under this constraint that the distribution speed of the dashboard information can be constituted - a key factor of success which allows it to play a primary role as an aid to decision-making with every executive.

- This is notably possible thanks to the repetitiveness of production of the information over time: indicators keep the same definition to allow comparison over time and keep their predictive value;
- It is also possible to capture the current evolutions more rapidly in order to facilitate decision-making.

From there ensues the discussion of the second research proposition:

Proposition 2: The automation of dashboards allows for the increase in the frequency of production and distribution of the data within the firm and its environment and thus improves the quality of the process of decision-making.

In both organizations, the individuals have perceived globally that automation has brought about an increase in the frequency of production of more varied data in the internal and external environment. So, the director of production of the industrial concern stated that he had regular information about the stock. He was also aware of comments made by the management control on the commercial side, for example on the commercial success of the new products. A person in charge of a workshop stated that the automated dashboards allowed him to obtain information concerning the other services, for example the service expedition indicators which gave him the commercial tendency which would influence the activity in his workshop. On the other hand, the person in charge of the automatic-process workshop

asserted that he only had information concerning production and no other information with regard to the rest of the company.

The automation of dashboards thus allows for being regularly informed. It returns the available information at any time. In the bank, the person in charge of the Commercial Unit indicated "that henceforth the available data is adequate enough to explain the history. Information on the immediate environment of the person in charge of the clientele (customer targets, customer catchment area, immediate competition) is however missing. He considers that at his level, the automated dashboards are not sufficient to make forecasts. The person in charge of Management Control explains that the current shape of the automated dashboards is the result of multiple evolutions: there are new criteria, some indicators were kept but are not always useful – "We maintained them so that the people in charge of the agency do not lose their way. Some ratios are destined to disappear".

Besides, according to the second proposition, the increase of the frequency of distribution of the dashboards allowed by the automation can improve the process of decision-making by making it more coherent. Two plans of analysis can be then envisaged: the manager plan via the EIS and that of the coordination of the decentralized units.

Concerning the analysis of the information system according to the Director, Leidner and Elam (1993) show that the increase in the frequency of availability of the EIS can improve the quality of the decisions. So, in their study, the identification of the problem to be resolved, the speed of the decision-making and the extent of the analysis increase with the frequency and the duration of use of the EIS.

Also, in both studied organizations, the actors perceive a distribution limited to the essential data for their decision-making. As a consequence, the decisions are considered faster and more effectively.

So, in the industrial concern, the actors declared that "every month, functional directors present the results of the important indicators of the performance of their particular function. However, some strategic information (for example, income statements per function) remains at a Director level. It is considered useful not to communicate them to all of their colleagues in order to maintain a certain confidentiality". In the Sales Department, according to its Director, "the ease of access to information is increased, and the information is more precise. Also, a global report on the performance of all the services is carried out with the knowledge of the various people in charge. Only essential information is put on-line constantly". In the bank, the follow-up process of the commercial activity is similar. In the same way, according to the Sales Manager, "the information passed on to the people in charge of Commercial Units is not systematically diffused to the other co-workers".

Furthermore, on the question of finding out if the decisions are faster and more effective, there is a fusion in the analyses of both entities.

With regard to the bank, in Management Control, according to the person in charge, "There are alert devices. If we discover a problem of invoicing for example, the problem is evoked in a specialized committee (in our case, the prices committee) which is then going to adjust its recommendations to the sales network". At the level of the Commercial Unit, the distances are more finely explained. It allows the re-centring of the activities or the efforts of the co-workers. This correction is considered more effective because the irregularities are identified earlier and there is less effort required to correct them ". As for the company, the Production

Director supplies similar information. According to him, "Thanks to having regular information about important orders, decisions can be made more quickly. We know henceforth how to rapidly measure the effects of such decisions. For example, the person in charge of the knitting workshop can make decisions through being more autonomous". On his part, the Sales Manager emphasises the fact that exchanges within his function are facilitated. Concerning the coordination of the decentralized units, cohesion is obtained through a pertinent structure of the system of allocation of decision-making rights (the delegating of such a type of decision) and of the system of control which includes at one and the same time the incentive sub-system⁴ and sub-system of performance evaluation⁵.

In decentralized firms, there can be problems of incentive. The local managers are not inclined "naturally" to act so as to maximize the creation of value for the company. That is why it is necessary to create incentive mechanisms which incite them to act in the sense of coherence and organizational cohesion. The implementation of these mechanisms generates numerous costs (installation and control costs) and inevitably provokes a residual loss⁶.

The generalization of the automated dashboards could allow for the reduction of a portion of these costs (Jacobides, on 2001). By decreasing the cost of access to the data, which reduces the asymmetry of information existing between the Director and the people in charge at a local level, and discourages cheating, thus strengthening cohesion, it is indeed possible in theory to collect more information on the activities carried out at each level by the firm, to measure more precise standards of performance in the dashboards of the Directors and the local decision-makers. The asymmetry of information which exists between the ruling team and the local managers or between the latter and their subordinates could thus be reduced. The automation of dashboards, by reducing the costs of the system of incentive could thus finally ameliorate the obtaining of behaviour corresponding to the expectations of the Directors. What can be observed in both cases?

II. The contrasted effects of the dashboard automation on the coherence of the system of incentive.

The place of automated dashboards in the internal coordination of the decentralized companies should permit, within this framework, the effective channelling of the behaviour of the various users. As dashboards may play a real role in supporting an incentive system, we can wonder if the automation of dashboards allows for the explanation, at least in part, of the origin of the value created by the I.C.T.

Two axes of analysis can be then envisaged: the reduction of the problem of opportunism on the one hand, and on the other, the control of conflict.

2.1 The automation of dashboards and reduction of the problems of opportunism

Employees' opportunistic behaviour can influence their performance evaluation and the efforts they make to reach their assigned objectives. For example, if the measure of their performance is not perfectly correlated to the performance of the firm, the effort of the

⁴ This sub-system includes financial incentive and non-financial incentive (promotion possibilities, inspection of employees, and the punishment system).

⁵ This concerns the selection and the measure of performance standards.

⁶ The residual loss arises from the fact that it is not possible to forecast all possibilities and to inspect all employees efficiently.

employees can lead to a drop in the company's performance in the long term (the gaming phenomenon or budgeting game).

So, apparently unbiased performance measures based on production or sales can lead the employees to develop dysfunctional activities that improve their own performance valuation but at the same time damage the company's worth. For example, an employee whose salary is based on production effected can be incited to reduce quality in order to increase the produced quantity.

We can then wonder if the automation of dashboards permits, thanks to the power of collection and data processing, a reduction in this behaviour. The proposition to be discussed takes therefore the following shape:

Proposition 3: The automation of dashboards helps to reduce the risk of individual opportunism.

The automation of dashboards is then perceived as a means for the hierarchy to supervise the behaviour of each manager's units. From this viewpoint, it may reduce the asymmetry of information existing between managers and employees.

Our observations show that the automated dashboards are not systematically perceived as an intensified control tool by the employees, but rather as a decision-making tool. So in the bank, some Multi-unit Managers consider automated dashboards as a tool for surveillance.

The Control Manager is of the same opinion and declares that the performance of those concerned with the clientele is examined through average ratios of success (achievement rate of commercial interviews, sales rate per appointment) calculated in his department in relation with sales management. Dashboard automation prevents employees from "playing around" with their performance.

In the industrial concern, this perception is less shared. Indeed, according to the Production Manager as well as the knitting workshop foreman, "It is a tool for surveillance and the quantification of objectives used in the annual evaluation meetings". On the other hand, for the foreman, the semiautomatic process "is rather a help in the working arena than a behavioural control of the actors".

The Sales Manager also notes that "It is a means to create and make the link between sales and results (gross profit margin ratio, supply costs)". He declares that "the commercial actors now know how gross profit margin is calculated ... it is a training tool and it allows high competence and efficiency management".

By increasing the capacity of the local managers but also by allowing the leaders to have better knowledge of the activities carried out in the firm, the automation of dashboards can also contribute to reducing the conflicts which arise from divergent individual interests.

2.2 The automation of dashboards and control conflict

By defining more clearly the objectives assigned to each unit manager, the automation of dashboards makes an extension of the individualization of salaries possible. The "wealth" of

the local managers (and also of the ruling team) is tied to the achievement of the global objectives fixed beforehand.

There is a real alignment of mutual interest in the value creation of the firm, and this leads to an intensifying of global cohesion. This results in the discussion of a new proposition:

Proposition 4: Dashboard automation contributes to a decrease in conflicts of interest and roles.

In both firms, the results of the observations on this matter are rather ambiguous. Indeed, the automated dashboards do not serve to calculate the bonuses directly, except selectively, but allow all the same for the calculation of the variable payment. This occurs in the case of the bank where, according to its Control Manager, "part of the variable payment rests on the achievement of global objectives and individual objectives" It is the case apparently also in the industrial concern even if there are differences in perception. The production manager stated that, "it does not allow us to calculate the merit bonuses. An experiment was attempted in this direction, but it was abandoned by the management because it damaged the group's cohesion". According to the person in charge of the semiautomatic process, "There is no merit bonus; there are only productivity bonuses for the operators". The person in charge of the knitting workshop said that, "This mechanism allows us to calculate merit bonuses because one part of the manager's bonus is variable and its amount depends on the attaining of the objectives which are attached to it. The automated dashboards thus give a certain objectivity to the mode of calculation of the bonuses". Concerning the sales manager, "The automated dashboards allow for the calculation of merit bonuses, for example, those of the Sales Manager and the Major Accounts Manager: bonuses depend on results obtained with regard to action plans defined in the budget with criteria such as the gross profit margin, the percentage of supply costs and the rate of return."

The automated dashboards could also be included as a means of fairer sanction when objectives are not achieved. Now, in the bank, these automated dashboards are perceived by the Operational Level Manager rather "as a tool of reorientation of activities or efforts", and by the Control Manager "as a means to verify the coherence of the data. There is really no sanctioning mechanism". In the industrial firm, the Production Manager states that "it is a sanctioning tool but not automatically so, because the tool was not set up for this". However, the person in charge of the semiautomatic process says that "it is not a tool for sanction, it is rather a call to order or memory". According to the Sales Manager, "the data stemming from dashboards is exact, and cannot be questioned. We can thus use these figures to take possible punitive measures".

The automation of dashboards as a support to the system of incentive allows for the supply of plausible explanations for the coherence of the behaviour which can be observed in a decentralized firm. The reduction of opportunist risk or conflict of interest can increase the value created by the firm by reducing the residual loss resulting from the existence of agency problems inside the firm. For all that, dashboard automation would not reduce the behaviour of the individuals to a series of actions and reactions linked to indicators of dashboards.

To conclude this section, the reinforced completeness of dashboard automation leads to the fact that all the actors potentially have knowledge of the strategy of the company and the objectives and performance of the other entities of the organization. This facilitates

comparison and decision-making. Furthermore, the automated dashboards can become a real support for the incentive system. Indeed, permanency over time of the automated dashboards means that the criteria and indicators are more strictly comparable from one period to the other and the measure of individual and collective performance is less questionable. Indicators can thus be included more easily in a payment system and in employee surveillance. It also means that the greater frequency of these boards increases the frequency of corrections and thus reduces the response time necessary for certain decisions. It improves the coherence of actions in time and in space.

Concerning all these points however, the collected perceptions contain ambiguities, contradictions and differences.

To give a better analysis of these perceptions, it would be necessary to return to the internal mechanisms which maintain the coherence of the actions, so as to see in which way the automation of dashboards may influence them.

Conclusion:

The automation of dashboards does not amount to the installation of a more sophisticated and more complete tool but concerns rather, through the produced effects, the coordination of the activities of the firm and in particular the decentralized firm.

The results show firstly that the automation of dashboards allows the actors to use a more complete and more permanent data system: the strategy adopted by the ruling team is better understood, the data is supplied more frequently and globally the information and data indispensable to decision-making are present in the boards. At the same time, the remarks and comments of certain local decision-makers cause gaps to appear in the available information. It seems that data available on the local level was concerned primarily with the operational part of the activities to the detriment of the long term activities of analysis which are reserved for the ruling team.

To put it clearly if we give information with regard to the strategy pursued by the Directors, we do not supply information and data which was used or which can be used to establish this strategy. The results also show that if the automation of dashboards effectively allows for the collection of more information on the activities of the employees, this information is not systematically used to keep watch on them. The first objective of dashboard automation remains above all that of supplying a decision-making tool. On the question of knowing if this tool reduces internal conflict, the results are ambiguous. The data supplied by the automation of dashboards allows indirectly for the calculation of certain bonuses, the case of the factory showing that a too direct use of the information could engender conflict.

The first synthesis of our results shows then a primary paradox: the data system is permanent but not necessarily complete, the coherence of the representations being based on a certain ambiguity: we have privileged the operational data with regard to the more global data. This ambiguity is even more strengthened when we envisage the automation of dashboards as a support to the incentive system, the completeness and the direct operating of the supplied data strengthening the internal conflicts. These primary results thus seem to indicate that the automation of dashboards allows businesses to increase their performance only if they are not systematized in their use and in diffused data. The first paradox which we raise is therefore that the increase in formalization does not create more rigidity. On the contrary, the

automation, because it is a process, does not freeze organization. It produces more dynamics or continuity and permanency. As a consequence, organizations are not made more vulnerable.

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