

Business Intelligence in Relation to Other Information Systems

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Abstract— Business intelligence (BI) systems are one of the major computing trends during the last ten years, in developed as well as developing countries. However, as often witnessed, the implementations are to a large extent not very successful. Our concern in this paper is the decision support role of BI systems, the perceived business value of implemented systems, and their contribution to facilitate the fulfilment of organisational goals. The study builds upon deep interviews with managers in combination with a previous quantitative survey. The survey and the interviews used three categories of questions: 1) how visions, objectives, strategies are supported by BI systems; 2) how business values are derived from such systems; and 3) how design and implementation issues affect the solutions. The overall conclusion of the study is that there are major problems in all three areas although not equally dire. What clearly emerges is that much of the problems encountered come from failing to appreciate the different nature of BI systems compared to support systems for daily operational processes. Thus, a fundamental reason for BI projects not succeeding entirely is that they are being wrongfully treated as just another kind of traditional information systems.

Keywords— Business intelligence, decision support, information systems.

I. INTRODUCTION

It is well-established in the literature that decision making in most types of modern organisations is made in a non-rational manner, at least compared to normative rules and prescriptive directives on how choices and decisions should be made. One reason for this is the human lack of capacity to process information in order to provide meaning in decision making. For many years, this phenomenon has been a key issue in the research regarding behavioural decision theory. For example, a well-known tendency when coping with complex problems is problem simplification, i.e. failing to consider a range of available options and omitting uncertainties and risk aspects. This is commonly referred to as bounded rationality [1]. This basically means that since people are not able to handle all the possible alternatives, parameters, uncertainties, etc., complex decision problems are simplified into smaller sub-problems. During the latter decades,

the decision making context has become even more complex since the amount of information that must be dealt with has increased dramatically. To deal with the increasing amount of data in organisations, we build data warehouses. However, the human capability to deal with large amounts of information remains rather poor, no matter how the data/information is presented or distributed. Given an integration of information systems into business processes, organisational decision making may often experience a substantial amount of environmental pressure due to, e.g., information overload and sharper time constraints [2,3]. Systems or methods for supporting decisions come in many forms, e.g., *decision analytical systems* focusing on supporting problem structuring and evaluations of alternative courses of action, *optimization tools* focusing on finding an optimal solution for a well-defined system of constrained variables, or *business intelligence systems* aiding in the gathering and analysis of business information. In this respect, business intelligence systems may be viewed as information systems with special focus on providing accessible business data, i.e., they can be viewed as type of decision support system with the capability of, easily and quickly, providing reliable and up to date information or figures about the organisation.

Our concern in this paper is the decision *support* role of business intelligence (BI) systems. Since the 1990s, such BI systems typically employ three different technologies for supporting decision making in an organisation: data warehouses (DW) for the gathering of business data, data mining (DM), and on-line analytical processing (OLAP) for data analysis [4]. With respect to the benefits of BI systems, it has been argued that these benefits cannot be properly understood by focussing only on the business process level [5]. In a later study, Elbashir

et al. [6] provide evidence indicating that business value of BI systems can be claimed at the operational level of the business' value chain, enabling for timely operational decision making. Another study based upon isolating BI capabilities and those capabilities impact on business processes shows that BI systems leverage value in terms of improving both operational and strategic business processes [7].

The latest decade has witnessed a remarkable increase of companies investing in BI systems, see, e.g., [8,9]. This makes it interesting to study the use and knowledge of the effects on the businesses of the companies utilising, or having the ability to utilise, such systems. But at present, studies of BI systems as a support for organisational decision making are relatively scarce, especially with respect to studies on how BI systems are used in a BI process [10]. For instance, a study by Shollo and Kautz [11] shows that the large majority of published material on BI systems refer to gathering and storing data, and less on the use of information and in particular almost nothing on making decisions based upon the intelligence information provided by the systems. However, research done within the latter two areas indicated that the use of BI systems focus on reporting on financial information, cf. [12].

With respect to decision support, considerable care must be taken of contextual circumstances. No matter what systems, tools, or techniques that are used in a BI solution, the final decisions are still to be made in a context. "*No decision takes place in vacuo: there is always a context.*" [13] Since the decision making context affects the decision making processes in many ways, it is of utmost importance to pay attention to the context in which the decisions intended to be supported are made [14]. Such aspects include structure, culture, norms, and processes of the organisation and they all affect how decisions are actually made, cf., e.g., [15]. This is not least important when incorporating autonomous components in a BI system [16]. Further, a decision support system is not used simply because it is accessible in an organisation, it is not used properly just because it is used, and it is not necessarily used for decision making purposes just because it is used properly. Thus, we need to look deeper into both uses of and motivations for BI systems and their implementation.

Therefore, in this paper we aim to investigate what business values BI systems generate as a fa-

cilitator of well-deliberated decision making within organisations. The initial questions to be raised are: What is the perceived and tangible value for decision making in information and reports generated from BI systems and how are they used? In particular, we are concerned with if they are used for decision making purposes and if so - how? Our hypothesis is that much emphasis in the development and implementation of BI solutions in organisations is put on the technical parts of the system, i.e. on the right hand side of Figure 1. This entails more focus on design and building of data warehouses and on creating different types of reports, and less on structuring and gaining insights into the decision making activities that are to benefit from all this.

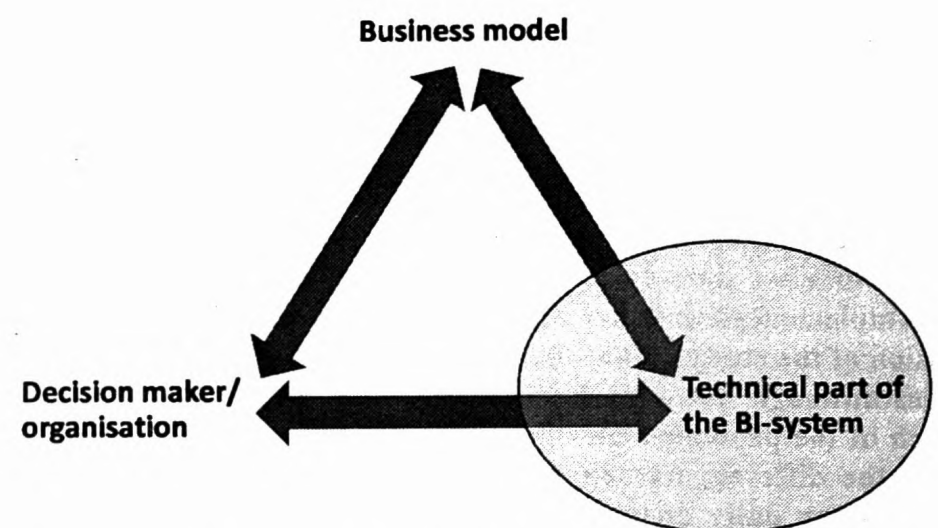


Figure 1. Objects of interaction in the use of BI applications and systems

A further question in this paper is therefore to what extent this hypothesis is supported by studying the beliefs, attitudes and knowledge of acquirers of BI systems.

II. STUDY OUTLINE

The study was conducted as a two-piece endeavour, where qualitative and quantitative methods were combined (interviews and questionnaires, respectively). The first part consisted of a questionnaire [17] and the second part piece consisted of interviews. The rationale behind employing a two-piece study is that employing a combined approach provide results that strengthen and confirm each other respectively, cf. [18]. In essence, the approach admits for confirming that answers obtained in the interviews represent instances of general problem issues identified from the questionnaires, and at the same time provide an understanding of the underlying sources and case-specific consequences of these general issues.

In the quantitative part of the study, 43 respondents (business managers in large organisations) answered the questionnaire in which they had to

estimate how well different statements regarding their BI solutions corresponded to their own perception of the reality in their own business. The questions were divided into three categories, each comprising of two sub-categories involving six questions. As follows from [17], the three categories were:

Category A: Visions, objectives, strategies

Category B: Business values from BI systems

Category C: Design and implementation

For the qualitative part, five semi-structured in-depth interviews with middle- and top-level managers in business organisations were conducted. The interviews were based on an interview protocol, serving as the basis for the interviews and probing was used by the researcher whenever it was necessary in order to gain more information from the respondents. This approach gave the interviews some flexibility that gives the possibility to take advantage of unexpected situations which may occur. The answers obtained in each interview were transcribed and analysed shortly after that the interview session ended. Each interview lasted for approximately ninety minutes.

III. RESULTS

A. Visions, objectives, and strategies

With respect to how well-informed the employees are about the overall objectives and strategy of the organisation, the answers of the respondents varied. For example, one of the respondents claimed that *“the strategies are known pretty well”* and that the objectives were *“often in focus in the daily business”*. But two of the respondents stated that the overall objectives were *“not very well-known”* and one of them said that this information, and its objectives, were, *“hard to get a hold of”* by the regular employees. With respect to the links between decision processes and goals, all but one respondent claimed that the decision processes were not at all clearly linked to the objectives. The disagreeing respondent said that the decision processes were linked to the objectives *“a little bit”* and continued with: *“I have a feeling that it is rather good”*. Another respondent said that *“the ambition is to create such links”* and mentioned a new organisational structure that was going to be implemented as a step towards this.

Further, a question on how and to what extent the strategies and objectives of the organisation were linked to the prerequisites, structure, culture,

and knowledge of the organisation gave answers in line with that, although the individual business units were aware of the overall objectives and strategies, they still operated fully toward their internal goals. And these internal goals may or may not contribute to the overall objectives. For instance, one respondent said that one overall strategy was to engage more multi-product customers. But the objectives of the individual business units did not have such focus at all, rather only to supply as many small services as possible. *“The focus on multi-product customers is not at all supported by the current structure and culture”*, as one of the respondents put it, referring to the individual business units being merely credited when reaching their internal objectives.¹ If the BI systems are not aligned to the objectives and strategies, there will be little in terms of strategic BI support when it comes to operations.

Regarding current instruments that are used in order to make the employees to act in accordance with the organisation's overall objectives and strategies, the most commonly used instrument are financial ones such as bonus systems related to easily measured KPIs (key performance indicators). The respondents highlighted one problematical issue with respect to this – that the performance indicators tend to become too narrow as they should be easy to measure, making the individual's and business unit's objectives remote from the strategic objectives and thus leading to a sub-optimisation. BI systems, while well-positioned to act as intermediaries in this case, failed to meet those demands.

B. Business value from BI systems

With respect to the perceived business value that the systems create, one respondent stated that *“overall, we have very limited knowledge regarding the actual business values our different BI systems create”*. Another said that *“we do not at all manage to create value from the information [that the systems provide], we simply cannot utilize the information in practical operations”*. A third respondent claimed that *“what we do know is what kind of reports that are generated, but we do not have a clue how these reports are used as a whole”* and later continued with *“we have no procedures for validating that our systems create any value”*.

¹ Multi-product customers are customers buying from several divisions of a company.

None of the respondents claimed that they had any way of securing that the BI systems created business value.

Regarding how and where the information provided from the BI system came into use, one of the respondents provided an example of how it was used, *“in order to inform the daily business”* and that *“we look a lot at deviations, but there are no stipulated guidelines for what actions to take when large deviations occur”*. The deviations in mind were later told to be deviations in sales figures. One respondent further said that *“I have a feeling that most of [the information] is being used, in one way or the other. But what comes out of the reports is very demand driven”*. A third respondent claimed that *“very little of the information is used in the daily business”* and a fourth said that *“I have no idea, but I believe that much of the information qualify as ‘nice-to-have’”*. The remaining respondent said that *“the information is not used as intended but in very isolated and fragmented ways. It is not at all used at the strategic or tactical levels either”*.

Only one of the respondents claimed that care was taken, although in an ad-hoc fashion, to support existing decision processes when BI reports are decided upon, *“for instance when following up on sales campaigns, special offers, and bonuses”*. As for the decision processes that *should* be supported by the BI system, two of the respondents stated that it was not at all clear which these processes were. As put by one of the respondents: *“We never discuss decision processes as a part of the business intelligence solution. The BI solution is a separate function, which is not linked to existing decision processes in any way”*. However, other respondents experienced that the situation was different. For example, one respondent stated that *“with respect to financial control, there is a direct link to the financial data warehouse”* and another said that the systems were used in *“decisions regarding campaigns and special offers, customer behaviour and in the follow up of marketing activities”*. However, all of the respondents stated that they had no idea of how effective or profitable the investments in BI systems were and that they had no means for measuring this. One respondent stated that *“we measure costs for maintenance and development, but nothing is assessed regarding business values”* but that *“there are signs that a dialogue about [business value] is emerging”*.

C. Design and implementation

As for the correctness of the information provided, and whether the provided information to decision-makers to support decision making was adequate, the respondents gave uniform answers. As one respondent put it: *“There is no model for how different parameters are related. We lack a holistic view of our business which makes it hard for the business units to actually act upon the information provided (from the system). It is a focus on details rather on the business as a whole.”* Another one simply said *“No, and the problem is that we always start with the question ‘what reports do you want?’ without any idea of where and for what these reports are to be used. Although the data is correct, it is very doubtful whether it is adequate”*. A third respondent said that *“data is being ‘washed’ and is moved from here to there all over the place, and in the end we [the specific unit] edit the information ourselves, particularly using Excel. It does not feel good at all. It is all very vulnerable as there is no structure regarding how to work with the system, but fully relies on the knowledge of the individual”*. Finally, one respondent simply said that *“we don’t really know which decisions or decision processes are to be based upon or utilise the information provided”*.

When asked about who were in charge of providing requirements specifications and how this was done, all respondents but one clearly stated that the requirements and functional descriptions came from the operational business units. Two of the respondents referred to their internal IT department as the ones who decided upon the technical designs and solutions which were to meet the functional descriptions. However, one respondent claimed that the operational units *“have problems formulating what they want and therefore we have not managed to provide a good requirements specification”*. Further, two of the respondents highlighted that there was a lack of involvement from the upper management in the formulation of requirements, leading to the management having very limited knowledge about which systems do exist and why they do so.

The respondents were asked about user participation in system design and implementation. Four respondents out of five claimed that the users do participate in the process of producing requirements specifications. However, three of the respondents further said that there was no common understanding of for what purposes the systems actually are going to be used for. As one respon-

dent put it: “...the focus is on the technical and practical use of the system, and not on how to use the information provided by the system” and “when you think about business intelligence and decision support, you rarely think about how you are to actually use the information provided”. None of the respondents thought that their organisation prepared itself in terms of making the employees use the information provided in their existing decision processes.

IV. CONCLUSIONS

From the study, some findings have emerged. They relate to the three categories of questions, i.e. how visions, objectives, strategies are supported by BI systems, how business values are derived from such systems, and how design and implementation issues affect the solutions. One simple, but perhaps not very helpful, answer is that there are major problems in all three areas. In order to find a full set of remedies, just about everything needs to be redone in another fashion. But clearly, this is infeasible. There is a reason for BI systems winding up in the state they are, viz. this is the way things will go if BI systems are treated as just another kind of traditional information systems.

Of the categories we surveyed, problems with business values (category B) were among the most troublesome. This was evident in interview responses as well as in the questionnaire results [17] where the results indicate a larger mismatch between desired BI system properties and current state. In other words, many BI systems are perceived as not delivering enough business value, either by performing poorly or by not being measured adequately. While almost every for-profit organisation builds business cases or similar around new investments, this is much more seldom done for BI systems, where the inability to measure its impact renders standard measurement models unusable.

In the visions, objectives, and strategies category, there were also a number of problems. Although possibly as many, they were not rated as equally troublesome compared to business value problems. There are two explanations for this. Failure to deliver business value is more easily perceived in an organisation. Not matching visions and goals might be as bad (or even worse) in the long run, but does not interfere with the daily operations in the same manner. Or the failure to meet visions, objectives, and strategies is more attributed to factors other than the BI system. To find out which is the main

cause in a particular organisation, a study should be made particularly for that business.

Finally, the design and implementation category fared better but not entirely well. The results indicate a neutral position rather than a satisfied one. Summing up the interview responses, this seems to stem from the fact that many users find some use for the output of the BI systems, albeit not always the intended one. But given the large potential of BI systems in general, clever users often find some value in using some report in some way to improve their work. Thus, this category faring a little bit better does not indicate all being well. Except for the user participation and user preparations in the systems design phase which, based on the interviews, seem to be very ill-structured. On a priority list the problems highlighted here would still find themselves a bit further down when compared to the other categories.

V. DISCUSSION AND OUTLOOK

What emerges from this study is that many of the problems encountered come from failing to appreciate the different nature of BI systems. They are support systems for *decision* processes, not for daily operational processes. Decision processes could also be modelled using process modelling techniques, but not the same ones as for operational business processes. Lacking another approach, it is understandable but not justifiable to treat a BI system as “just the next information system”. And consequently winding up in the problem set experienced today. However, it is undoubtedly infeasible to disregard today’s procedures and start all over. Rather, we need to find some priority for what to remedy and in which order.

All too often, the flow of design, i.e. the BI requirements design process, progresses from databases and possible reports to – only in the latter stages and perhaps only implicitly – reaching the impact on and needs of the organisation. This is a technocentric design process, see Figure 2. One of the problems with such a process is the risk of missing or misinterpreting the true business requirements.

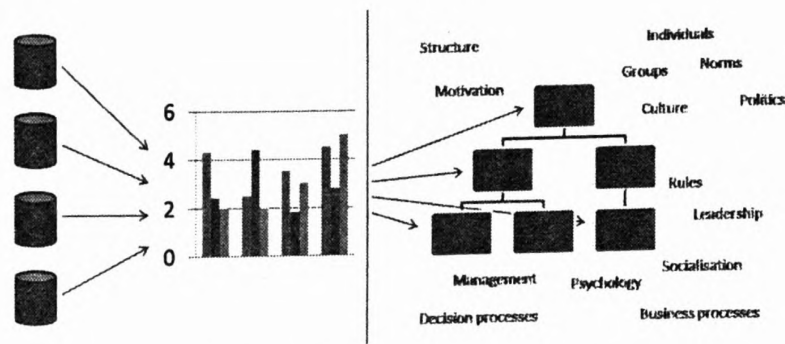


Figure 2. Technocentric design process

In order to develop good BI solutions that support organisations in reaching their overall goals, we must strive for the implementation of more holistic BI solutions. This means that the solutions must be based on knowledge from a number of areas in addition to database management and computer science. The solutions must be built upon a balance between decision-makers, business models, and the technical support systems intended to support the business model and the decision-makers operating in it. In other words, when looking back at the triangle in Figure 1, we have found that most efforts in the design and implementation of business intelligence focuses on the right hand side of the triangle in the figure, i.e. on the technical parts of the BI solution. In most current BI solutions there is a lack of balance in terms of focus on the different corners in the triangle. The main objective when implementing a BI system seems to be that of simply getting it to operate, with too little emphasis on actually getting it to work within its context. Therefore, most companies nowadays have difficulties in getting the most out of their invested BI money.

ACKNOWLEDGMENT

This research was partly funded by the Swedish Research Council FORMAS, project number 2011-3313-20412-31, as well as by Strategic funds from

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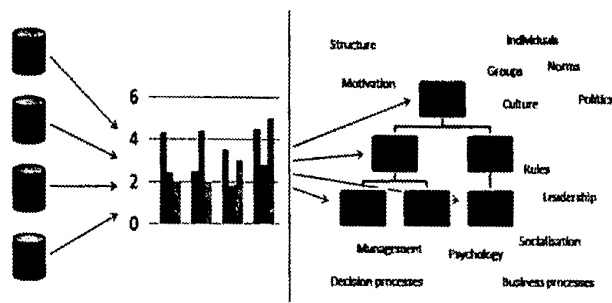


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