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# Business Dashboards- Challenges and Recommendations<sup>1</sup>

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## ABSTRACT

Business Dashboards have become an important Business Intelligence (BI) tool available to managers and executives to monitor various aspects of organizational functioning including continuous performance monitoring. Similar to the dashboard on a car that shows the current status of the trip and monitors vital statistics of the car, business dashboards can offer real-time information about the organization and aid in better managerial decision-making and agility. Business dashboards are a fairly recent phenomenon and, as a result, offer several challenges and opportunities. This research examines characteristics of dashboards as a tool that should have a unique place when compared to other BI tools. It discusses some issues related to dashboards and puts forward some suggestions/recommendations. It uses a post-implementation survey for a dashboard implementation, conducted in a regional North American bank to support the issues and recommendations proposed in this research.

## Keywords (Required)

Dashboards, Business Intelligence, Real-time Information, Decision-Making.

## INTRODUCTION

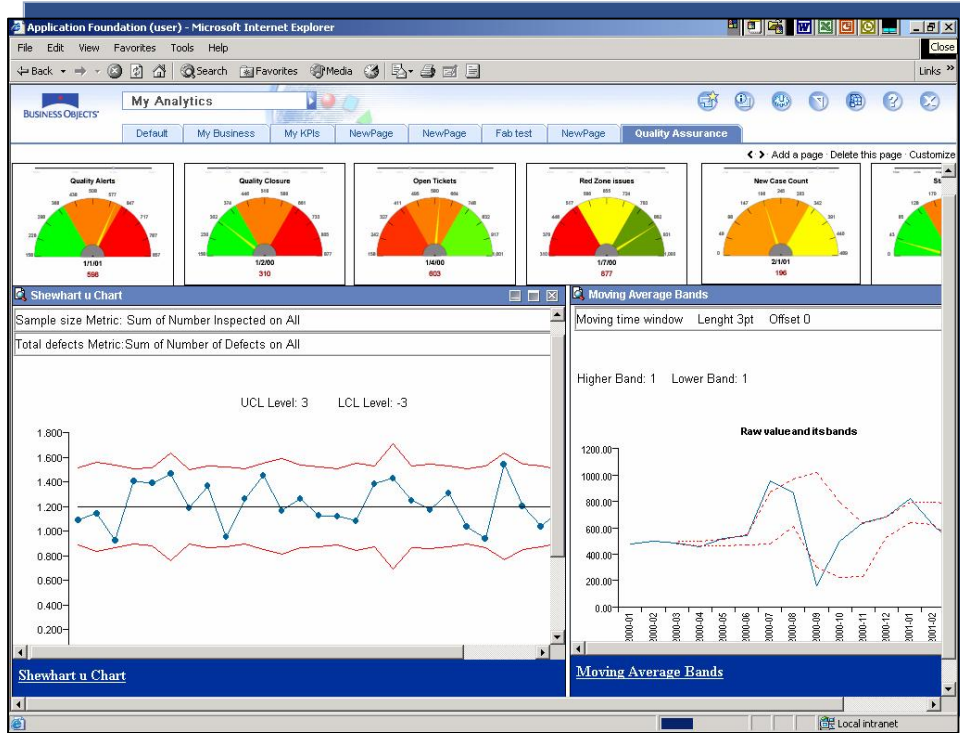
The current economic and business environment is characterized by a high rate of change. Market conditions are volatile and characterized by a rapid flow of information that gets integrated into the decision-making and is immediately reflected in indicators like stock price, product price, and market-value of a company. A good current example of this may be the price of crude oil. For instance, on February 24, 2006 the price of one barrel of crude oil increased by \$2.00 on news of a suspected attack on Saudi Arabian oil refinery. The news of the attack was reflected in the price of the oil within minutes. Depending upon the organizational context, some selective information can be monitored in real-time and this information can be incorporated into real-time decision-making, hopefully leading to several benefits for the organization. In the example of attack on the Saudi oil refinery, if a manager was planning to procure crude oil on the day of the attack and the procurement could not have been delayed, then *hypothetically* the manager could have placed an order as soon as news of the attack came. He/she could have been notified of that real-time news flash in a browser window or an email alert or a dashboard to make a buy decision and could have prevented the organization from paying the higher price. Real-time information can definitely enhance organizational agility (Pankaj, 2005) which is appealing in the current volatile environment.

This need for real-time information has been translated into various new information delivery processes and mechanisms/tools for managers. One such recent development that is being promoted widely by various industry vendors (e.g., Business Objects, Cognos, Hyperion) is the concept of business dashboards (refer to Figure 1 for an example of a business dashboard). The concept of a dashboard has been directly borrowed from the cockpit of a plane or dashboard of a car where a collection of widgets (dials, digital displays, colored lights, etc.) hooked to various sensors (that collect

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<sup>1</sup> Observations and assertions forwarded in this paper are also supported by the work of the authors in the area of business intelligence. Limited research existed in this area in the peer reviewed academic MIS journals at the time of writing this article.

information) relay real-time information about vital and relevant parameters about the airplane/car. This information allows the pilot/driver to determine if the vehicle is functioning as intended and is progressing as intended to fulfill the designated goal/objective at hand. This objective may be to travel from New York to Dallas using the designated route within the designated time while ensuring a comfortable ride for the passengers.



**Figure 1: Example of a Business Dashboard (Courtesy Business Objects Inc.)**

Similar to a dashboard in a car a business dashboard may be conceived as a set of widgets to provide managers the relevant information in real-time. Often times as a concept transfers into the management domain there is a period of transitioning and maturity that is accompanied by confusion leading sometimes to many botched implementations and failures. An example of this is the concept of Information Systems (IS) Agility which has been a big theme in the IS industry in the last four years with little clarity and a lot of confusion on what it entails (Pankaj, 2005). The learning often is an arduous process sometimes clouded by significant hype. Again, one may look at the example of agility where most Software Suites available on the market today claim to increase agility. Business dashboards may be characterized to be in such a state. The area of instrumentation and telematics dealing with design of an automobile dashboard or an airplane cockpit is a mature body of knowledge. There are definitive guidelines on what information is to be collected, the sensors that collect information, user interface<sup>2</sup> that is employed to convey the information, etc. Most of these considerations are still being worked on for business dashboards. At the same time, businesses are under constant pressure to perform well under ever changing conditions. Often times when managers meet the constant rhetoric from the industry vendors and consultants that dashboards are a useful tool to alleviate this pressure, they may give in, take the dive, and start dashboard projects. Even when the projects are implemented as pilot projects, they may involve buying the software and infrastructure with significant expenditure of resources since dashboards run on top of most transactional, management support, and some decision support IS.

In this study some fundamental concerns on which managers should focus when contemplating dashboard implementations are examined. Subsequently, results of a post-implementation survey from a regional North American bank that decided to implement business dashboards are presented. While implementation per se was successful, if success was measured as a

<sup>2</sup> see for example the following on how mental workload can be minimized using a good design - Riskin, M. D., Bessette, K. C. and Castillo, I. (2003). "A Logarithmic Barrier Approach to Solving the Dashboard Planning Problem." *INFORM* 41(3): 245-257.

function of use, the project may not be considered as a success (Davis, 1989). These issues are then linked to this post-implementation review and consequently some recommendations are forwarded.

## **BUSINESS DASHBOARDS- FUNDAMENTAL CONSIDERATIONS**

### **Target and Purpose**

It is important to consider at the very outset that business dashboards hold a unique place in information delivery in the organization. They are distinct from other existing mechanisms and systems targeted towards middle and top management to aid in decision making, and should be treated as such. Examples of some such systems include Data Warehouses, Data Marts, Portals, reporting tools like Crystal Reports, and Executive Information Systems (EIS). A distinguishing feature of a dashboard is that it should display some real-time dynamic information. While the information may differ in different organizational contexts this information would be about some aspect of the organizational state and/or functioning.

Different personnel at different levels in an organization have different responsibilities and authority and hence may need different dynamic or real-time data. In addition, given the current state of information systems in organizations, delivering real-time information can be an endeavor that would involve substantial resource commitment with the exception of few organizations that have an Enterprise Resource Planning system in place that integrates various aspects on an organization in a single comprehensive data model. Thus a fundamental question of concern is to determine what information should be displayed for personnel at different levels and in different roles. Additionally, is there a set of personnel in an organization who are most likely to benefit from the dashboards?

Both of these questions of information and the target may be answered based on the criteria of whether the information can be used for action. If dynamic real-time information cannot be translated to actions in real-time or in time that is quicker than the traditional organizational response time, the information may not hold much value, and the benefit of the system from a Return on Investment (ROI) perspective may not justify the implementation of the system. Some instances of dashboards (like a stock-ticker) demonstrate this concept very well. In the case of a stock ticker, the real-time information can be used for immediate action. Linking information and action (or potential action) is crucial for dashboards. It also brings forth the issue of actor.

If one looks at the origins and the purpose of dashboards in areas like airplanes and automobiles, they probably hold more value in the realm of monitoring functioning and operational control. They keep the vehicle on track to fulfill the stated objectives which are formulated outside the infrastructure of the dashboard. As per the common opinions and understanding in the IS industry, personnel that are expected to benefit most from a dashboard are CEO, CFO, and COO (Anonymous<sup>3</sup>, 2005). While the top executives may benefit from the information, the personnel with the responsibility to act on the information probably reside elsewhere in the organization, more notably in middle management and operational areas (for example in the bank branches in a bank). It may be argued, based on the criteria for action that staff at operational levels may benefit most from the real-time information provided by dashboards. They can make decisions to modify operations within their vested authority and thereby improve business operations or achieve the stated goals of Business Process Management (BPM).

Hence the first fundamental concern for a dashboard is that it should hold its unique place for information delivery in delivering dynamic real-time information and position separately and exclusively from other available information sources. It may be argued that the user interface (UI) components of dashboards are unique and different from the UI components used in other existing applications but UI goals may not be the primary goal of a business dashboard. In addition, the dashboards may hold more value at the operational level. Therefore organizations and the industry may consider refocusing the effort to implement dashboards for middle managers and line managers under the sponsorship of the top management.

### **Data/Information Availability**

Before commencing discussion on data/information that may be used in business dashboards, it should be pointed out that though there is little discussion on external sources of information, they are not implied to be excluded from dashboards. Business dashboards are stated to hold their unique place. However, this does not mean that they exclude the need for existing sources of information in the BI realm like data warehouses, data marts, and custom databases for reporting purposes. These existing sources are needed for benchmarking and establishing thresholds which are needed in dashboard displays.

If there is a focus on real-time operational control then an organization needs to make necessary changes to the IS infrastructure to provide the information/data needed for this purpose. Dynamic information would require a continuous

stream of data from internal and external sources. In most organizations, provision of dynamic real-time data would be difficult if not impossible to provide. A related question may then be how dynamic the data on the dashboard should be. While one may say that it should be as dynamic as possible, the existing IS infrastructure may have limitations. Many dashboards are currently fed exclusively from data warehouses which have a daily refresh rate and in such a case, a report from the data warehouse is probably more useful than the information on the dashboard due to the level of detail in the data warehouse report. While real-time data warehouses, or active data warehouses (Anonymous2, 2005), may alleviate these problems, building real-time warehouses or data-marts is not a simple undertaking.

In the traditional hierarchy of IS on the dimension of decision-making, Transaction Processing Systems (TPS) capture the basic, or atomic, information about business operations (Laudon and Laudon, 2006). Hence any data that is needed by managers about the organization/processes has to be either captured at this level or should be able to be derived from the data collected at this level. This introduces several issues. The very first relates to data that is integrated across the enterprise through the use of a common enterprise-level data model that is used in all or most applications. While common data and object definitions are making in-roads in enterprises, due to reasons like mergers and acquisitions, existence of legacy systems, use of external transaction processing provider, and proliferation of package systems to cut on implementation times, this integration is far from being in a state that may be considered sufficient for purposes of a business dashboard. Thus designing effective dashboards may involve extensive retooling of the TPS so that relevant data can be captured on an enterprise level on a continuous basis and fed to the dashboards. Integration with external data sources introduces another level of complexity. Another relevant consideration is that the information requirements are likely to change and evolve over a period of time and so the interface between the dashboards and TPS need be designed or architected for changeability.

Hence another consideration for effective implementation of business dashboards would be integration and retooling of various TPS so that relevant data/information of interest about the system can be captured on a continuous basis to be fed to the dashboard. The external data sources that are selected should be those that have the capabilities or providing real time dynamic information.

### **Usability**

The issue of usability can be examined from the view point of the Technology Acceptance Model (TAM) by considering the factors of Perceived Usefulness, Perceived Ease of Use, and Attitude towards Using the Technology (Malhotra and Galletta, 1999). A detailed study of the issues can constitute a study in itself and due to restrictions of length, the issues are examined in less detail with the qualifier that these are no less important than other issues discussed so far.

Some of the issues that would constitute Perceived Usefulness relate directly to the content or the information presented in dashboards. Information on the dashboard should be interpreted and acted upon in the context of the organization's overall objectives and goals. The information should be aggregated or combined into meaningful metrics which allow better decision-making while reflecting the concerns of organizational goals and objectives where applicable. An example of a useful metric would be a ratio of the current actual sales to budgeted sales instead of the actual difference. The implication is that while implementing dashboards, there needs to be an organizational-level exercise to derive useful metrics for different personnel and different levels. This exercise may also derive from the best practices in the industry. Many organizations that are contemplating dashboard implementations, or are in the process of implementation, have gone through the involved exercises of constructing Key Performance Indicators (KPIs) using the balance scorecards. This approach is highly laudable but still begs the question of organizational maturity and the ability to perform such an exercise effectively. Many such exercises derive extensively from best practices and in that process may attenuate some of the internal organizational realities. As such, design of metrics is important if dashboards are to be perceived as useful.

The whole rich area of Human Computer Interface (HCI) is relevant to the Perceived Ease of Use. The dashboard metrics should be assimilated quickly by managers and should display relevant information unambiguously without involving significant cognitive effort. An example can be coded alerts linked to the hourly sales level across a region or nation, the number of calls queued in a call center, the number of calls dropped in a call center, etc. While modern commercial packages allow the use of a variety of widgets to display the same information, there are recommended widgets for a given type of information. This body of knowledge (Ghani and Lusk, 1982; Byler, 1983; Lee, 1985; Song, 2004) should be used in conjunction with existing literature and usability experts for dashboard design rather than leaving it to the technical personnel. The use of widgets that are customizable to individual consumer's tastes should also be a consideration. Users should have some ability to customize the widgets. The customization could be in terms of where the widgets are anchored on the desktops, consolidating widgets in one or multiple clusters, customizing colors, customizing sound alerts, etc. In addition proper and adequate end user training needs to be conducted for the effective use.

As far as attitude towards the use of technology is concerned, there may be several possible issues of relevance. None of them can be considered specific and unique to dashboards as such, and have been studied elsewhere in detail. Based on the discussion so far, the first issue, of course, may be the impression of dashboards being the latest management fad driven by upper management, given that these are being targeted at the top management by BI consultants and vendors. Initiatives like Business Process Reengineering and others have been considered as such initiatives before (Currie, 1999). Thus strengths of dashboards and the rationale for implementing them should be highlighted and they should be positioned as a distinct and differentiating mechanism for information delivery. The second issue may be that the move towards metrics and common and/or visible performance measures may inculcate the fear of a big brother attitude on the part of top management and a loss of autonomy at lower levels, at regions, or in distributed offices (Goodhue, Wybo and Kirsch, 1992). There may be other political and/or cultural issues also. There should be an attempt to foster a positive attitude towards new technologies such as dashboards by explaining the benefits as early in the project as possible. But if this is an issue that can not be resolved quickly, then a corporate directive may be used more appropriately to ensure adoption.

Usability issues related to dashboards should be addressed since the underlying technology and business philosophy may entail new methods of decision-making, performance-monitoring and process management.

## **POST-IMPLEMENTATION SURVEY DETAILS**

### **Organization and Project Details**

The organization studied in the survey is a North American bank ranked amongst the country's 50 largest bank holding companies. It operates branches across multiple US states. The bank has been in existence for more than a century. The bank has recently undertaken many initiatives to improve decision-making at all levels and the dashboard implementation was part of these initiatives. The dashboard project was started on March 2004 and ended on December 2005 (refer to Figure 2 for sample screen shots of the dashboards) and cost about \$300,000 to implement. The implementation involved senior managers and a further roll-out to managers at lower levels of the organization is planned.

The project initiation and inception was based on satisfying the following objectives:

1. Provide a holistic view of key performance indicators to lines of business: "Connect strategy with goals".
2. Ensure that sales and support functions are aligned and systems are meeting established Service Level Agreements: "Cross functional alignment".
3. Everyone is looking at the same thing: "One version of truth".
4. Provide management with some performance management tools: "Manage using dashboards".
5. Leverage existing data repositories, investment in Business Intelligence Technology and skills: "Build on what we have".

### **Post Implementation Survey Details**

Ten top bank executives were interviewed for effectiveness of the dashboard in January 2006. At the time of the survey, the executives had been using the dashboard for 6 to 9 months. The executives involved in the survey were as follows: Head of Marketing, Head of Retail Sales, Head of Credit, and five Regional Sales Managers. Data was collected through personal interviews using a form as guideline (refer to appendix A). Personal interviews were conducted to gain better insight into usage and get richer information. Three of the executives were interviewed over the phone due to considerations of time and money. The surveys were conducted by consultants engaged by the bank who had played an active role in the implementation and conceptualization of the dashboards. One of the researchers was involved in six of the interviews.

The following are the salient results from the interviews:

1. Only one interviewee used the dashboard on a regular basis and others did not remember the last time they had used the dashboard.
2. Most interviewees relied heavily on the reports from the data warehouse for decision making.
3. For making business decisions, the interviewees needed a level of detail much deeper than what was offered on the dashboards.
4. Though not specific to the dashboard, interviewees were skeptical of the quality of some of the data/information that was being displayed.

5. The dashboard data did not provide exception-reporting primarily due to the fact that the thresholds for such exceptions had not been established. The data being presented was a summary of data available elsewhere in other systems like the data warehouse and therefore did not seem to add any value.
6. Most interviewees did not see the link between the information being provided on the dashboard and the overall objectives of the bank.
7. The data on dashboard was not dynamic enough. It changed only from day-to-day.
8. Proper training was not provided to the executives and the documentation was poor. In addition, multiple sign-ons were needed to get to the dashboard. The dashboard was accessed through Microsoft Outlook using a using plug-ins.
9. Only the top executives had access to the dashboards and their direct-reports could not access the dashboard. Hence there appeared to be some disconnect where the information was provided and where it was needed or where it should have been provided for action.
10. Most data being displayed on dashboards is “after the fact data”. This data if made available to executives as it was generated could have aided in some action that would have a positive impact on the company.
11. Information collection at the lower levels can be improved to provide the required information on the dashboards.

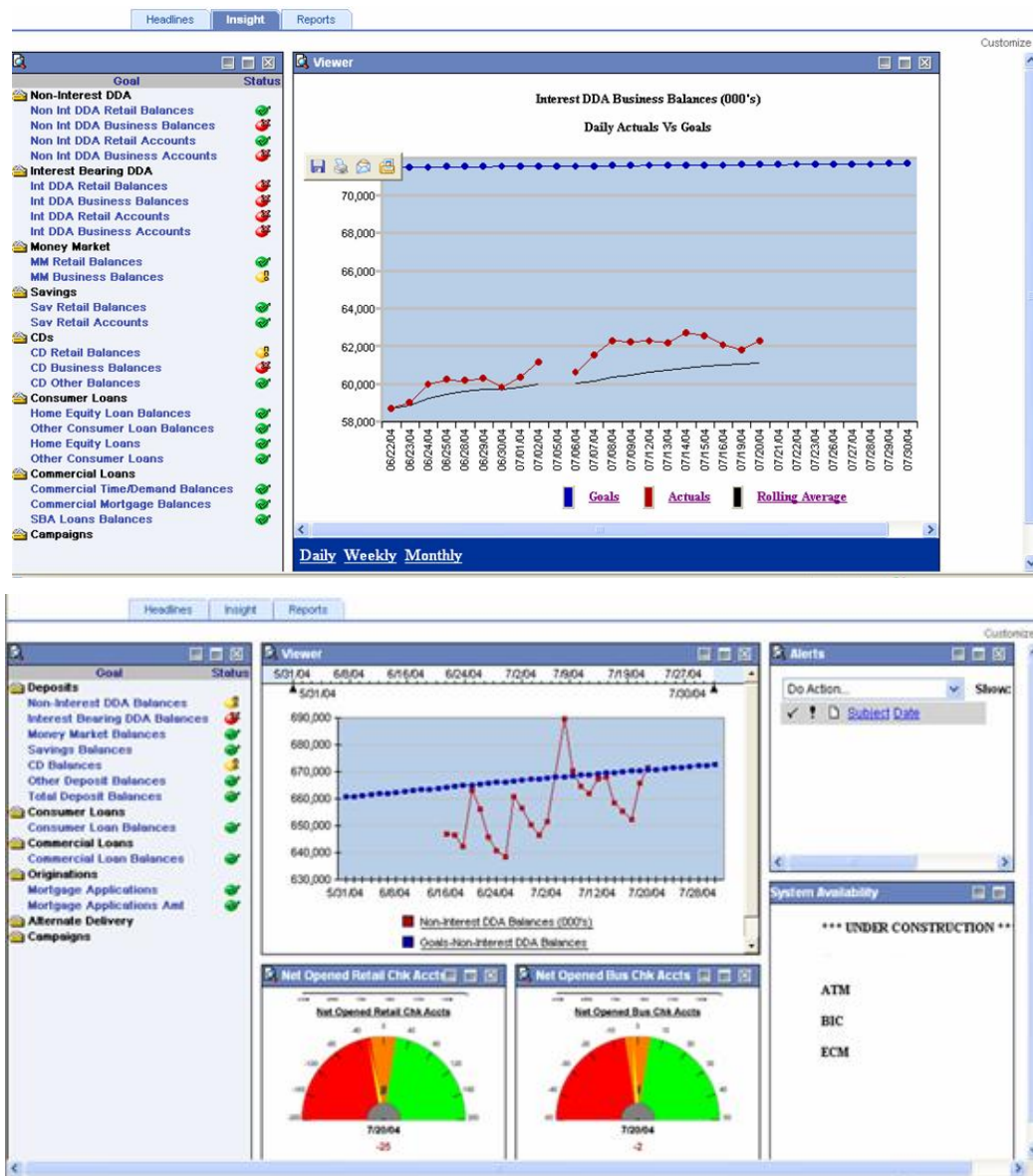


Figure 2: Sample Bank Dashboard Screens



### Assessment of Survey Results

As per the internal assessment of the bank, only the objective of “Leverage existing data repositories, investment in Business Intelligence Technology and skills” was achieved. When assessing why the objectives were not, or could not be, met, the following is the shared understanding of the reasons as derived by the authors and the leader of the team involved in implementation.

1. **Lack of Appropriate Metrics/KPI:** A significant number of metrics had no clear connection to the units/departments’ objectives and goals. As a result, the dashboard did not provide the means to act to exceptions. Also there were too many metrics on the dashboard and navigation got cumbersome when trying to look up different information. Further, most of the metrics only refreshed daily, which did not provide adequate insight into the business operations.
2. **Lack of Proper goals:** The organization did not have goals at an individual metric level. Proxies were used, where applicable, since in some cases data was either not available, could not be obtained from service providers, or the cost of retooling applications to get the data was considered too high. This exercise highlighted the need for goal-setting and the ability to obtain relevant data.
3. **Management Culture:** It was assumed that executive management would use the dashboards. The President of the bank was sponsoring it and as a result, there was no open push back/resistance. The managers were not very receptive to the concept of information transparency since it entailed a loss of control. There was a general fear that problems/issues in a specific unit would be viewable by other peers. Finally, management was used to a lot of detail (MIS) reporting. The dashboard was something that no manager had used in the past. There was also a lack of understanding on how to use it effectively. Management style is very hands-on and is not management-by-exception. There was no ownership for each of the metrics/KPIs.
4. **Limited access:** The initial rollout only included the senior managers. Teams beneath them were kept out and as a result there was no alignment down through the ranks. They were using different sets of reports and/or looking at different things. The bank now feels that giving access to line managers would have significantly enhanced the effectiveness of the dashboards.

### DISCUSSION, RECOMMENDATIONS AND FUTURE RESEARCH

Most issues outlined in the post-implementation review of the dashboards may be seen to stem on account of divergence from the fundamental considerations outlined in this study. A major issue for concern may be that the dashboards have the appearance of a glorified EIS that use widgets (commonly used in dashboards) to provide visual representations with the backend plumbing coming from the data warehouse or other relatively static sources. The similarity to an EIS is enhanced given that the information represented is primarily derived from aggregated historical data from the data warehouse. Unless a distinction is achieved, it is possible that dashboards are likely to be unable to achieve their intended objectives.

Some salient recommendations can be made based on the discussion so far. Dashboards should be positioned as a unique and different information delivery mechanism to enhance their value proposition. As far as possible they may be implemented as a set of desktop widgets that can be easily viewable at a glance without significant navigation requirements. They should display dynamic information that can be used to take some corrective or proactive action in the operational time frame for the business. Dashboard implementation may initially be targeted at managers and supervisors at an operational level and then rolled up gradually for the senior management.

It is possible the issues raised in this study are taking a purist approach as far as positioning of the dashboards is concerned but these issues are important for setting realistic expectations about the use of the dashboard technology. A review of a set of white papers and case studies did reveal that there are implementations to support what is proposed in this study. In the case of Honeywell Uniformance (Anonymous1, 2002), real-time information for real-time decision making was one of the primary objectives. As such, it is anticipated that considerations outlined in this study can increase the chances of success for a dashboard implementation.

A follow up study can examine the second phase of implementation and determine if the results and conclusions presented in this study hold ground. This can also be validated through study of organizations where dashboard implementations have been considered as a success. There are other major issues that warrant examination such as architecting of the Information Systems so that data/information is readily available, and changes in IS can be implemented rapidly as the conditions change. A cohesive and inter-disciplinary approach encompassing research and developments in areas of data warehousing, BPM, Decision Support Systems, and HCI is needed to create and implement successful dashboards.



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**APPENDIX A**

**Dashboard Questionnaire**

Reviewer:		
How often do you review the dashboards?	Daily	Weekly
	2-3 Times Week	2-3 Times a Month
Other: _____		
Criterion	Rating	Comments
	Low High	
<b>Functionality</b>		
Ease of getting started / accessing the dashboard	1 2 3 4 5	
Ease of navigation	1 2 3 4 5	
Range of functions appropriate to purpose and content	1 2 3 4 5	
<b>Content</b>		
Appropriate mix of text, images, tables	1 2 3 4 5	
<b>Relevance</b>		
Relevance to daily work	1 2 3 4 5	
Relevance to national / regional / departmental areas	1 2 3 4 5	
<b>Outcomes</b>		
Clarity of the anticipated learning outcomes of the daily information	1 2 3 4 5	
Ability of application to raise standard of achievement / take action	1 2 3 4 5	
<b>Questions</b>	<b>Comments / Response</b>	
1. Based on the ratings above, and on your judgment, please comment on the strengths and weaknesses of the dashboards		
2. Please list up to 5 opportunities for the use of the dashboards in your department, or give your reasons if no use of the dashboards is warranted...		