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Towards a Deeper Understanding of the Use and Effectiveness of Human Resource Dashboards

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**Towards a Deeper Understanding of the Use and Effectiveness of
Human Resource Dashboards**

by

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Abstract

The goal of this thesis is to examine the factors which influence the effectiveness of human resource (HR) dashboards and the antecedents which motivate employees to use them. To do this, I have examined research on executive information systems (EIS) and dashboards and have developed models of the factors which lead to HR dashboard use and success. Looking to this idea that a dashboard is a relative of executive information systems, EIS literature was used to provide the factors in the models of dashboard use and success. In hopes of being able to develop more used and more effective dashboards, two models were built using past EIS and dashboard research. Additionally, interviews were conducted with two business professionals whom had experience using HR dashboards to gain more insight.

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Introduction

The role of technology in business management practices is growing rapidly. With improvements in data processing capabilities, businesses can use these technologies along with internet resources to create powerful information systems which can be used to better manage and lead the organization forward. Due to these changes in information distributing and accessibility, both internal organizational information and external environmental knowledge can be made more available than in the past. With this increase in knowledge availability, there is also a stronger need for designing systems capable of processing and displaying this data so that business professionals without specialties in information technology can also easily use these tools effectively. Instead of being intimidated by new technical capabilities, companies must learn to use them towards creating competitive advantages.

For example, dashboard are being used by executives and managers to anticipate trends or new events, identify possible upcoming problems, and find competitive solutions (Lamont, 2007). A dashboard is defined as “visually attractive mechanism of monitorization and is used for obtaining information through a set of indicators” (Campos, 2008, p. 259). A single screen visual display built on color coding and graphs rather than numerical values is important in transforming detailed, minute pieces of quantitative and qualitative data into a more communicable and easily understandable idea (Lamont, 2007; Few, 2005). Settings can often be customized and tailored to individual users to meet their specific needs to show either the big picture or “smaller slices of data” (Lamont, 2007).

The analogy of gauges on a car dashboard is commonly used to explain dashboards. Car dashboards, like business dashboards only display the most relevant

measures like speed in real-time and use the specific colors or symbols to indicate low gas or high tire rotations. Individual pieces of data must be consolidated and graphically presented in summarized form indicating trends in comparison to benchmarks, such as the speedometer being split into intervals of five with a red area alerting drivers of extreme and dangerous speed.

According to Dover (2004) benefits from successful dashboard use are as follows:

- Provide key executives with the ability to drill down data to show what is actually driving the specific measure.
- Allow management to integrate resources for organizational efficiency and adaptability to external forces.
- Promote transparency and accountability in various performance areas.
- Help users summarize and analyze information quickly and present it in a format that is easy to follow and comprehend.
- Promote proactive reactions to issues which come up cross-functionally and allow executives to forecast and adjust strategies when performance does not go as planned.

Executive Information System Overview

Dashboards derive from their older ancestors- executive information systems (EIS) which were capable of similar functions but with less emphasis on visual representation of information. An executive information system is defined as general term for a type of management information system program used by top executives to aid and support in decision making (Singh, 2002). EIS emerged in the mid 1980's before dashboards and helped organizations monitor organization performance, reach decisions, and consolidate and connect information between departments and employees (Hwang, 2007 and Singh, 2002). The goal of these systems was to provide managers "easy access" to variables critical to the business' success (Singh, 2002, p. 71). These factors came from both internal and external sources (Singh, 2002). EIS were meant to help executives

reach decisions by providing analyses that showed relationships hidden in the data through “slicing and dicing” (Singh, 2002, p.71).

While not the same exact system, a dashboard is specific case or application of an executive information system (Lamont, 2007). These older EIS placed less importance on visual components than dashboards. Dashboards take advantage of modern improvements in graphics and data streaming that were not available when executive information systems were first implemented.

HR Dashboards Overview

Specifically, Human Resource dashboards are visual representations of relevant external and internal data meant to improve decision outcomes in HR. Campos identifies six Human Resource management activities in which dashboards can help the firm gain a competitive advantage: organization, working environment, knowledge management, Human Resource development, reward management, and workers’ relationships (2008). HR dashboards have the potential to improve Human Resource functioning by standardizing “policies and processes of staff through all organization, facilitating the development of an integrated and coherent system of staff management” while lessening “the load of work of Human Resource functions eliminating low value tasks” (Campos, 2008, p.258). They also allow for supplying of “efficient administrative services” and enhancing “winning strategies” and competitive advantages over rivals (Campos, 2008 p. 258). It should be used to support decision making, remain clear and efficient, be easily adaptable as the organization changes, maintain maximum visibility of key indicators, and motivate management (Campos, 2008). Thus dashboards serve to improve operational activities at the transactional, or granular level in order to present information

in a way that facilitates critical analyses of HR functioning requiring sophisticated managerial thinking. Ideally they should automate or simplify the dull job of collecting relevant data in order to leave more time to for higher functioning activities such as critical analysis and decision making.

HR dashboards aid executives in decision making by consolidating internal and external information graphically in order to make it easier to evaluate. This is mainly accomplished through taking large sums of data and drilling-down variables to uncover trends and patterns (Boudreau, 2002). If successfully developed and maintained, Human Resource departments can use information technology to improve decision making and both directly and indirectly lower costs. Direct cost reductions for example are increased productivity while indirect savings could stem from lower turnover leading to less training expenses. Although HR dashboards are used mainly by Human Resource professionals, they must also incorporate data from other departments and sources in order for users to make well informed decisions. In addition to improving functional specific performance, they must also benefit the organization overall. Boudreau argues that ideal HR dashboards should “tie HR measures to a compelling business concept and, in principle, can articulate links between HR measures and strategic or financial outcomes” (Boudreau, 2002, p.14).

Linking Executive Information System Research to Dashboard Theories

Because of the relatively low amount of studies regarding dashboard use, other research needed to be incorporated. Because they stem from executive information systems, it is logical to assume that theories from EIS literature can be applied to dashboards. Lamont writes executive information systems are “early versions of

dashboards” with “a similar goal” but were “not connected to original source data” and thus were not “sustainable” (2007, p.14). Modern dashboards however use new technological capabilities to pull data from multiple warehouses and databases, linking the system directly to original sources (Lamont, 2007). Because a dashboard is a specific case of an executive information system it is logical to infer that EIS research can contribute to the general understanding of HR dashboards which explains why research on executive information systems has been collected in order to study dashboard success factors. The following table summarizes previous dashboard research. A similar table of EIS literature can be found in the appendix.

Dashboard Research Table

<i>Citation</i>	<i>Method</i>	<i>Key Variables</i>
Wolpin (2006)	Literature Review	<ul style="list-style-type: none"> • Problems: being overwhelmed by too much or irrelevant information, dashboard designed without much regard to the overall organizational performance and too much focus solely on the HR department.
Campos (2008)	Case Study	<ul style="list-style-type: none"> • Problem: striking a balance between being broad and displaying relevant details, gaining easier access to data for indicators
Mathe (2009)	Case Study	<ul style="list-style-type: none"> • Important that medical language was clear and specific so that doctors could understand the suggested treatments- this decreased the need for IT support • Enables transfer of knowledge- compliance to protocol improves with dashboard advisory • Benefits: improved communication/cooperation cross-regionally leading to better efficiency/patient care • Success factor: quality of data
Wolpin (2006)	Survey	<ul style="list-style-type: none"> • Dashboard visualization was divided into three categories: introspection, customization, and presentation • Display should be easily switched from showing broad or detailed information
Jain (2008)	Field Observation	<ul style="list-style-type: none"> • Should show accurate and timely information, monitor progress towards goals in order to increase manager accountability, and increase government transparency to improve public opinion
Edwards (2005)	Case Study	<ul style="list-style-type: none"> • Success factors: correct metrics, executive support, simplicity, ease and speed of implementation, respond to fluctuations in business conditions.
Kawamoto (2007)	Literature Review	<ul style="list-style-type: none"> • Problems: Too much information, functional bias, over reliance on historical data, narrow perspective, inconsistent item definitions, unnecessary metrics, blurry strategic vision, lack of benchmarks, no executive sponsor, disagreement across departments, slow implementation, and too little training
Christensen (2006)	Literature Review	<ul style="list-style-type: none"> • Chief complaint: inability to drill down information • Benefits: Align their efforts with organizational objectives.
Snow (2006)	Survey	<ul style="list-style-type: none"> • Cultural change is needed to increase user acceptance • Organizations must provide training require employees to use dashboard systems
Dover (2004)	Literature Review	<ul style="list-style-type: none"> • Cultural change is needed to increase user acceptance • Organizations must provide training require employees to use dashboard systems

Rau (2004)	Literature Review	<ul style="list-style-type: none"> • Dashboards show the general concept as well as specific details of what it is tracking all under one interface. Correlations shown by dashboards can help users make decisions.
Gonzales (2005)	Literature Review/Case study	<ul style="list-style-type: none"> • Facing pressure to demonstrate value of IT/link business objectives to IT strategies • Benefits of CIO dashboard: aligning IT goals with corporate strategy, showing the value of IT, improving IT image, improved decision making regarding complex issues and implementation of the balanced scorecard • Executive support and enthusiasm factors leading to dashboard success
Lamont (2007)	Case Study	<ul style="list-style-type: none"> • Visualization and spatial data argued to be most important in increasing business intelligence through using dashboards
Langston (2006)	Literature Review	<ul style="list-style-type: none"> • Dashboards are modern EIS that are more sustainable and interactive and require less input from the IT department.
Beckman (2007)	Case Study	<ul style="list-style-type: none"> • Successful if easy to use, simplifies communication with vendors, and external aspects are designed to match the firm's branding.
Few (2005)	Literature Review	<ul style="list-style-type: none"> • Make sure indicator is goal specific, could be used in making a decision, can be timely, can be quantified, and has the ability to assess the performance of an organization

Purpose of Study

The purpose of this study is to add to academic knowledge of information technology usage and performance theories as well as provide practical guidance for actual business application. Specifically, it is hoped that findings from this research can identify factors critical to successful outcomes of HR dashboards as well as pitfalls to avoid. The research goal is to fill in gaps left in previous studies and then use these new ideas in actual dashboard development and implementation, and ultimately apply these constructs towards creating value added Human Resource specific dashboards which benefit the individual user as well as the overall organization's objectives. Two models have been developed to explain dashboard use and success with factors drawn from studies on both dashboards and executive information systems (EIS).

Dual Models

Dashboard use and success were looked at separately and assumed to be two distinct concepts with unique relationships with antecedents. Because of this assumption, two models were developed. Two models were constructed separating dashboard use from success because the relationships and pathways between the variables were thought to be different. Model 2 shows direct relationships while Model 1 shows indirect pathways. The complexities of human behavior cannot easily be explained looking at simple one-to-one relationships. Given this assumption, interceding variables are used in the dashboard use model. A link must be put between human behavior (use) and what is affecting it otherwise there is no real explanation being proposed. Intention is a cognition that explains how a variable influences a behavior in a human. Dashboard success contains dimensions other than actual human behavior. It is not defined as a human

behavior but as a general outcome typified by the behavior of decision making and the result of improved strategic business functioning. Because success is not construed to be a pure human behavior, direct relationships between factors and the outcome were proposed in model 2.

Dashboard Use

The first model concerns dashboard use and is based upon Ajzen's theory of planned behavior (TPB) and uses his constructs of attitude, subjective norms, perceived behavioral controls, intention, and use (1991). In Ajzen's original Theory of Planned Behavior, he suggests that intention influences behavior (1991). Stronger intention leads to a higher motivation to engage in the behavior (Ajzen, 1991). The behavior of interest in this study is dashboard use. Attitudes and subjective norms are motivational variables which influence behavioral intention. A third factor, perceived behavioral control predicts both intention and use (1991).

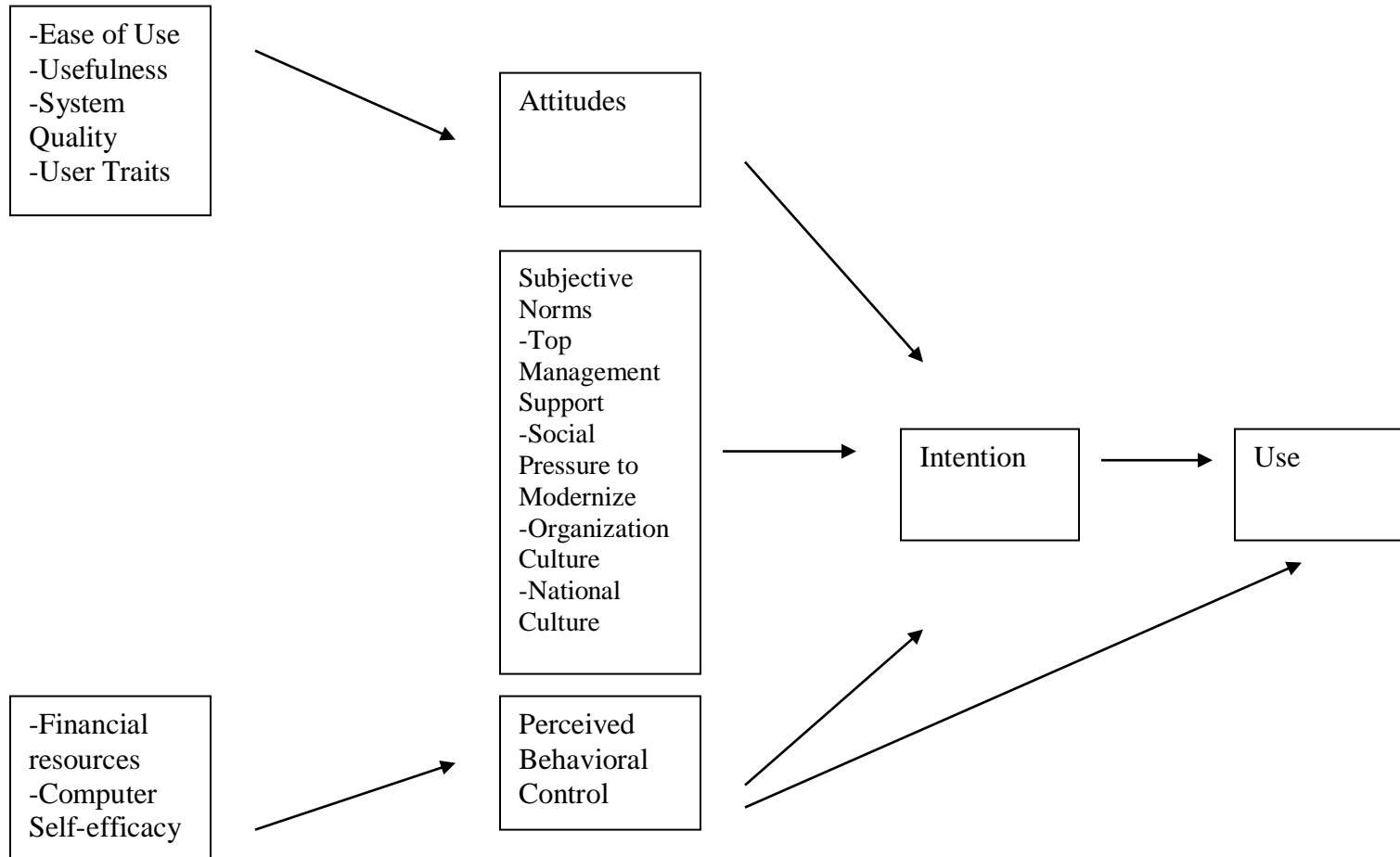
An attitude (A) is defined as "the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question" (Ajzen, 1991). Essentially it is a value judgment. A subjective norm (SN) on the other hand is a "perceived social pressure to perform or not to perform the behavior" and refers to external conventional practices which an individual wants to conform to. Perceived behavioral control (PBC) is one's "perception of...resources and opportunities available to a person must to some extent dictate the likelihood of behavioral achievement (Ajzen, 1991, p.184)". He assumes that "the effort expended to bring a course of behavior to a successful conclusion is likely to increase with perceived behavioral control (Ajzen, 1991, p. 184)." This construct combines both the motivation and ability aspects of intention.

Ajzen argues that attitudes, subjective norms, and perceived behavioral control predict behavioral intention; Differences in behavioral intention along with perceived behavioral control explain variance in behavior (Ajzen, 1991). The model assumes that the more positive the attitude and subjective norms, and the greater perception of behavioral control an individual has towards a given action, the stronger the intention to perform the behavior. According to Ajzen A, SN, and PBC all work to influence each other as well. Also, PBC directly affects behavior as well as indirectly influencing it through intention. It is assumed that if intention is kept constant that an increase in perceived behavioral control will lead to higher effort to be successful in that action. In other words if an individual thinks he or she has the capabilities to accomplish something, they are more likely to be confident enough to actually try. Another reason for this direct link is that if PBC is in fact realistic enough then it can be substituted as a measure of actual behavioral control. Logically, an increase in real “resources and opportunities” should boost behavior (Ajzen, 1991).

Model 1 applies HR dashboard specific factors to the framework developed by Ajzen. Ease of use, usefulness, system quality, and user traits are assumed to influence individuals’ attitudes and therefore intentions towards using dashboards. Top management support, social pressure to modernize, organization culture, and national culture are specific examples of subjective norms which affect intentions. Two perceived behavioral controls are financial resources and computer self-efficacy. This theoretical approach suggests that internal and external factors influence if humans engage in a certain behavior. Intention incorporates motivation into the model. Attitudes, subjective norms, and perceived behavioral controls influence the cognitions behind behaviors.

These variables were gathered by looking at studies of both EIS and dashboards. Figure 1 shows these relationships between the aforementioned antecedents and dashboard use.

Figure 1
Dashboard Use



Attitudes

Ease of Use

Ease of use is theorized as one factor which influences attitudes towards dashboard use. Perceived ease of use (PEOU) is defined as “the degree to which the user believes that using the system will be free from effort (Davis, 1989).” The term is taken from Davis’ Technology Acceptance Model (TAM) (1989). Pijpers’ modified TAM model predicts that individual characteristics, organizational characteristics, task-related characteristics, and characteristics of the IT resource determine perceived ease of use (2001). In Pijpers’ study, it was demonstrated that attitude towards EIS use was determined in part by PEOU (2001). It is assumed that as the degree of perceived ease increases the more likely an individual will have positive attitudes towards using the dashboard. Having more positive attitudes in favor of something should in turn boost intentions to engage in the certain behavior. In contrast, negative attitudes are deterrents to behavior.

Other studies examining the relationship between ease of use and attitudes towards information systems have shown similar relationships. In Taylor and Todd’s study comparing TAM and TPB, a correlation coefficient of .24 was found between perceived ease of use and attitude towards use which was significant at the .05 level (1995). Also, Wixom and Todd identified the components of PEOU as reliability, flexibility, integration, accessibility, and timeliness (2005). Results show that ease of use and attitude had a positive correlation of .50 with significance at $p < .0001$ (Wixom, 2005). This should hold true for dashboard use as well. Believing a dashboard is easy to use should illicit more positive attitudes towards using the system. Thinking something is difficult to use should be discouraging, which leads to the following proposition.

Proposition 1: The degree of perceived ease of use affects attitudes towards dashboard use.

Usefulness

Usefulness is another factor which has been theorized as influencing attitudes towards dashboard use. Perceived usefulness (PU) is another concept from TAM that is suspected to influence attitudes towards system use. It is defined as “the belief that using the technology will enhance performance (Taylor, 1995, p. 148).” While ease of use focuses on functional operation of the system, usefulness refers to any value added from utilization. If something is thought to be useless, people are likely to form negative attitudes towards the act and these cognitions will lead to them thinking of fewer reasons to actually perform the task. A behavior deemed useless will be replaced by intentions to engage in something perceived to be worthwhile instead.

Research has demonstrated support for a relationship between usefulness and attitudes towards system use. In Taylor and Todd’s study a .79 correlation coefficient was found between perceived usefulness and attitude toward use which was significant at .05 (1995). In Pijpers’ study perceived usefulness and attitude towards use showed a relationship of .466 which was significant at the .01 level (2001). These studies support the theory that perceived usefulness directly influences attitude toward IT system use. Wixom and Todd propose that object-based beliefs on information quality predict object-based attitudes of information satisfaction, which in turn influences the degree of perceived usefulness (2005). They further argue that usefulness has an impact on both attitude and intention to use (Wixom, 2005). Completeness, accuracy, format, and

currency are factors of information quality (Wixom, 2005). Results of their study showed that usefulness and attitude had a positive correlation of .42 with significance at $p < .0001$ (Wixom, 2005). In the professional arena, it is thought that only projects perceived as helpful would continue to be used. Anything that proved to be not valuable would be associated with wasting resources. This would associate negative attitudes with using the system. These ideas lead to the following proposition.

Proposition 2: Perceived usefulness will affect employee attitude toward dashboard use

System Quality

System quality is another variable associated with system use. It refers to the dashboards' visual display options and layout, functionality, and existence of errors or programming glitches. It can be thought of as how well the system delivers information as opposed to the quality of the underlying data itself (Wixom, 2005). Components of system quality include reliability, flexibility, integration level, accessibility, and timeliness (Wixom, 2005). Reliability focuses on dependability while flexibility refers to adaptation. Integration is defined as how well the system pulls information from multiple sources and accessibility is how easy information of interest can be found. Lastly, timeliness is how quickly the system performs tasks (Wixom, 2005).

Dashboard users can potentially form perceptions of system quality based upon both direct experience as well as opinions from others during dashboard development and after actual implementation. Common sense logic suggests that if an executive thought the system was unreliable, rigid, not easily available, slow, and poorly assembled he or she would not be motivated to use the dashboard. These thoughts seem to account for

some of the variance in attitudes toward intention to use IT tools. Why would a professional business person want to use a poorly functioning system? Wixom and Todd go on to suggest that system quality directly affects system satisfaction which in turn has a relationship with ease of use and attitude (2005). Study results show that reliability and accessibility are positively correlated with system quality at a significance level better than .001 while flexibility was significant past .01 and integration's relationship was at .05 (Wixom, 2005). The association between timeliness and system quality was not found to be significant (Wixom, 2005). In this paper, a more direct effect of system quality on attitude toward dashboard use is being examined, with the middle components of system satisfaction and ease of use being collapsed. The following proposition summarizes the relationship between system quality and dashboard use.

Proposition 3: Perceptions about system quality predict attitudes towards dashboard use.

User Traits

An employee's own traits can influence their attitudes towards using a dashboard. Volonino and Watson found four functional EIS user types that differ on purpose and methods "to improve information access; improve communication; solve problems; monitor performance." Walstrom and Wilson use ideas from Volonino and Watson and categorized three different EIS user types as follows: concerters, pacesetters, and analyzers (1997).

In the study, respondents were asked to identify for which of the following ten purposes they use the EIS— information formerly provided by a written report; predetermined and preformatted reports; electronic mail; sources outside the

organization; news services- outside the organization; latest data on key organizational variables; company news; perform analysis of data; scheduling; automatic rolodex- phone list; drill down capabilities; word processing; tickler file- to do list; automated filling; ad hoc querying of organizational data bases; computer conferencing; network television via computer (Walstrom and Wilson, 1997).

Converts used EIS to replace old systems while pacesetters used EIS for the most purposes: communication, and data analysis. Analyzers used EIS the most for "ad hoc querying of organizational databases (Walstrom and Wilson, 1997, p. 80)." High importance on information access was a characteristic of convert EIS users while organizational understanding was most important for analyzers. Pacesetters were characterized by placing strong emphasis on both organizational monitoring and information access (Walstrom and Wilson, 1997). User types differ on three fundamental areas of EIS: "organizational understanding, information access, 'organizational monitoring (Walstrom and Wilson, 1997, p. 82)."

It can be inferred that these different user personalities will have varying attitudes towards dashboard use. Attitudes will differ on the basis of the three underlying dimensions of organizational understanding, information access, and organizational monitoring. Because converts tend to develop EIS to replace old information systems, "their comparatively low use of the EIS for communication and/or data analysis functions appears to confirm that such users have yet to fully embrace the capabilities offered by an EIS (Walstrom and Wilson, 1997, p. 80)." Because of this "lag" in attitude it is possible converts would have less of an intention to use a dashboard because they do not yet perceive all of its strategic capabilities and only see it as a monitoring function.

Pacesetters reported the most purposes for use out of all three user types with emphasis on EIS use for communication and data analysis (Walstrom and Wilson, 1997). Perhaps because pacesetters list more reasons for using an EIS, these attitudes will cause them to have a stronger intention to engage in dashboard use than the other user types. Analyzers identified the system was used for the least amount of the ten purposes and used it mainly for performing analysis of data and ad hoc querying (Walstrom and Wilson, 1997).

Conversely to pacesetters, maybe analyzers would have less intention to use dashboards because they believe in fewer of these purposes.

Proposition 4: Dashboard user types influences attitudes regarding use.

Subjective Norms

Top Management Support

Top management support is a variable cited in many EIS and dashboard studies. In Model 1, it is a subjective norm (SN) which impacts intention to use the dashboard. Ajzen defines subjective norms as “the extent to which ‘important others’ would approve or disapprove of their performing a given behavior (1991, p.195).” Top management support is known by other similar terms such as executive support and executive sponsorship. Top management is a type of SN as high level executives can be considered “important others” that have significant influence over employees’ evaluations of many things including information systems (Ajzen, 1991, p.195). Top managers try and spread their perspectives throughout the organization to spread their vision among all employees.

Having strong support from top executives can give both tangible and intangible influences on social norms and dashboard use. Enthusiasm for a project from the top-tier executives can help project developers and users get resources and support. In more

abstract terms, executive championing influences perceived subjective norms about the value, relevance, and acceptance of the system in the organization's culture. Employees are likely to take pick up on these social cues implied by top management support and believe using the system is worthwhile.

In a fairly recent study by Diez (2009), top management support was the best predictor of system use. The correlation shows that “locking in support from top managers has a strong positive influence on the adoption of IS (p. 599).” Having top management support shows individuals that using the dashboard is a behavior desired by superiors and this, as Ajzen suggested, exerts power over individuals to engage in that behavior.

In Rainer and Watson's 1995 study, top management support was referred to as executive sponsorship. Executive sponsors' duties were included “developing support for the EIS, allocating the necessary resources, participating in the system's development, and handling political resistance. (Rainer, 1995, p.85).” In this case, the executive sponsor was a representative or symbol of general top management and through these activities employees felt added social pressure to use the system.

According to Koh and Watson, aspects of executive support included “necessary resources,” “encouragement,” availability “to discuss matters important to the EIS project,” readiness “to discuss their information needs with...support staff,” and tackling “any political resistance (Koh, 1998, p. 308).” Management actively and directly fueled EIS use by encouraging and communicating about the project extensively. This enthusiasm was social influence that was meant to lessen “any political resistance” that

may have surfaced among users (Koh, 1998, p.308). Based on these ideas, the following proposition was built.

Proposition 5: The level of top management is a subjective norm associated with dashboard use.

Social Pressure to Modernize

Social pressure from top managers is not the only subjective force to influence intention to use a dashboard. Pressure to modernize and harness growing technological capabilities is another example. Rapid changes and new innovations in technology can place pressure on businesses to modernize and take advantage of new advances in computer and Internet capabilities in order to expand and evolve. Improved internet capabilities and lower cost of information technology products have worked together to fuel this change (Volonino, 1995).

This social pressure to modernize is due to an underlying need to access the growing amount of data made available and accessible through technological advances. Pressure to harness the power of technologies to become more knowledgeable exists in order to gain a competitive advantage. These technological changes can influence subjective norms surrounding dashboard use. In this instance Ajzen's "important others" could be society in general or competing firms that are leaders in using technology to improve business functioning (1991, p.195).

In a study by Cerpa (1998), "rapid change of technology" was an important variable in deciding to use the information system strategic positioning, a type of information system (ISSP). The ISSP process is defined as a plan on how to manage and

control information technology tools (Cerpa, 1998).” These quick technological changes as well as conducting research on them were two factors identified by ISSP users that were interviewed and ranked on average as “very important” on a scale from no importance to crucial (Cerpa, 1998, p. 205-206). This pressure to develop and use new computer tools is especially pressing in hyper competitive industries such as investment banking and consumer goods in which the external environment is constantly changing and requires quick response and adaptation (Volonino, 1995). Volonino found improvements in accessing available data to be the underlying theme connected all new information technologies, including EIS (Volonino, 1995). Looking to this past research, the next proposition summarizes these ideas.

Proposition 6: Social pressures to are subjective norms which influence behavioral intention.

Organizational Culture

Another way social forces influence information system use is through the broad organizational culture. Organizational culture must be examined when discussing dashboard use. The level of centralization and business focus are structural factors which reflect corporate culture. Byrd compares and contrasts EIS use in hierarchal versus adhocracy firms (Byrd, 1996). A hierarchal company, also known as “internal process organization or machine bureaucracy” focuses on internal environment factors such as “internal efficiency, uniformity, coordination, and evaluation” and “places emphasis on processes such as measurement, documentation, and information management (Byrd, 1996, p.451-452).” Top executives are generally concerned with “control, stability, and

efficiency (p.452).” In contrast, Byrd states an adhocracy values “expansion and transformation” and focuses on competitive positioning by being flexible and responsive to the external environment (p.452). Adhocracy executives are generally idealists, risk takers, and entrepreneurial.

Byrd proposes that EIS use is more likely in an adhocracy because of values such as future-orientation, higher risk tolerance, and innovation. It is argued that hierarchal cultures are more likely to have EIS for internal efficiency improvements. One company is specifically cited as using EIS for finding new markets internationally in hopes of maintaining its position as “the top appliance manufacturer in the USA and Brazil (Byrd, 1996, p. 462). A case study of the hierarchal MCGroup manufacturing company showed EIS planning was not so much a rational, pre-planned process but more of a product of continuous social and organizational culture (Nandhakumar, 1996). Similar to findings from Byrd’s research, MC Group’s EIS was meant to improve internal meetings and boardroom presentations and other “ongoing organizational practices (Nandhakumar, 1996, p.208).”

The structural aspect of organizational culture is said to influence subjective norms in Model 1. While both structures are likely to produce behavioral intention to use a dashboard, there are different sets of subjective norms behind each type of company. Internal improvements are valued by hierarchal structured firms while adaptation to external factors is important to adhocracies. These underlying themes are subjective norms which can drive behavioral intention of dashboards. Byrd’s proposition that adhocracies are more likely to use EIS because of certain organizational values calls for much more research to be done. It is still unclear exactly why an adhocracy would value

EIS more. In fitting with the model, these values of expansion and transformation, competitive positioning, flexibility, entrepreneurship, risk appetite, idealism, and responsiveness to the external environment could be the subjective norms which influence behavioral intention.

It is possible that adhocracy organizations are more likely to use dashboards because the system is perceived as transformational and strategic rather than merely for simple transactional data processing. Adhocracy cultures value information sharing across different levels while hierarchal companies have rigid power structures based on exclusion. Because of this, sharing information is a positive norm in adhocracies leading to organizational progress while it can be seen as a way of losing power and privileges by top managers in more hierarchal structures. Based on these views, a relationship between organization culture and dashboard use is being proposed.

Proposition 7: Organizational culture is a subjective norm which predicts dashboard use.

National Culture

National culture is another subjective norm which influences intentions to use a dashboard. This refers to the societal, political, and economic context of a country which influences both general business functioning as well as individuals' specific information system use (Arnott, 2007). National culture is theorized to be an external, or environmental factor which places social pressure on business professionals to either use or not use information systems (Ajzen, 1991). Just as "no system is implemented in a vacuum," neither is human behavior (Bussen, 1997, p. 149)." The external force of

national culture impacts business functioning through influencing individual intention to engage in certain actions. It can either work to support or knock down intentions.

Arnott argues that EIS research centered on industrialized Western cultures do not exactly reflect the unique underlying cultural themes of Eastern societies (2007). He discusses how EIS development and implementation is different in Thailand when compared to Western companies and how cultural context is important in system creation (2007). Confucian principles originating from Chinese culture are argued to be important cultural dimensions which needed to be included in EIS development in Thailand. He observed that Thai executives felt it was "beneath them" to be involved in system development and were resistant to drilling down because it did not match traditional values of hierarchy and harmony (Arnott, 2007). Conflicts of EIS cultural fit were detrimental to system success. EIS cultural fit is defined as the degree of similarity of both the organization's social and cultural context and its IT policies and methods with that of the large western organizations where the concepts that underlie EIS were originally created (Arnott, 2007, p. 2083)". This implies that an EIS "fits" the best with Western cultures rather than non Western societies and that Westerners are more likely to have an interest in using dashboards.

In another study comparing American, Japanese, and Chinese executives it was observed that managers from each country had different usage habits. Japanese managers were more inclined to listen to co-workers and employees before reaching a decision while Chinese executives used an EIS to process data efficiently and to weigh different options and decide using personal discretion (Martinsons, 2007). Americans tended to use EIS for making decisions using a standardized, formal procedure (Martinsons, 2007).

He proposed that Japanese managers value personal relationships when making decisions while Chinese executives focus on maintaining formal power structures and Americans have a need for achievement and recognition that drive their behavior. It is interesting to note that EIS research and use in China have been steadily rising since the 1980s and systems are being used in both public and private organizations (Tian, 2007). Different societal values seem to be driving different sets of subjective norms. Therefore, system development and implementation should take these national influences into consideration.

Based on this past research, it appears that national culture influences how a dashboard is viewed and used. Values derived from national culture place different pressures on the business environment as well as relationships between employees. These different pressures can affect how much the dashboard is used as well as for what it is used. Hofstede's five dimensions of culture provide a framework for explaining these relationships (1984). These five dimensions represent spectrum of a certain facets of national culture that account for variances among different societies. They include individualism versus collectivism, large versus small power distance, strong versus weak uncertainty avoidance, and masculinity versus femininity (Hofstede, 1984). These dimensions which especially distinguish Eastern and Western cultures might explain how users from different countries show variation in dashboard use. It seems that national culture influences how individuals use dashboards more than the amount of actual use. The dashboard would be used for different reasons and to support unique societal values. This next proposition summarizes these ideas.

Proposition 8: National culture is a subjective norm that influences dashboard use.

Perceived Behavioral Control

Firm Resources

The amount of resources a company has to devote towards dashboard implementation is being suggested as having an affect on the amount of behavioral control users perceive in having over dashboard use. Necessary resources include “problem solving knowledge, availability of (or funding for) hardware and software, and access to the necessary personnel in the organization (Chaudhary, 1996, p.66).”

In Model 1, the amount of resources devoted to EIS development is said to be an antecedent to perceived behavioral control that influences both intention and actual use. According to Ajzen, a perceived behavioral control is “people’s perception of the ease or difficulty of performing the behavior of interest... [that] can, and usually does, vary across situations and actions (1991, p. 183).” When applied to dashboards, the provided project budget could influence “expectancy of success... [or] perceived probability of succeeding at a given task (Ajzen, 1991, p. 183).” For example, if an individual user sees budget cuts for the system, he or she might think the dashboard would not be made as well and difficulties would arise in trying to use the software and successful decisions would be less likely to be made. With these perceived problems, users would have less intentions to utilize the system and actual use would likely decrease. An EIS developer noted in an interview for a Rainer and Watson study that, “None of us (executives) felt politically comfortable supporting an expensive information system (the EIS) for so few people. If it had failed with a huge price tag, everyone felt that its champion might take a fall (Rainer, 1995, p. 151).” This executive felt some degree of a lack of control over the use of the EIS and thus had reservations about his intentions to develop an expensive system.

Past literature has examined issues related to financial resources and EIS use. In a Bussen's case study of a manufacturing company in New Zealand, an EIS user noted that the cost of the system was a problem and not enough resources were available for such a large project (Bussen, 1997). Because the proper funding could not be secured the project leader pushed it down her list of priorities as a lack of resources made the dashboard seem futile (Bussen, 1997). This shows that because the new team leader did not believe she had control over the resources to fund EIS development or support staff, she did not show a strong intention to push the project farther and continue its use. Other employees working on the EIS showed similar weakening intentions to use the system because "the team had 'spent too much money on it to make it work, so we gave up on it (Bussen, 1997, p.147)."

These financial difficulties stemmed from the fact that New Zealand was facing a recession leading the Australian parent company to impose spending restrictions on IT research and development (Bussen, 1997, p.150). The general financial state of the company impacts how much of its total expenditures can be devoted to the dashboard project. Improper funding can prevent use of the system indirectly through decreased perceived behavioral control. A user may believe that it is out of his or her hands how much money will be devoted towards the dashboard project. This feeling of lack of control over the project budget derived from the general economic well-being of the company can lead to fewer intentions to use the dashboard as employees believe the system won't even be completed whether they use it or not. Because of budget problems and other issues, use of the system eventually stopped and the EIS was abandoned. The

Bussen study highlights how macroeconomic environmental forces such as recessions can impact the amount of resources used to find dashboard implementation.

In an EIS developed for a small grocery store, Chaudhary observed that the owner believed that benefits outweighed the costs and thus perceived the project as “inexpensive” and “was motivated to devote time and resources to the project (1996, p. 70-71).” Because the owner thought he had the appropriate amount of resources for the EIS, it gave him the intention to implement the system. This next proposition summarizes these ideas about firm resources and dashboard use.

Proposition 9: Financial resources influence the amount of perceived behavioral control individual users feel they have over system use.

Computer Self-efficacy

Computer self-efficacy (CSE) is “defined as an individual judgment of one’s capability to use a computer (Compeau and Higgins 1995, p. 192). The term can be further split into two subsets of CSE: task-specific computer self-efficacy and general computer self-efficacy (Marakas, Yi, Johnson 1998). Task specific CSE refers to an “individual’s perception of efficacy in performing specific computer-related tasks within the domain of general computing” while general CSE is an “individual’s judgment of efficacy across multiple computer application domains (Marakas, Yi, Johnson, 1998 p. 128-129).” If an individual has never used a dashboard, general computer self-efficacy (GCSE) could initially affect perceived behavioral control. Then after the user has spent some time with the information system, dashboard task-specific CSE might become the

more referenced PBC. The individual might generalize their broad computer skills to dashboard software if they perceive them to be related.

It can be inferred that computer self-efficacy would influence an executive's beliefs about his or her "capabilities to use computers (Pijpers, 2001, p.965)." A field study conducted by Hung shows that higher computer self-efficacy reduced time needed to reach decisions (Hung 2003). This implies that the more confident a user is in his or her skills, the less time spent second guessing and the quicker a decision can be reached. It can be inferred that computer self-efficacy is a factor which influences the control an individual perceives in successfully using a dashboard.

A possible explanation for this is an executive's level of confidence in using a computer is associated in his or her mind with beliefs in using information technology. If a user believes he or she does not possess the necessary computer skills, he or she will then be lead to believe that this deficit will lessen his control in using the dashboard. In Taylor and Todd's decomposed theory of planned behavior model, self-efficacy is a perceived behavioral control related to beliefs about individual ability to complete a task (Taylor and Todd, 1995). Looking to Ajzen's theory of planned behavior, Taylor and Todd suggest that higher self-efficacy leads to increased levels of behavioral intention and usage (Taylor and Todd, 1995). In their study, a statistically significant relationship was found between self-efficacy and perceptions of behavioral control (Taylor and Todd, 1995). This implies that if someone thinks they are not skilled at a certain activity, they are less likely to engage in the behavior in order to avoid failure. A relationship between CSE and perceived behavioral controls is suggested by the following proposition.

Proposition 10: Higher computer self-efficacy will increase an individual's perceived behavioral control over dashboard use.

Use Leading to Success

Performance is assumed to follow use in dashboard implementation. Success cannot be measured of a system is not first used. Also, just because information technology is used does not mean it is being used in a way that adds value and is beneficial to individuals and the organization. This idea leads to the need for two different models separating use from success. The measurement of success answers why a dashboard is used and to accomplish what. Use is thought to be related to dashboard success based on the reasoning that simply doing something repeatedly will increase skills and improve performance.

Dashboard Success

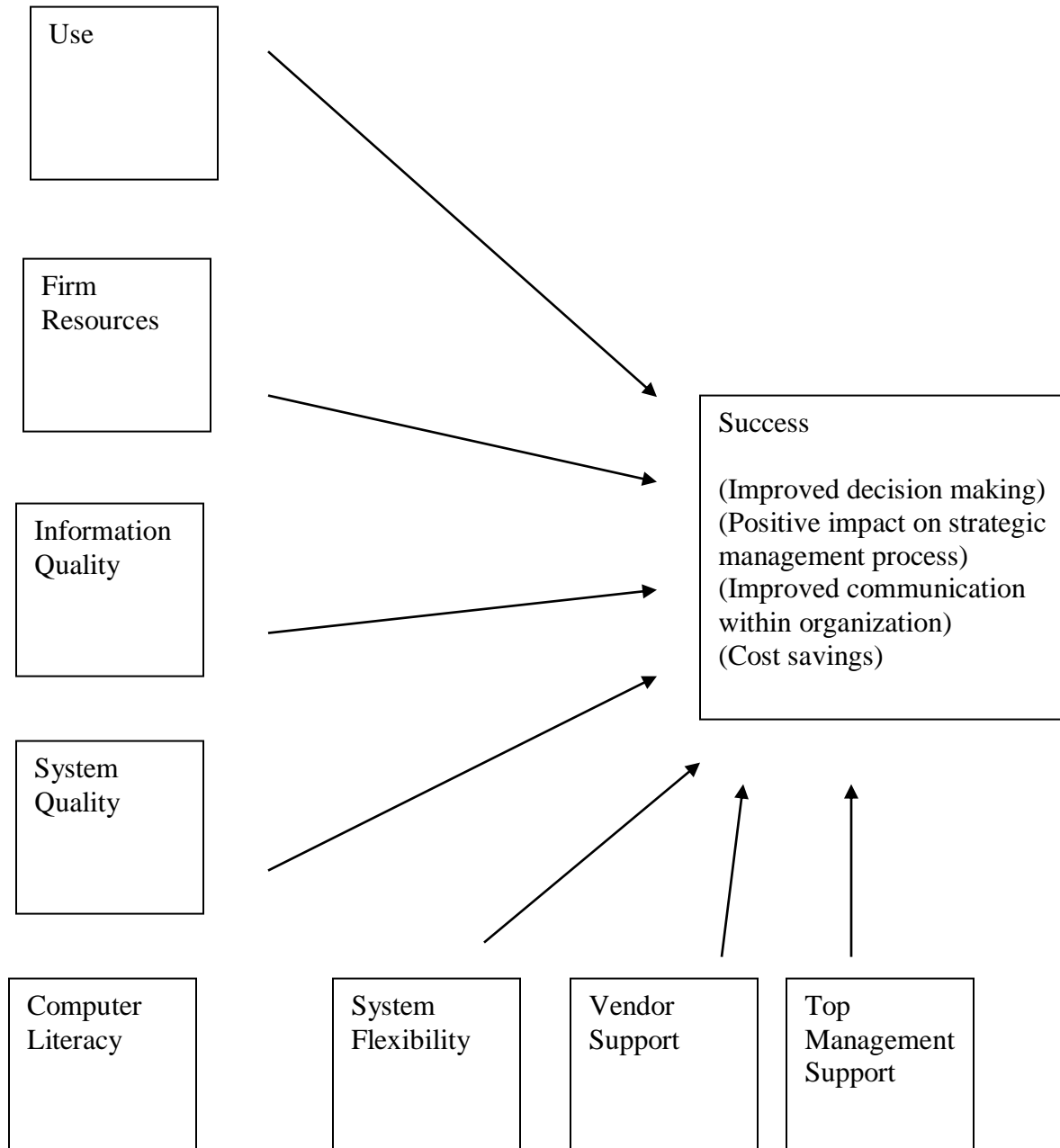
EIS success is measured in terms of improved decision making and positive impact on the strategic management process in terms of its five stages: organizational objectives, environmental scanning, strategy formulation, strategy implementation, and strategic control (Singh, 2002). The strategic management process is one measure of determining EIS success because it helps organization's accomplish its objectives (Singh et. al, 2002). Specific objectives include operational objectives and strategy implementation (Singh, 2002).

The second model depicts factors taken from EIS and dashboard research that are hypothesized to predict dashboard success. EIS success is measured in terms of positive impact on the strategic management process in terms of its five stages: organizational objectives, environmental scanning, strategy formulation, strategy implementation, and

strategic control (Singh, 2002). In a study by Singh, the authors ask the question, “To what extent does an EIS support the strategic management process? (2002, p.75)” The strategic management process is one measure of determining EIS success because it helps organization’s accomplish its objectives (Singh, 2002). Another aspect of dashboard success is improved decision making through use of the system. Better decisions offer “a better understanding of the business” and better ability to forecast future events and identification of problems (Bajwa, 1998, p.32). Figure 2 shows the model of dashboard success that demonstrates more direct relationships than the first model.

Figure 2

Dashboard Success



Use

Use is related to successful dashboard outcomes based on the logical assumption that repeated exposure to something improves performance through experience and practice. If an individual does not use a dashboard, there is no chance for the strategic goals to be impacted by the system. As executives often have busy schedules and multiple responsibilities, time is a valuable resource to them and will not be devoted to tools or projects not perceived as beneficial.

Outcomes however, are the consequences of using the dashboard. The outcomes of use may include practice using the system and understanding how to use it in decision making. Practicing using a system and understanding the benefits from experience can influence individuals to continue to employ the dashboard in a productive manner. On the other hand, using the technology and not seeing any improvements to decision making, communication, cost, or organizational goals could potentially lead to abandonment of the system resulting in failure. The next proposition explains the influence of use on dashboard success.

Proposition 11: Use is a variable critical to successful dashboard implementation.

Firm Resources

Having an inadequate amount of financial resources to develop, implement, and maintain the system is often cited as one reason for EIS or dashboard failure. Money is needed to finance expenses such as staffing, supplies, training, technology, and infrastructure. Poon (2001) cites one particular university in his study that did not have the appropriate human, physical, or financial resources to have a successful EIS in contrast to a railway company that did not worry about small budget issues due to “very

deep pockets (2001, p.406).” Adequate financial resources to secure funding for the technology and infrastructure for the system allowed the organization to have the proper tools for developing and maintaining the EIS (Poon, 2001).

Having enough in the project budget is one of the most obvious success factors but often difficult to actually realize. Estimating the costs and benefits accurately is complicated especially when some advantages are hard to quantify into a dollar figure. This is an even larger problem if a company has never developed a dashboard before. Also if there are not enough resources to keep a system maintained and the project has to be terminated, benefits from improved decision making will be lost.

Financial resources also symbolize to the developers, users, management, and organization as a whole about the level of importance or priority deemed to any given project. Thus not getting appropriate funding implies that the dashboard is not important or beneficial for the company and this problem could lessen support for the system. One problem HR executives often face is demonstrating benefits of Human Resource activities in an actual quantifiable measure (Boudreau, 2002). The HR department must “demonstrate, with data, that their human resource strategies significantly enhance competitive advantage (Boudreau, 2002, p. 4). If the Human Resource managers cannot show this, chances of getting an appropriate budget are smaller and the project will likely be pushed back which leads to the following proposition.

Proposition 12: Adequacy of financial resources predicts successful dashboards.

Information Quality

In a very broad sense, information quality refers to the desired or ideal characteristics demanded of the data used in a system (DeLone and McLean, 1992). These include accuracy, precision, currency, timeliness, reliability, completeness, conciseness, format, and relevance (DeLone and McLean, 1992). Relevant, accurate, up-to-date in the correct amount is needed for a dashboard to properly aid executives in making decisions and reach strategic goals. First the information to be displayed on the dashboard must be relevant to the users and the organization's objectives (Salmeron, 2002). For example, in an HR dashboard relevant information might include turnover metrics, selection ratios, and production output indicators. Irrelevant data will just overwhelm and distract from important indicators that actually require attention. In order for information to be relevant, user information needs must be identified (Salmeron, 2002). One problem associated with information quality is that users often have a difficult time identifying their own data needs to tell system developers. Timeliness and accuracy of data, other aspects of information quality, are important in dashboard success because basing decisions on old or erroneous information is not competitive or strategic. Old and inaccurate data are not also relevant in making improved decisions which support organizational objectives.

Looking to previous studies, having the right information needs was among the top three critical success factors and saw an increase in importance from 1999 to 2001 (Salmeron, 2002). Satisfaction with content, accuracy, format, timeliness of information, and satisfaction with system's ease of use all have demonstrated a significant positive correlation with organizational performance (Gelderman, 1998). In a study by Wixom focusing on the Technology Acceptance Model 75% of the variance in

information quality was due to completeness, accuracy, format, and currency. Rainer found that information quality had the highest mean contribution to ongoing maintenance of a successful EIS operation (1995). Too much information is one of several common pitfalls in dashboard implementation (Christensen, 2006). Boudreau lists that one possible disadvantage of using a dashboard is being overwhelmed by too much or irrelevant information (2002). In a survey by Rainer, information quality had the highest mean contribution to ongoing maintenance of a successful EIS operation (2002). A case study of Lockheed Georgia indicated EIS benefits included timely and relevant information available to the organization (Houdeshel, 1987).

If information is inaccurate or incomplete, quality decisions are less likely to be made because these holes might leave needed data from being considered by users. The solution might be in the missing data. Different decisions could be reached had managers been able to access the other information. Having irrelevant or too much information can also be detrimental to dashboard success as it could distract the user from what was actually important. The following proposition shows the influence of information quality on success.

Proposition 13: Information quality predicts dashboard success.

System Quality

As defined in earlier section, system quality refers to the dashboards' visual display options and layout, functionality, and existence of errors or programming glitches. It can be thought of as how well the system delivers data as opposed to the quality of the data itself (Wixom, 2005). Common factors thought to affect system quality include

reliability, flexibility, integration level, accessibility, and timeliness (Wixom, 2005). Sound system quality fosters can foster dashboard success by facilitating proper functioning and operability. If a system is not programmed well and is slow or full of errors, frustration will kick in and all stakeholders in addition to users will start to lessen support for the system (Wixom, 2005). Ultimately system quality affects user satisfaction (Iavari, 2002). In the individual scale implementation stage system quality was one of eight factors for successful development (Diez, 2009). Another study points to the following aspects of system quality being positively correlated with performance: satisfaction with content, accuracy, format, and timeliness of information (Gelderman, 1998). If system quality is poor, needed information cannot be delivered correctly or efficiently for users to use in making decisions. Dashboard system quality is the delivery system for rough data and users cannot manually process through it by hand. This relationship is summarized in the next proposition.

Proposition 14: System quality affects dashboard success.

Computer Literacy

Computer literacy refers to a user's understanding of and technical skills associated with using computers and information technology (Bussen, 1997). Users' level of computer literacy is thought to be one factor related to dashboard success. In a previous case study by Bussen, a lack of computer literacy skills by executive users as one factor which lead to the failure of the EIS (1997). EIS failure was identified as abandonment of the system after one year. The initial project leader of EIS

implementation was aware of the computer competency of the executives but did not stay with the project. It is speculated that the second project leader was unaware of how well executives could use computers and that if the first person had remained he would have been able to train them (Bussen, 1997). Lacking computer skills led to executive resistance to the project and cut down on enthusiasm (Bussen, 1997). Also because top managers often have assistants to look up information for them, systems must prove to a better data gathering tool than a human in order for executives to put forth effort in learning about the tool (Rockart and DeLong, 1988).

Additionally differences in education, opportunity, and interest lead to disparate skills among workers as well. Because of these variances in computer literacy among the workforce, training is often implemented to level the playing field. Watson however implies that advanced computer skills are not necessary if an EIS is developed to be easy to use (Watson, 1991). He looked at previous studies and saw that executives are resistant to going through a lot of training to use an EIS (Watson, 1991). For example, because of busy schedules and time constraints executives are unable to attend long training sessions (Albala, 1988). Watson suggests that using an EIS should need very little training or computer knowledge and should not require any intermediaries (Watson, 1991).

Regardless, certain basic computer skills must be in place before an individual can benefit from using a dashboard. Without even basic computer skills an executive might even be reluctant to support a dashboard project as he or she might find training individuals to be too expensive and time consuming. Because development is an important function assigned to Human Resource departments, the level of computer

literacy is quite relevant in creating dashboards as HR associates would be in charge of developing and implementing measures to train employees.

The higher the level of computer literacy, the more enthusiastic users might be towards using an information system because they are already used to utilizing technologies. Users with higher computer skills, whether trained or self-taught, arguably could learn how to use an information system quicker and be able to improve decision making more readily than those with less technological literacy. These studies lead to the following proposition in determining dashboard performance.

Proposition 15: Computer literacy is associated with the success of a dashboard.

System Flexibility

System flexibility refers to the maintenance of dashboards in terms of flexibility and adaptability to change after initial development. Rigidity in systems one reason for EIS failure in previous literature. As information needs, technology, external forces, or user preferences are updated a system must undergo modifications as well. One potential problem is that users do not always realize their information needs have changed until some time has passed and they have become dissatisfied enough to abandon the system. The system must be able to respond to changes in both internal and external conditions so that the dashboard remains relevant, useful, and accurate. Otherwise decision making will no longer be improved by the system.

In a survey by Salmeron, users' interests and right information needs were both seen as the top key determinant of EIS success each by 96.55% of respondents followed

next by having flexible and sensitive systems at 79.31% (2002). Further research showed the top three factors leading to EIS success in order from first to third were users' interest, right information needs, and having a flexible system (Salmeron, 2002).

Studies show dashboards need to adapt in response to fluctuations in business conditions (Kawamoto, 2007). Specific to Human Resources, changes in the labor force, merging with another organization, and new recruitment initiatives are some aspects that might need to be adjusted in the dashboard. New metrics or visual displays are some ways to reflect these changes. These factors would all lead to users having different information needs that would need to be addressed in order to continue to improve decision making through dashboard use. System flexibility is proposed to be directly related to dashboard success.

Proposition 16: System flexibility influences dashboard success.

Vendor Support

Vendor support refers to the assistance given by developers, whether internal or external, to implement and maintain information systems. Bajwa defines vendor support as the “extent to which vendors/consultants participate in the development, maintenance, and enhancement of EIS” in delivering EIS functions through training and technical support (1998, p.34) He then points to IS support as “the extent to which the IS function of the firm participates and involves itself in the development and implementation, maintenance, and enhancement of EIS (Bajwa, 1998, p.34).” If a system is created in-house then these two roles are the same so for the purpose of this study the terms will be combined and referred to as vendor support. This type of support is needed to help keep

the dashboard functioning, train users on processes, fix any technical errors, and adapt the system to new needs. Vendor support is the main way to ensure smooth technical operation of the dashboard from development all the way through training, maintenance, and monitoring of the system.

Research has examined the relationship between vendor support and success. In a case study of large manufacturing company, vendor support was split between the actual software developers and the in-house IS staff (Nandhakumar, 1996). The EIS project staff trained for two weeks under the outside software vendors so that in turn they were better equipped to help end users with the system. The IS support team performed routine maintenance activities like resetting passwords, upgraded software, and addressed any other questions from users within their scope (Nandhakumar, 1996). With the support staff as a liaison between developers and end users, the organization can keep costs down by outsourcing system creation while still having an internal support system to deal with everyday issues. A less obvious way in which vendor support can promote successful information system development was revealed in which close relationships with EIS vendors allowed the company to try new software immediately when it was released during system development (Nandhakumar, 1996). In this case it was the vendors' access to new software and initiative to show it to the company that helped the EIS succeed. The relationship between vendor support and dashboard success can be summarized using the following proposition.

Proposition 17: Vendor support predicts dashboard success.

Top Management Support

Top management (or executive sponsor) support refers to how large of a role a company's corporate executive management team plays in sponsoring system efforts (Bajwa, 1998). This comes in the form of informal support and devotion of time and resources. These top executives can help to facilitate a successful dashboard by increasing the system's visibility within the firm, steering it toward strategic importance, pulling together necessary resources, and giving it a high priority status (Bajwa, 1998). Executive's influence and power coming from their position in the organization can put pressure on users to adopt the system. Their authority is needed to handle any political resistance to the system by others in the organization (Rainer, 1995). The executive sponsor must be able to understand and communicate capabilities and limitations of the system and ensure the project is realistic and attainable (Poon, 2001). Kawamoto lists executive support as one of the top three critical factors leading to dashboard success as senior managers have the "sufficient authority" and business savvy to keep the dashboard from "fading into obscurity and irrelevance" (Kawamoto, 2007, p. 21).

Research supports the theory that top management support leads to information system success. In a study by Salmeron, 62.07% of EIS users argued that executive sponsor support was a "key element to success" and the "lack of it a serious problem for the system" (Salmeron, 2001, p. 201). Additionally, in a survey of Dutch EIS users "commitment of senior management" was seen as very important in the development of the system and crucial in its maintenance (Cerpa, 2005). Diez' literature review revealed that in implementing an EIS, top management support was one of the key factors for success (2009). It appears that top management support is needed at all stages of dashboard development in both formal and informal ways. Their positions of power are

instrumental in securing actual resources as well as influencing system users, developers, vendors, and other stakeholders to staying committed to the project.

Specific to Human Resource, top management support can improve HR dashboard success by demonstrating to the rest of the organization and other functional departments the importance of the system. Additionally, top management could work to dampen any organizational political resistance towards funds and support being used for the HR dashboard. In organizations where Human Resource projects are not given priority or importance, executive sponsorship is crucial in championing the HR dashboard. This final proposition of top management support and dashboard success is as follows.

Proposition 18: Top management support is needed for dashboard success.

Method

Interviews were conducted with business professionals in order to explore the practicality of the models' theoretical constructs and to identify any factors missing that are important in explaining HR dashboard use and success. Out of over twenty HR professionals contacted, two responded as having experience in developing or using human resource dashboards and were willing to be interviewed.

The interview format was structured but consisted of open-ended qualitative questions. The questions were constructed in attempt to draw out information about the different antecedent factors of attitudes, subjective norms, perceived behavioral control, and success. One difficulty in writing these questions was making them easily understood without muddling down interviewees with complicated theoretical vocabulary. Another was not to take up too much of the business professionals' time. Therefore, questions had to be somewhat broad as there was not time to ask about each factor separately. Interviews lasted from between twenty-five and forty-five minutes and were conducted over the phone. Direct quotes were used from the interviews to build up support for the two models on dashboard use and success. Different factors and relationships were inferred from the dialogue.

Interviews

The first interview conducted was with a Human Resource corporate executive (pseudonym: Minerva) of a healthcare organization. The company was comprised of over thirty hospitals across the United States. As a developer, Minerva was also the main support staff for the HR dashboard users. HR executives across the different hospitals were the main users and used the information to report to their CEOs. This dashboard

system was standardized across the entire organization. It is used to combine disparate information from various departments in order to benchmark, monitor, trend, and forecast human capital activities.

Secondly, I interviewed an HR executive (pseudonym: Dane) working in a state credit union who used a dashboard. The credit union has a work force of about 350 employees. The dashboard was developed by an outside vendor and focused on critical organizational objectives. When it was first developed, it dealt only with employee satisfaction. It now covers employee engagement, which is more in depth than just satisfaction. It deals with how involved and enthusiastic an employee is about his or her work and organization.

Results- Model 1

Several theoretical factors were supported by the interviews. System quality, user traits, top management support, and organization culture were the only factors from model 1 to be mentioned by the interviewees. In terms of system quality, Minerva said, “I do provide some drill down stuff for some of the ones behind it. So they can you know better understand why its happening what’s going on.” This suggests that system quality affected attitudes about users understanding about what the dashboard was telling to them. If they felt like they understood the meanings behind the numbers, they would be more likely to use the dashboard. Drilling down the information seemed to be the most important part of system quality to the HR professional as Minerva only mentioned that aspect specifically. Drilling down is an aspect of system quality as it deals with how the dashboard operates and delivers information.

Out of the two interviewees, user traits were only brought up by Minerva. (S)he said when asked about any shortcomings of the dashboard system, “there’s people that not necessarily want to have to do that work.” Minerva called them weak HR leaders because they were unable to perform strategic functions on top of transactional tasks. The weak Human Resource leaders who were unable to be active in strategic management were eventually fired. The specific user trait that appears to be critical for dashboard success appears to be knowledge of and ability to perform strategic management functions. Strategic functioning as a user trait was implied in Walstrom and Wilson’s analyzer EIS user type (1998). Analyzers were defined as using the system for improved organizational understanding (Walstrom and Wilson, 1998). Organizational understanding matches the first stage in the strategic management process of comprehending company objectives. This supports that strategic functioning is important for individuals using dashboards and shows a relationship between user traits and success outcomes of HR dashboards.

Top management support in relation to dashboard use in model 1 was implied through statements made by both professionals. Top management consisted of an HR council in firm 1 which included Human Resource executives as well as other departmental heads such as finance and information systems. This HR council was responsible for managing and directing the strategic objectives reached using the dashboard. By having the authority to steer how the dashboard was used and for what reasons, they were able to use formal pressure as opposed to social pressure to influence system engagement. For example, the HR professional specifically mentioned the CEO of the organization as critical in leading dashboard system efforts. (S)he said that,

“people will only use them if they are important to the CEO. This is one of those top down things. The CEO’s gotta say its important.” This implies that top management support is critical for system use.

Next different aspects of the organization culture was mentioned by Minerva also seemed to influence dashboard use. The healthcare organization is made up of separate hospitals across the United States, and the “corporate office really had little to do with or nothing with what was going on individually at the hospitals.” The decentralization lead the different segments to have varying policies that needed to be unified using a dashboard. This aspect of organizational culture can be thought of as a subjective norm which placed pressure on the different regional managers to use the dashboard in order to maintain uniform procedures.

The “need to standardize across the organization” which Minerva listed as a factor driving dashboard implementation. This is a reflection of organizational culture influencing dashboard development. This norm of standardizing created pressure to build a dashboard to correct this problem and represents a main reason for its use.

Results- Model 2

System quality, vendor support, and top management support were the factors from model 2 inferred from the interviews in regards to dashboard success. In terms of system quality, Dane felt the system was “a little bit narrow- It’s not as comprehensive as I’d like it to be.” This lack of comprehension was identified as a weakness of the dashboard which implies the relationship between that aspect of system quality and successful outcomes. With a dashboard that was too narrow, important information was

left out in reaching decisions. In order to be used successfully, the dashboard system needs to adapt to and be inclusive of new information requirements.

Vendor support was mentioned by both professionals but in markedly different ways. The dashboard used in Minerva's company was created in-house so the professional interviewed said that (s)he was "the resource here," implying that (s)he was the vendor support. Minerva was a resource as (s)he provided one-on-one training, informational intranet sites, and phone support to users. In the credit union however, an outside company created the dashboard and helped them run reports using it. Dane stated that an outside vendor was necessary to keep employee information confidential as they had to answer questions about employee engagement. In this way the developer helped maintain the dashboard functionality.

Lastly, top management support was highlighted in both interviews. Before implementation in the healthcare organization, the corporate office had little to do with the individual hospitals' HR policies. Afterwards however, the CEO utilized the dashboard as well to remain connected with the other hospitals and unify the organization's efforts. The second HR professional specifically said that executive support was one of the reasons the dashboard "worked well." This shows a clear relationship between top management involvement and success of the dashboard system.

Measures of success including positive impact on strategic management process were brought up in the second interview in respect to the first step of formulating organizational objectives. These organizational objectives were called "people drivers" and included "fulfilling our mission," "ensuring sustainability," "improve profitability," and "grow the business" and measure the company's "strategic goal." They were

important factors looked at when developing the dashboard and were designed to analyze how well the organization accomplished stated purposes.

Emergent Ideas

Before I conducted these interviews, I expected that factors incorporated in both models would be identified the most by HR professionals like system quality and top management support. I anticipated that these “double factors” would be most salient in the minds of the interviewees because they were relevant to both use and success. I was not surprised to see that Top Management Support was brought up several times by the interviewees as it is cited frequently in research studies. System Quality was brought up less than top management in the interviews, but still was mentioned by both professionals. As I expected, drilling down was specifically listed as an attribute of system quality influencing both use and success. Drilling down was focused on heavily in both EIS and Dashboard literature. It seems that drilling down is the clearest and most core component of dashboard systems.

While drilling down was supported, new ideas about system quality were implied by Interviewee 2. Previous studies pointed to a need for information system flexibility required for adapting to changes in information needs. The second interview offered an interesting precaution regarding updating and altering the information system. (S)he said, “We really don’t like changing it that often cause then trending because more of an issue if you know you’re changing them every year.” This seems to imply a tradeoff between system adaptability and data analysis techniques like trending. This raises issues concerning the potential problem of changing dashboard factors impeding on the ability to make meaningful insights into progress of improvement.

Another concept brought up by Dane was employee satisfaction with dashboard. (S)he said that having an information system which measured human capital indicators “sends a great message to employees.” Initially I thought satisfaction with the dashboard would fall under the user traits category but it actually is an outcome rather than a precursor. Use must come before satisfaction. This separate factor was discussed in previous studies but I did not initially incorporate it into my models. It potentially could be a subset of dashboard success.

This implies that measuring the impact to employee morale from having an HR focused dashboard is one way to assess how the system has positively impacted the organization. The human capital component of the dashboard perhaps symbolizes organization compassion for employees and shows employees that their well-being is as important as financial performance. This implies that an aspect of dashboard success in order to improved decision outcomes and impact to the strategic management process is improved employee morale. Furthermore, it is possible that general worker support of the system is an aspect of success in addition to just employee use of the dashboard.

Final Discussion

Many factors were supported by the interviews, and it is possible that more interviews could have revealed other variables included in the models. Because these factors surfaced in the interviews, it appears that using EIS research to speculate on dashboard implementation was a valid inference to make. More research needs to be done in order to further explore the criterion specific to predicting HR dashboard use and success.

Appendix

Executive Information System Research Table

<i>Citation</i>	<i>Method</i>	<i>Sample</i>	<i>Key Variables</i>
Singh (2001)	Survey	51 North American Firms	<ul style="list-style-type: none"> Results support that EISs most relevant use in the operational objectives and strategy implementation phases
Pijpers (2001)	Survey	87 users from large firms	<ul style="list-style-type: none"> Relationships between perceived usefulness and attitude towards use, perceived ease of use and attitude towards use, attitude towards use and actual usage frequency all showed statistical significance.
Bajwa (1998)	Survey	238 business executives	<ul style="list-style-type: none"> It appears that IS support and vendor support influence top management which in turn has a higher influence on EIS success
Bussen (1997)	Case Study		<ul style="list-style-type: none"> Historical context: ownership changes, rapid organizational growth Political context: budget restrictions, technician support, power issues Social content: staff changes Economic context: market growth vs recession.
(Schenk) 1993	Case Study		<ul style="list-style-type: none"> lowest component of customer satisfaction was availability of data to meet information needs and ad hoc reporting capability support service satisfaction was rated highest
Watson (1991)	Survey	50 executives from DSS conference	<ul style="list-style-type: none"> User interface and response time are main factors of EIS success Response time of EIS is seen as a reflection of EIS usefulness
Leidner (1995)	Survey	91 users/developers	<ul style="list-style-type: none"> Frequency and length of EIS use are correlated with quicker problem identification and reaching decisions faster. Executives also perceive information is more available the more they use the system.
Wetherbe (1991)	Literature Review		<ul style="list-style-type: none"> Mistakes made in developing dashboards were suggested to be: viewing the system as "functional instead of crossfunctional, interviewing managers individually instead of jointly, asking the wrong questions during the interview, and not allowing trial-and error in the detail design process"
Simard (1990)	Case Study		<ul style="list-style-type: none"> Visual interface was split into three modules: communications, error processing, and data extraction Automation of the EIS is achieved using error recovery, backup procedures, and redundancy.

Hwang (2007)	Case Study		<ul style="list-style-type: none"> EIS used to monitor equipment effectively & reach decisions on performance safety. EIS aimed to connect information between executives, middle managers, and workers and take scattered information and consolidate it.
Watson (1993)	Survey	54 interviews, 133 surveyed	<ul style="list-style-type: none"> Discussions with executives most helpful during initial stage and ongoing assessment
Salmeron (2005)	Survey	18 EIS users	<ul style="list-style-type: none"> Users' interests were found to be the most important critical success factor in Human Resources EIS development followed by executive sponsor support.
Hauser (1991)	Literature Review		<ul style="list-style-type: none"> Twelve steps were identified for implementing a successful EIS: 1. creating steering committee 2. project team 3. understand/confirm benefits + costs 4. project blueprint 5. technical architecture/database designs 6. confirm data accuracy 7. ensure software matches the company's vision 8. compare to references 9. licensing agreement with vendor 10. prototype 11. anticipate any shifts in the project team, 12. allow executives to give suggestions.
Martin (1989)	Literature Review		<ul style="list-style-type: none"> Information should pertain to critical success factors and include external sources, ideas should be shared through electronic communication and print reports, learning can be reduced through minimizing keyboard inputs and having menus
Walstrom (1997)	Survey	43 selected from Business Week's list of 1000 Corporate Elite CEOs	<ul style="list-style-type: none"> EIS user types (converts, pacesetters, analyzers) and EIS usage types (organizational monitoring, information access, organizational understanding) were found to be differentiating factors of EIS users Converts used EIS to replace old systems while pacesetters used EIS for the most purposes, Analyzers used EIS the most for "ad hoc querying of organizational databases. Pacesetters were characterised by placing strong emphasis on both organizational monitoring and information access.
Volonino (1991)	Case Study		<ul style="list-style-type: none"> EIS needed to draw upon data from various departments EIS made available to a large number of users in order to boost support and enthusiasm for the system.
Rainer Jr. (1995)	Survey	149 EIS users	<ul style="list-style-type: none"> Executive sponsorship, defining information requirements, top management support = success factors Timely information, improving efficiency, providing accurate information = maintenance needs Executive involvement issues had the highest mean contribution to EIS development success Information quality had highest mean contribution to ongoing maintenance
Belcher (1993)	Case Study		<ul style="list-style-type: none"> EIS evaluation can spark new interest in system, assess which applications are working/which are not Needs to include usage statistics, qualitative interviews, "mission-critical applications" System benefits need to be evaluated at the organizational level they occur at instead of the bottom line
Viehland (1990)	Literature Review		<ul style="list-style-type: none"> Speed, graphical display, and ease of use are ESS success factors Information should be gathered across departments, show trends, able to drill down, related to critical success factors, and be matched along side a comparison group.
Chi (1995)	Literature		<ul style="list-style-type: none"> DIEIS= EIS incorporating multiple artificial intelligence for solving complex problems

Review			
Nandhakumar (1996)	Case Study		<ul style="list-style-type: none"> • System planning was a product of continuous social and organizational culture • Staff interested in implementing EIS called upon a higher status group chairman to gain support • Close relationships with EIS vendors allowed developers to try new software immediately
Averweg (2004)	Survey	31 South African companies with EIS	<ul style="list-style-type: none"> • Middle managers more likely to use the system than top management • Financial information was listed as the most important type of information to display
Hasan (2000)	Case Study	4 companies using EIS	<ul style="list-style-type: none"> • Finding and fixing broken data needed • Changing dimensions of the system required subsequent changes in the information database • Understanding business objectives more important than skills in database management.
Nandhakumar (1997)	Literature Review/ Case Study		<ul style="list-style-type: none"> • Limits on EIS development: social constraints, hierarchical business structure leading to developers "guessing" information requirements, imbalance of authority made EIS development team members less able to or uncomfortable in speaking with users • Cultural norms: developers believed interacting with users was not as important as technical aspects • Individual factors: weak social skills and perception of lower status
Nash (1977)	Literature Review		<ul style="list-style-type: none"> • Problems with the older MIS "lack of decision aids," "lack of compatability between systems," "positional rather than directional formation," and "wide separation of manager and systems." • Solutions provided by new EIS were graphical display, ad hoc math functionality, standard interface, single database, adaptable inputs, "time series database," customization, and availability of external data.
Iiavari (2002)	Case Study		<ul style="list-style-type: none"> • "Perceived system quality predicts user satisfaction," "Perceived information quality predicts user satisfaction," "Perceived system quality predicts actual use," "User satisfaction predicts actual use," "Actual use predicts user satisfaction," "User satisfaction predicts individual impact" all showed statistical significance
Sauter (2005)	Case Study		<ul style="list-style-type: none"> • DSS quantified qualitative information (rumors, opinions, and informal conversation) • Users did not believe qualitative information was strategic data; organization culture must first change
Nord (1995)	Survey	152 selected from CEOs of Fortune 500 companies	<ul style="list-style-type: none"> • Better communication most cited benefit while increased profits were the least • Second most important benefit was increased confidence in decision making • Ease of use was perceived as the most important EIS characteristic
Byrd (1996)	Literature Review		<ul style="list-style-type: none"> • EIS are more likely to be used for internal control and efficiency in hierarchical organizations whereas they are used for adapting to external changes and responding to markets in adhocracies.

Rainer Jr. (1995)	Survey	48 EIS developers and users	<ul style="list-style-type: none"> Executive sponsor, Define information requirements, Top management support, Manage data, Cost considerations were the top five ranked factors related to EIS success according to the survey.
Koh (1998)	Case Study / Survey	85 EIS developers	<ul style="list-style-type: none"> The relationship between 1) breadth and depth of data provided and difficulty of data management issues 2) support from key people and difficulty of data management issues show significance
Salmeron (2001)	Survey	3 Spanish Companies	<ul style="list-style-type: none"> Users' interests and right information needs were top success factors followed by flexible and sensitive systems and suitable software/hardware
Watson (1995)	Survey	43 firms in the University of Georgia's EIS database	<ul style="list-style-type: none"> Top three factors leading to development were (respectively) to provide quicker and easier access to information, enhance efficiency and effectiveness of top executives, and to track the progress of organizational performance Top three problems in developing were (respectively) obtaining accurate data, keeping up with changes in executives' information needs, and agreeing upon system objectives.
Elam (1995)	Case Study		<ul style="list-style-type: none"> EIS use leads to quicker problem identification and faster decision making. Different decision styles are inferred to account for variations in usage amounts and EIS must match decision styles.
Walters (2003)	Survey	116 small manufacturing firms' CEOs	<ul style="list-style-type: none"> Operational efficiency, cost controls, and market environment were top requirements Market environment, operational efficiency and competitive environment were top concerns
Hasan (1995)	Case Study		<ul style="list-style-type: none"> Problems: aligning system development with organizational objectives, understanding information needs, finding errors in data, conflicts concerning "data ownership," executives wanted to be more involved in system development
Young (1995)	Survey	81 organizations using EIS	<ul style="list-style-type: none"> Significant relationships between the number of features and staff size, number of features and the number of users, ease of use and usage of EIS
Poon (2001)	Case Study		<ul style="list-style-type: none"> "Meta-factors" of EIS success: championship, availability of resources, links to business objectives "Failure factors": fear of change, lack of enthusiasm, desire to receive information informally
Stein (1995)	Case Study		<ul style="list-style-type: none"> Factors include business goals, business strategy, leadership strategy, information success factors, and information tools
Arnot (2007)	Case Study		<ul style="list-style-type: none"> Confucian principles cultural dimensions needed to be included Observed Thai executives felt it was "beneath them" to be involved in system development, resistance to drilling down because it does not match traditional values of hierarchy and harmony Conflicts of EIS cultural fit were detrimental to system success.

Bergeron (1995)	Field Study	38 executives from 9 Canadian organizations	<ul style="list-style-type: none"> Significant relationships (listed from strongest to weakest) were found between EIS use and the perceived consequences of using EIS, satisfaction with access, work group influence in regard to EIS, and EIS experience the sophistication of EIS products.
Frolick (1995)	Literature Review		<ul style="list-style-type: none"> Advantages of using GSS to support EIS were deeper understanding of executives' information requirements, executive understanding of the interdependency of information with other managers, better incorporation of "soft" data, better system for indentifying changing information requirements, increased communication, and more information sharing.
Hung (2003)	Field Study	24 South Taiwan firms	<ul style="list-style-type: none"> Significant relationships found between computer self efficacy and time taken to complete task, perceived usefulness, and user information satisfaction. Significant relationships found between expertise and time taken to complete tasks, and task type and time taken to complete.
Forgionne (1995)	Field Study	59 nurses, health care practitioners, and physicians	<ul style="list-style-type: none"> Medical workers randomly assigned, given a hypothetical problem to solve using either a MSS or DSS MSS included EIS functions and gave better decisions and improved the problem solving process.
Vlahos (1995)	Survey	55 Greek Companies	<ul style="list-style-type: none"> Significant positive correlation between overall value and satisfaction Perceived value based on how the EIS supported executive's own mental models in decision making.
Eierman (1995)	Literature Review		<ul style="list-style-type: none"> Implementation strategy influences both user behavior and performance Environmental factors influence performance Configuration influences performance."
Arnott (2008)	Literature Review		<ul style="list-style-type: none"> Suggestions for improvement: employing more case studies, pay more attention to the "rigor of a project," research relevant problems, more funding, focus on business intelligence and data warehouses, update theories to include judgment and decision making.
Volonino (1995)	Literature Review		<ul style="list-style-type: none"> Rapidly changing business environments Business objectives and creativity of designers are the bigger driving forces.
Salmeron (2002)	Survey	112 Spanish company industry leaders	<ul style="list-style-type: none"> Top three success factors: users' interest, right information needs, and having a flexible system Benefits: quick access to information, information about competitors, accessing external data, more control, better planning, less paper used, and other cost savings.
Martinsons (2007)	Survey	299 American, Chinese, and Japanese Business leaders	<ul style="list-style-type: none"> Japanese managers more inclined to listen to co-workers and employees before reaching a decision Chinese executives use EIS to process data efficiently, weigh different options, decide using personal discretion. Americans use EIS for making decisions using a standardized, formal procedure.
Chen (2003)	Survey	6 business "decision makers"	<ul style="list-style-type: none"> Top factors: ease of starting up, user-friendliness, quick response time, "quickly record and retrieve business cases, personal experiences, etc.," and "helps me make better decision[s].

Green (1996)	Literature Review		<ul style="list-style-type: none"> • HR EIS success factors: users' involvement, competent EIS staff, executive sponsors' support • Information and technology CSFs: correct information needs and appropriate hardware/software..
Hartono (2007)	Literature Review		<ul style="list-style-type: none"> • EIS antecedent factors: system development characteristics, management support, user training, user perceived benefits, user participation, organization characteristics • Success measures: information quality, system quality, satisfaction, information use, individual impact, and organizational impact.
Palvia (1996)	Literature Review		<ul style="list-style-type: none"> • Factors in development: executive support, software development, telecommunications network, strategic planning, IS human resources, end-user computing, expert systems, IS effectiveness measurement, IS role and contribution, and competitive advantage.
Diez (2009)	Literature Review		<ul style="list-style-type: none"> • Pre-implementation: user participation best predictor of success • Individual scale implementation stage "behavioural intention, computer experience, perceived usefulness, subjective norms, system quality, top management support, user support and user training" predicted success • Organizational scale implementation stage, "external pressure, the amount of external information that an organization needs to handle, IS unit professionalism and top management support predicted success • User satisfaction predicted success in the post implementation stage.
Gelderman (2002)	Survey	85 Dutch managers	<ul style="list-style-type: none"> • Support ability influenced by task difficulty rather than task variability • Increase in task variability led to a decrease in user satisfaction • When task difficulty increases, DSS functionality negatively influences user satisfaction.
Chaudhary (1996)	Literature Review		<ul style="list-style-type: none"> • Small business DSS success factors: adequate resources and time given to complete, executive sponsorship, and portraying the system as a needed, overall organizational trade.
Kuo (1998)	Literature Review		<ul style="list-style-type: none"> • Cognitive reasoning important for executive decision making, difficult to quantify/reflect • Solutions: "well-designed computer–user interfaces, collaboration networks, event simulation, and direct manipulation that makes direct perception and thinking actions easy."
Vahidov (2004)	Literature Review		<ul style="list-style-type: none"> • Should incorporate relevant information from the external environment and must be considered in designing the interface
Wybrow (1996)	Survey	20 EIS users from 4 companies	<ul style="list-style-type: none"> • Of those who said they used MIS to get up-to-date information 81% of those individuals believed they actually got accurate and current results
Basnet (1996)	Case Study		<ul style="list-style-type: none"> • Benefits: reduced milk collecting costs, time spent making schedules, efficient utilization of fleets, strategic planning of new routes, enhanced ability to deal with surprises and new situations.
Tian (2007)	Literature Review		<ul style="list-style-type: none"> • Cost savings, increased productivity, and better quality decisions are cited benefits.

Cerpa (1998)	Case Study		<ul style="list-style-type: none"> • Success factors in strategic planning: linking IS to organizational goals, commitment of senior management, "understanding the human side of introducing IT and change into the organization." • Problems: reporting level of IS department, organizational politics, rapid change of technology, lack of senior management involvement, lack of training
Au (2002)	Literature Review		<ul style="list-style-type: none"> • Previous research focused heavily on expectation disconfirmation while this theory combines the needs theory and equity theory • IS performance and performance expectations related to end user satisfaction
Gelderman (1998)	Survey	212 Dutch Companies	<ul style="list-style-type: none"> • Ease of use, timeliness of information had highest correlations with use • Satisfaction with content, accuracy, format, timeliness of information, satisfaction with system's ease of use showed a significant positive correlation with organizational performance
Wixom (2005)	Survey	465 EIS users from 7 organizations	<ul style="list-style-type: none"> • Effects of usefulness, ease of use, and attitude towards use counted for variance in intention to use. • Information satisfaction accounted for variance in perceived usefulness • System satisfaction influenced perceived ease of use • Information quality and system satisfaction influenced information satisfaction • Variance in information quality was due to completeness, accuracy, format, and currency.
Xu (2002)	Case Study		<ul style="list-style-type: none"> • Information specialists support seen as most important for data filtering/summarizing • Managers' knowledge in strategic information must be shared with EIS support specialists • Executive culture" must change so that managers see information specialists as useful/affordable.

Dashboard

<i>Citation</i>	<i>Method</i>	<i>Sample</i>	<i>Key Variables</i>
Wolpin (2006)	Literature Review		<ul style="list-style-type: none"> Problems: being overwhelmed by too much or irrelevant information, dashboard designed without much regard to the overall organizational performance and too much focus solely on the HR department.
Campos (2008)	Case Study		<ul style="list-style-type: none"> Problem: striking a balance between being broad and displaying relevant details, gaining easier access to data for indicators
Mathe (2009)	Case Study		<ul style="list-style-type: none"> Important that medical language was clear and specific so that doctors could understand the suggested treatments- this decreased the need for IT support Enables transfer of knowledge- compliance to protocol improves with dashboard advisory
Wolpin (2006)	Survey	23 completing follow up, 6 interviewed	<ul style="list-style-type: none"> Benefits: improved communication/cooperation cross-regionally leading to better efficiency/patient care Success factor: quality of data
Jain (2008)	Field Observation		<ul style="list-style-type: none"> Dashboard visualization was divided into three categories: introspection, customization, and presentation Display should be easily switched from showing broad or detailed information
Edwards (2005)	Case Study		<ul style="list-style-type: none"> Should show accurate and timely information, monitor progress towards goals in order to increase manager accountability, and increase government transparency to improve public opinion
Kawamoto (2007)	Literature Review		<ul style="list-style-type: none"> Success factors: correct metrics, executive support, simplicity, ease and speed of implementation, respond to fluctuations in business conditions.
Christensen (2006)	Literature Review		<ul style="list-style-type: none"> Problems: Too much information, functional bias, over reliance on historical data, narrow perspective, inconsistent item definitions, unnecessary metrics, blurry strategic vision, lack of benchmarks, no executive sponsor, disagreement across departments, slow implementation, and too little training
Snow (2006)	Survey	590 companies using dashboards	<ul style="list-style-type: none"> Chief complaint: inability to drill down information Benefits: Align their efforts with organizational objectives.
Dover (2004)	Literature Review		<ul style="list-style-type: none"> Cultural change is needed to increase user acceptance Organizations must provide training require employees to use dashboard systems
Rau (2004)	Literature Review		<ul style="list-style-type: none"> Dashboards show the general concept as well as specific details of what it is tracking all under one interface. Correlations shown by dashboards can help users make decisions.

Gonzales (2005)	Literature Review/Case study	<ul style="list-style-type: none"> • Facing pressure to demonstrate value of IT/link business objectives to IT strategies • Benefits of CIO dashboard: aligning IT goals with corporate strategy, showing the value of IT, improving IT image, improved decision making regarding complex issues and implementation of the balanced scorecard • Executive support and enthusiasm factors leading to dashboard success
Lamont (2007)	Case Study	<ul style="list-style-type: none"> • Visualization and spatial data argued to be most important in increasing business intelligence through using dashboards
Langston (2006)	Literature Review	<ul style="list-style-type: none"> • Dashboards are modern EIS that are more sustainable and interactive and require less input from the IT department.
Beckman (2007)	Case Study	<ul style="list-style-type: none"> • Successful if easy to use, simplifies communication with vendors, and external aspects are designed to match the firm's branding.
Few (2005)	Literature Review	<ul style="list-style-type: none"> • Make sure indicator is goal specific, could be used in making a decision, can be timely, can be quantified, and has the ability to assess the performance of an organization

Interview Transcript

Minerva

M: Basically we are a healthcare organization. We own hospitals. About 35 or so across the US. I am at the central, the corporate office, HR and basically how our HR is structured will kinda help define how our organization is structured. You know hospitals historically used to be single entity types of things and its only through time that they've combined to create larger organizations with multiple hospitals. So basically the hospitals are coming from a standpoint where they had different policies, different procedures, everybody ran their own the way that they want. And right now the HR is still roll up to the individual hospital CEO however over the last five or six years we have started down the path of standardizing things, HR things, across the organization. The first thing we had to standardize was the HR system, payroll system across the organizations which we did that and once we did that we standardized all the things within that system across the organization. So you know We used the same job codes in every place and those types of things so those are a lot of the HRIS projects that I'm having to do with standardizing across the organization. But beyond that we also want to start looking at the organizations and measuring the organizations not only off each other but our benchmarking and things like that. So here the corporate HR office most of this office is here to support the corporate office in the HRIS offices however my specific job and a few of us here we support all the hospitals in the field. So for instance I do decision support stuff on HR scorecards and things like that for HR for the whole organization so I support any of these types of data any of these types of metrics or anything for all the hospitals and push it out to them. Now there are a few hospitals that are big enough to have someone like me inside the hospital that can do it for their specific facility so I don't have to worry about supporting them quite as much in ad-hoc type of stuff they can do it on their own. But I also do a lot of education on trying to teach them on how to do it on their own because I'm one person.

R: Oh wow- right,. A lot of things for just one person to do.

M: Yeah, so when I talk to people I talk to people from all over the US I work in this office but I don't really support anybody here at corporate unless somebody at corporate wants numbers from me about the workforce and then I'll supply those. So that's what I kinda do. So that kinda gives you an idea of how we're also put together.

R: That was a really good description actually. Thank you. So you were saying that you are actually involved in with like designing the dashboard. So is there an outside vendor that you use or is it all made in house?

M: Nope, I, We do it all in house. Basically we started doing an HR we called it a score card. I guess the difference between a score card and a dashboard why don't we start there. A scorecard is more of an overall strategic look at what's going on typically it is a monthly type of thing that is done since a lot of what we do In regards to human capital is also related to finance I work closely with finance getting numbers from finance in order

to create the scorecard. Dashboards are more, something that tells you operational what's happening, what's going on right now from more of an operational standpoint. So each morning a CEO can look and say ok how many people how many what's our population in the bed how full are we those types of things those are day to day operational types of things and that's a dashboard that's kinda the difference between a dashboard and a score card is. So a dashboard from a human resource standpoint they can contain what that days vacancy is how many work hours are happening and how many workers and where there's gaps and all that kinda stuff. Those types of things are typically done at the individual facility if they have the so called desire and the expertise to do that. Because that's really detailed down to probably more of a you know the department wants to see versus what the CEO of the organization. So our scorecard is something that was we put together we started about five or six years ago and its matured and developed over the years as we've gone because at the time you know hospitals they were always the last when it comes to this type of stuff. They can't do any of this, but basically we started where we call a hr council which is a group of HR vice presidents, leaders of HR in our organization as well as a leader from information system, from finance, purchasing so it had a multidiscipline group of leaders on it. But basically they oversee or kinda guide the efforts of what strategically we are gonna do regarding hr in the organization globally so if we're gonna do a new applicant system if we're gonna do a new imaging system if we're gonna do a new hr system it would go through this group to make decisions so they wanted a score card so they could see strategically what is going on within the organization and so the start of that was to decide what is important to our organization and this is going to be different with every organization what are their strategic goals what is important to them what has value and all that so its different for everybody we came up with four main drivers. We call them people drivers in the organization that are important. The first being to fulfill our mission. We are a hospital or a health care system so fulfilling our mission is always number one priority and ensuring sustainability that we continue to you know to be sustainable make a lot of business improve profitability and to grow the business and those are sort of the four things the organization says are important to the organization so lets make them the four things that are important to the human capital or the people of the organization out of those four main drivers people drivers we come up with metrics that measure towards that as what our strategic goal is so for instance improved profitability what's something you can look at in human capital that has anything to do with the cost ability to the organization you know its things like investing in the labor appropriately and those types of things what your labor cost is what your return on workforce within each of those four groups we come up with a number of metrics that measure and reflect back to that and initially they came up with a group of them and over time a few of them have dropped off they've become less important and a few new ones that we've created have come onto the scorecard. We really don't like changing it that often cause then trending because more of an issue if you know you're changing them every year so we have every year we look in fulfilling our mission, we look at some of our Gallup engagement scores adverse tenure and stuff like that growing the business we look at quality hire rates, and recruitment rates and are employees lying and growing and stuff like that improved profitability I talked about how those labor costs expense turnover work force premium labor expenses health care cost per employee those types of things and then sustainability looking at turnover, vacancy and time to fill

almost hiring and firing types of numbers there. So then we selected benchmark sources and what percentage is our goal. What is that benchmark that we want to fulfill. And those are reviewed about every year or two cause sometimes new benchmarks come out that are a little better you have more hospitals participating than the old so you have a better group and stuff like that and each month it is basically my job to go into the HR system and pull out all the information from that get from finance the information we need from them get from our recruiting system the information we need from them and take all the information from the disparate systems put them together and get the metrics for those things that we view. And right now we have a total of 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19 metrics that we put on our scorecard. In our scorecard we give what they did up for the month and then either year to date or a rolling year number depending upon what the number is and which makes more sense to show. And the scores here's the target here's your score whether its yellow red or green and how has it been trending. And that's on the scorecard and is distributed out not only to the executives here at the corporate office but to each of the facilities hr leaders and they are supposed to sit down with whoever they report to whether its the COO, CFO, CEO its different at each hospital and go over that and that type of stuff and I do provide some drill down stuff for some of the ones behind it. So they can you know better understand why its happening what's going on and if not that's why I'm a resource here to help them to look and they say you know we keep having this problem with our labor cost expense we don't know why its so high I will help them figure that out so they can make decisions on what to do regarding that issue. So that's kinda the overall on the scorecard. Like I said we use a number of benchmarks. We have a couple internal benchmarks but the majority of them are either Saratoga benchmarks or advisory board and the advisory board is a hospital consortium think tank out of Washington dc so they have good hospital specific data whereas Saratoga is worldwide every company they do break it out for hospitals only which that's what we try to use but the number of participating hospitals some of them aren't as quite as high as those with the advisory board and its all overseen any changes to it anything all has to go through the HR council that has people from all disciplines leadership from all disciplines its chaired by a senior VP for the whole corporation who reports directly to the CEO of the whole organization. Anytime I have Anything I want to add, take off, change we usually have a working group with some of the hospitals outside of that and then we present to that committee and we say here is what we would like to do and they say yay or nay

R: Ok lets see what else you've answered a lot of the questions I didn't even need to ask. But what would you say are some of the main factors that influenced the organization to implement these scorecards and dashboards?

M: Well I think being that for a long time how the organization was run was every hospital was kinda on their own and the corporate office really had little to do with or to nothing with what was going on individually at the hospitals. And a decision was made that is not the best way to run the system, we need a stronger corporate office we need to standardize whether its hr or finance or inventory or purchasing, we need to standardize across the organization. Take advantage of the fact that we have over 45 thousand employees and we're big so we can do things more efficiently more effectively make

changes that happen across the organization. So its an outcome ultimately of that decision you know they went from not really having a HR corporate office to having hr and having taking people from the individual hospitals that have individual expertise in things and bringing them the corporation to have that expertise in hr so that we could provide the consulting services to the individual facilities and the expertise they may not have there locally. And part of when you do that is we need to know what's going on from a human capital standpoint in the organization so we can provide counsel and corrective measures and see things happening before they happen to the organization. And so that decision was made you know we need to start a strategic scorecard in order to know what's going on.

R: Let's see. And what would you say, what value have you seen because of the dashboard what are some of the biggest benefits and improvements you've noticed.

M: The easy one probably is you know the cost of health care for employees ourselves you know we are a health care provider but we also have health plans like other companies and having that on there has allowed the organization and individual hospitals you know to say we are a hospital all of a sudden we're twice paying twice as much as the rest of the organization you know we're wasting money somewhere and have to fix it. In regards to managing the cost of human capital has probably been the thing that's the easiest thing to do when you do this and the easiest to see when you do this. The correlating the hard part correlating the showing how what's going on in the workforce with just the overall revenue all that stuff has been quite a journey we think we now have the metrics that show us the to see okay are we utilizing the workforce correctly are we able to identify when we're not in order to make changes. So were just you know not wasting money and doing the wrong things that we're doing what provides the best care for the patient, the best workforce to get the job done and those types of things so getting it so getting what hr measuring from an hr standpoint what's going on in the workforce to what's our ultimate product, which is actually patient care and making people better. Getting that relationship shown has been quite a long journey and we've still got a ways to go with that so. And it starts to show leaders of the organization typically most organizations are you know finance driven and finance viewed. The CFOs see the workforce there's a cost not as an investment. How do you save money you cut workforce. Not necessarily you look and say is the workforce working as effectively as they can. Or are they being blocked and not working and having the scorecard and presenting it to the CFOs and to the c level these types of information has opened their eyes and changed how they value the workforce. So they see the workforce as human capital as opposed to human expense.

R: Those are good points. Then I guess on the other side what sort of problems have you encountered or like any shortcomings you've noticed after implementation?

M: Well the biggest is thing when you know you start putting out numbers and you starting putting out this stuff and its showing hey you may not be doing good in this certain area and these things then that means you have to do something about it and there's people that not necessarily want to have to do that work. so probably and then

right off the bat what was noticed especially in the HR leadership area we had a lot of weak HR leaders because that has not been something they had to do. They weren't held accountable for these types of strategic things. HR leaders were always operational just processing the paperwork and now all of a sudden strategic things are they're now having to be responsible for bringing these things to light and participate in making the organization better and just you know you find the leadership who understands the strategic versus the operational and those who don't. and so slowly moving those who don't out and bringing in those who do understand the correlation between what the organization is trying to do and what hr does. So its been difficult in some areas to get hr to that table to take that responsibility because of how weak they've been and so that's you there's a lot of individual things because all of a sudden hr is coming out with data. Do we believe it you know ensuring that you know when it comes to people data HR is the source of record. Its real its what it is its as right as that finance data you get. You know because there's just organizations aren't used to getting data from hr and then well also the scorecards and all those types of things start to pop up. The first thing is I don't believe it and I tracked my turnover and its not what you're saying it is. You know Well how are you tracking your turnover. I have a sheet of paper that I write people's names on oh yeah well I go right into the hr system and I pull out who's been hired and termed during that time period. You know here's the list that you say you know tell me which one of these people that have been termed that have not been. You know you get people like that and it takes a while to build that trust that the data is correct and everybody's on the same page in regards to what its saying and especially when you're rolling across you know like we did al these hospitals they all have different definitions you know they might have called it the same thing separation rate or turnover rate but they all had different definitions so standardizing the definitions and making sure everybody is using the same and understanding there's a lot of education and stuff like that that's important and takes a lot of time and effort

R: So does the organization encourage the use of this dashboard. Is the organization supportive?

M: Oh yes. We it is now a part of the CEO's dashboard so they can go and look at the scorecard for anytime for hr as well as we are building a hr internal scorecard that's juts for hr but basically that's gonna measure I don't wanna say measure the hr leaders at the facilities its measuring the hrs at the facilities but it is measuring the leaders are they actually involved in utilizing it and when we ask their CEO have you seen the hr scorecard for this month if they say no then that's going to show up somewhere and so you know it is as mandatory as can be without being mandatory you know we kinda publish them to say we kinda show the world they not doing anything in order to make them do it or say I'm leaving and so we can get somebody who will do it.

R: So what kind of training is given in order to learn how to use the dashboard.

M: There's a number of things. I put on when we have a new HR director or a new CEO or something they do spend a day here at the corporate office and they sit down with me and I go through it al l with them. But I also put on quarterly webinar training interactive

video type of things. I have a metrics specific intranet site that has all the specific definitions and what to do type of things so if it says your return on workforce is going down here's the possible reasons here's where to look. I put out a lot of consultive information to help them to try and provide the facilities with everything they need in order to react to do something regarding it. Also with our hr residents that come through which hopefully are our future hr leaders I have a bootcamp with them where they spend the whole day going through the philosophy of why of what of how of how its important and those types of things so I spend a lot of time also just getting phone calls from facilities saying you know my CEO saw our labor cost went up and I didn't know what to say what do I do. I help them through that process you know I take it form the standpoint of trying to you know not just give them the answer they're asking for but to teach them how to get the answer themselves the next time.

R: Are there any other additional thoughts or comments you wanted to share?

M: There are only good if people use them. People will only use them if they are important to the CEOs. Its one of those things you know certain things are good for an organization when they're bottom down and other things are good for the organization when they're top down and this is one of those top down things. The CEO's gotta say its important gotta wanna look at it and going to want actions upon them otherwise you're juts doing it for you know no reason whatsoever.

Dane

R: I guess we can just first start off with maybe just a little description about where you work.

D: Yeah I work at UW Credit Union in Madison, Wisconsin. And UW Credit Union is a financial institution with approximately 350 employees. We have 140,000 members or customers. Asset size of about 1.2 billion. We have 16 branches throughout the state of Wisconsin but our primary area of service is Madison, WI. And you're familiar with how credit unions operate- the difference between credit unions and banks?

R: Yup, I'm pretty familiar with it.

D: Ok, good. Great.

R: Ok so the first question I guess I have is so what factors influenced you know your company deciding to use a dashboard.

D: Well you know one of the things we need to probably update. If I'm thinking about what you came across on the internet is probably a presentation I made out in San Diego, ASTD. It's probably about six years old so some things have changed a bit. We still utilize a dashboard that's really dealing with employee engagement now. Back then we were talking about employee satisfaction.

R: Oh ok, well you can talk about whichever one you're most comfortable talking about.

D: What it really is dealing with employee engagement now is what we utilize it for. I think if you look at some other HR dashboards it's a little bit narrow its not as comprehensive as I'd like it to be. That's part of one of the things I've always been and interest in doing more of this and I think this year we'll probably add more because we have better systems in place to give us more accurate data. We did pretty good with measuring the employee engagement over the past four years and we've done a pretty good job with the employee satisfaction over the years. But we've really moved I think and a lot of organizations have from looking at engagement versus satisfaction.

R: Oh ok good, So I guess when it was decided to be implemented. Was it the organization that decided it that it was a good idea or was it more a single person pioneered the project.

D: Well What it was word kinda came out, this goes back to like 2000, 2001 we instituted critical measures for the organization and what that is a scoreboard basically. I had worked in manufacturing before and we utilized a similar type of concept where I worked before. You know a scoreboard type of concept on the production floor. We do the same things here. And the engagement or satisfaction as it was back then was part of the overallly company scorecard. Or as we call it critical measurements here. And those critical measures obviously dealing with the organization at a quick glance was based on

the balance scorecard concept. I can't remember who did a lot of that work its just escaping me right now. The balanced scorecard concept has been around for a while but you wanted to have measures that balance out each other so you've got a good healthy view of how the organization's performed at a glance. And its always been difficult coming up with the Human Resource measures. And satisfaction was a good one for us and we did a lot of work on trying to slice and dice the numbers but what we've moved on to now is engagement. We've patterned our engagement survey after a lot of the work that was done by Gallup. It's a Q-12 if you're familiar with that. There's book out there called first break all the rules.

R: First Break All the Rules

D: Yes that really gives a lot of background on the research that was done. They were really the pioneers of moving a lot of focus from employee satisfaction to employee engagement

R: So what kinds of problems have you encountered using it. Are there any things you'd like to improve on in the future?

D: Well I think we've kinda what we've done it does not at this point factor into the bonus however. Where we've been putting it into effect now because our scores have continually gone up now it's a great thing but the problem with that is other sin the organization will say well we don't have to put as much focus on this. Which could be a problem. But the nice thing with engagement is what we've done now is we've made all our managers responsible for engagement in their departments. They now they really watch that engagement score. Its so much easier to put activities together or put practices together for a manager to follow to bring their engagement up particularly if its in a certain area. For example one that usually comes up is recognition. You can never do enough recognition. And how to understand what types of things that managers need to do to help bring that score up. Well it's hard for me to come up with things that are problems with it. I've been fortunate. I'm a member of the executive team here and my teammates here have been very supportive of it. And that's probably why its worked well. And you know if I didn't get that support. It probably wouldn't work that well. But we've been able to really- my boss, the CEO, was really the one who brought engagement in wanted us to move engagement and thought it was a great idea and its worked out very well for us. But within my own area we do use some other measures and I want to expand upon that as we go into this year so that we have more of a traditional type of dashboard for the group for our organization. But engagement is the big one for us now.

R: Great, so then what type of technical support is there, at all for any of the dashboard users just if there's any bugs or errors or anything. Is there a team that is an IT support?

D: Well we don't utilize internal resources because we utilize a vendor. The cost for us is about \$7000 a year. And they'll do the survey, collect the data, and give us the report back. And I think that's important because you want to be able to, the employees want to be able to feel its confidential. If we did it internally you could lose that opportunity

they're always going to question that. So we utilize an outside source. We work with them quite a bit to develop the reports we need. The reporting comes back and it breaks engagement into four categories of engagement- there's only 12 questions. And then we also what we do with this we have a set of five core values and we ask our employees how we're doing with the core values so we also measure that. So the total survey is only 30 questions long and it also has open ended questions so we can get some comments from them too. I takes them maybe 10-15 minutes for them to complete each year.

R: So is there any training involved?

D: For the dashboard- no. What it does is leads to additional types of training on skill development for managers and employees.

R: So what are the main benefits you see after the dashboard was in place compared to before the organization had it.

D: I think it really helps you to focus on your employees and sends a great message to your employees that yeah we do measure more than just how many loans we have or where our operational costs are even member satisfaction is important. But I think its great to be able to- we say we want to be an employer of choice and obviously this helps us to prove to our employees that we're serious about it. That's definitely an advantage of what we see with this in place. The other thing that it does is it does focus the supervisors on activities on how to improve the environment with their own employees. If we didn't have that in place then they'd be more likely to say ok well I've got my loans are down so I'll have to deal with that. If you didn't have that engagement score in there you'd be imbalanced. So it does provide that balanced scorecard concept. It's worked real well for us.

R: Do you feel like the organization as a whole supports dashboard use?

D: Oh yeah. The organization has taken to it really well here.

R: Great. Are there any other thoughts or comments you wanted to share that we didn't already touch upon?

D: I think its something that is definitely very worth while for any organization to take a look at particularly as your looking at these times when the economy's tough. You don't want to forget about what your employees are going through.

References

- Ajzen, I., (1991) The theory of planned behavior. *Organizational Behavior and Human Decision Processes* (50) 2, 179 – 211. doi:10.1016/j.physletb.2003.10.071
- Arnott, D., (2007). Executive information systems development in an emerging economy. *Decision Support Systems* (42), 2078 – 2084. doi:10.1016/j.dss.2004.11.010
- Bajwa, D., (1998). Key antecedents of executive information system success: a path analytic approach. *Decision Support Systems* (22), 31 -43.
- Boudreau, J., (2002). Strategic HRM measurement in the 21st century: from justifying HR to strategic talent leadership. *CAHRS Working Paper Series* (2) 15, 1 – 20. Retrieved from <http://digitalcommons.ilr.cornell.edu/cahrswp/56>
- Bussen, W., (1997). Executive information system failure: a New Zealand case study. *Journal of Information Technology* (12) 2, 145 – 153. doi:10.1080/02683967345152
- Byrd, T., (1996). Corporate culture, related chief executive officer traits, and the development of executive information systems. *Computers in human behavior* (12) 3, 449 – 464.
- Campos, A., (2008). Human resources metrics dashboard . *Proceedings of the 26th Annual ACM international conference on Design of communication*. 257 – 262. Retrieved from <http://doi.acm.org.libproxy.albany.edu/10.1145/1456536.1456587>
- Cerpa, N., (1998) Case study: the effect of IS maturity on information systems strategic planning. *Information & Management* (34), 199 – 208.
- Chaudhary, S., (1996). A small business inventory DSS: design, development, and implementation issues. *Computers Ops Res* (23) 1, 63 – 72. doi:10.1016/0305-0548(95)00004-6
- Christensen, M., (2006). Avoiding common dashboard pitfalls. *DM Review*, 28 – 43.

- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly* (13) 3, 319-340.
- DeLone, W., and McLean, E., (1992). The DeLone and McLean model of information systems success: a ten-year update. *Journal of Management Information Systems* (19) 4, 9 – 30.
- Diez, E. (2009) A review of the factors which influence the use and usefulness of information systems. *Environmental Modelling & Software* (24), 588 – 602.
doi:10.1016/j.envsoft.2008.10.009
- Dover, C., (2004). How dashboards can change your culture. *Strategic Finance*, 86(4), 43-48.
Retrieved from
<http://www.thefreelibrary.com/How+dashboards+can+change+your+culture%3a+companies+become...-a0123085925>
- Few, S., (2005). Dashboard design: taking a metaphor too far. *DM Review*, 18 – 67.
- Gelderman, M., (1998). Task difficulty, task variability and satisfaction with management support systems. *Information & Management* (39), 593 – 604.
- Houdeshel, G., (1987). The management information and decision support (MIDS) system at Lockheed-Georgia. *MIS Quarterly*, 127 – 140.
- Hofstede, G., (1984). Hofstede's culture dimensions. *Journal of Cross-Cultural Psychology* (15) 4, 417 – 433. doi:10.1177/0022002184015004003
- Hung, S., (2003). Expert versus novice use of the executive support systems: an empirical study. *Information & Management* (40), 177 – 189.
- Hwang, W. T., (2007). Building an executive information system for maintenance efficiency in petrochemical plants – an evaluation. *ICChemE* (85) B2, 139 – 146. Retrieved from

<http://search.ebscohost.com.libproxy.albany.edu/login.aspx?direct=true&db=a9h&AN=28090887&site=ehost-live>

Iavari, J., (2002). An empirical test of the DeLone-McLean model of information system success.

The Database for Advances in Information Systems (36) 2, 8 – 27.

Kawamoto, T., (2007). Key success factors for a performance dashboard. *DM Review*, 20 – 21.

Koh, C., (1998) Data management in executive information systems. *Information &*

Management (33), 301 – 312.

Lamont, J., (2007). The view from the dashboard. *KMWorld (16) 3*, 14 – 30. Retrieved from

<http://search.ebscohost.com.libproxy.albany.edu/login.aspx?direct=true&db=a9h&AN=24250562&site=ehost-live>

Marakas, G., Yi, M., and Johnson, R., (1998). The multilevel and multifaceted character of computer self-efficacy: toward clarification of the construct and an integrative framework for research. *Information Systems Research (9) 2*, 126 – 163.

Martinsons, M., (2007). Strategic decision making and support systems: comparing American,

Japanese and Chinese management. *Decision Support Systems (43)*, 284 – 300. doi:

10.1016/j.dss.2006.10.005

Nandhakumar, J., (1996). Executive information system development: a case study of a

manufacturing company. *Journal of information technology (11)*, 199 – 209.

doi:10.1080/026839696345252

Pijpers, G., (2001). Senior executives' use of information technology. *Information and Software*

Technology (43), 959 – 971.

Poon, P., (2001). Critical success factors revisited: success and failure cases of information

systems for senior executives. *Decision Support Systems (30)*, 393 – 418.

- Rainer, K. (1995) The keys to executive information system success. *Journal of Management Information Systems* (12) 2, 83 – 98.
- Salmeron, J., (2002). EIS data: findings from an evolutionary study. *The Journal of Systems and Software* (64), 111 – 114.
- Singh, S., (2002) EIS support for the strategic management process. *Decision Support Systems* (33), 71 – 85. Retrieved from <http://www.efsa.unsa.ba/~nijaz.bajgoric/dst/eis1.pdf>
- Taylor, S. and Todd, P., (1995). Understanding information technology usage: a test of competing models. *Information Systems Research* (6) 2, 144 – 176. Retrieved from <http://home.business.utah.edu/actme/7410/TaylorTodd.pdf>
- Tian, J., (2007). DSS development and applications in China. *Decision Support Systems* (42), 2060 – 2077. doi:10.1016/j.dss.2004.11.009
- Volonino, L. and Watson, H., (1991). The strategic business objectives method for guiding executive information systems development. *Journal of Management Information Systems* (7) 3, 27 – 39. Retrieved from <http://portal.acm.org.libproxy.albany.edu/citation.cfm?id=116927.116929&jmp=cit&coll=GUIDE&dl=GUIDE&CFID=90220928&CFTOKEN=70714838#>
- Walstrom, K. and Wilson, R., (1997). An examination of executive information system (EIS) users. *Information & Management* (32), 75 – 83. doi: 10.1016/S0378-7206(97)00010-4
- Watson, H., (1991) Executive information systems: a framework for development and a survey of current practices. *MIS Quarterly*, 13 – 30.
- Wixom, B. and Todd, P., (1995) A theoretical integration of user satisfaction and technology acceptance. *Information Systems Research* (16) 1, 85 – 102. doi 10.1287/isre.1050.0042