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Hospital Management Decision Support:

A Balanced Scorecard Approach

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Abstract

Hospital management teams receive voluminous data from a wide variety of sources, but are unable to distill the essential data they require to make good decisions. We have used a methodology, which helps teams define and use important management data coupled with an information system that makes this data accessible. Results of our evaluation indicate that the process of developing a Balanced Scorecard indicator system helps management teams to define meaningful strategic objectives and measurable performance indicators. The framework combined with the information acts as an integrating force, providing a shared understanding of the unit's goals. We conclude that a customized decision support system, which integrates multiple measures in a balanced Scorecard framework, is a powerful tool for enabling complex decision making by a management team.

Keywords

Decision Support Systems; Management, Decision Making; Organizational

Introduction

Hospital management teams at all levels of the organization are constantly exposed to a flood of data reported in a variety of forums and presented in a range of formats. Ironically, this overabundance of data does not necessarily contribute to more informed management decisions. The mass of data often obscures important facts. Managers may have no sense of how the data relate to each other or to organizational priorities. Management teams need a methodology for articulating which data is important to them. They also need information systems which not only make this management data accessible, but which also provide a context for integrated decision making. These strategic management decision support system aim not to replace decision making, but rather to aid teams in unstructured strategic management processes and to catalyze strategic learning.

Defining Management Information needs

Different organizations have different approaches to providing their management teams with information. Some organizations have focused on implementing systems that are designed to perform routine paperwork processing functions, such as admissions and discharges, lab orders or payroll. Heavily aggregated reports are made available to managers as a system byproduct. This approach is common, but does not take manager's real needs into account. In the key indicator approach, organizations arbitrarily select a set of key indicators and collect data about them. Typically the emphasis is on standard financial and quality management data defined by corporate staff in the financial or quality management area areas. The information is provided periodically in voluminous multi-page reports. This approach provides useful data serendipitously, but fails to provide assistance to managers in thinking through their real information needs. The Critical Success Factor (CSF) methodology addresses this shortcoming. CSFs are defined as the limited number of areas in which satisfactory results will ensure successful competitive performance. In the CSF methodology, management teams define industry CSFs, then corporate CSFs and then CSFs for each subsystem of the organization. This top down influence pattern is repeated through the organizational hierarchy down to the individual manager level [1].

The Balanced Scorecard methodology builds on the CSF concept of a limited, coherent set of performance measures related to strategic objectives and adds the concept of balance among indicators. The Balanced Scorecard framework originated from a collaborative research project among twelve companies [2,3]. It presents a management team with four different perspectives from which to choose measures as shown in figure 1:

The Balanced Scorecard does not require the top down approach advocated in the CSF technique. In the Balanced Scorecard methodology, a management team at any level selects a set of performance indicators in each quadrant and postulates relationships between the indicators and quadrants. The process of selecting and agreeing on measures in each quadrant forces the management team to define what is strategically important to it. Limiting the number of allowable measures in each perspective obliges managers to focus their strategic vision and identify the handful of most critical indica-

tors. The relationships between the measures encourages managers to form strategies that positively influence all quadrants or where this is not possible, to explicitly choose the tradeoffs they must make between different objectives.

We hypothesized that the Balanced Scorecard methodology would help hospital management teams define their strategic information needs. Implementing a decision support system based on the framework would help management teams focus on the most important information and provide them with insight into complex management situations.

Customer	***Internal***
How well are we doing from our customer's perspective?	At what do we have to excel?
Innovation	***Financial***
How well are we able to adapt to our changing environment?	How wisely do we use our resources?

Figure 1 - The four perspectives of the Balanced Scorecard (after Kaplan [2])

Method

We developed prototype decision support systems based on the Balanced Scorecard methodology in five different patient service units (PSUs) at Sunnybrook Health Science Centre, a major teaching hospital. In Sunnybrook's program model, each PSU is a 'mini hospital', optimized for the needs of a particular patient group, with its own decentralized professional staff, nursing staff, resources and budgets[4].

Each decision support system was developed using an evolutionary prototyping spiral development cycle[5]. In the early stages of the project, a Balanced Scorecard analyst (the primary author) worked with the PSU management team to learn about the PSU strategic priorities and management issues while at the same time sensitizing them to the Balanced Scorecard concepts. Once the management team decided to proceed with a project, the team defined a preliminary Balanced Scorecard. Typically, management teams agreed fairly quickly on the content of their first scorecard either by building consensus or using multivoting techniques. Figure 2 shows a sample Balanced Scorecard for the Cardiovascular patient service unit (CVPSU) which treats medical and surgical patients with cardiovascular disease.

Following preliminary definition of the PSU scorecard, a risk assessment was done on each indicator. The risk assessment allowed the management team to balance the potential value of the indicator information with the development risks of that indicator

Risks included economic factors, technical or data acquisition feasibility, data definition difficulty, data ownership and data sensitivity issues. On the basis of the risk assessment, the management team and analyst agreed to develop one indicator from each quadrant for the first prototype. The analyst then worked with a management team representative and a technical resource to iteratively define the indicator, determine a suitable data source, extract and analyze the data and present it to the management team for approval. Software was developed to acquire, manipulate and display the data. As an indicator neared completion, additional indicators were selected by the team for implementation. Thus progressively more complete software prototypes were built with each iteration. Table 1 shows a selection of indicators, their definitions, data sources and update method.

The project is now in its third year of development. There are five PSU Balanced Scorecards at various levels of sophistication and completeness. They utilize over a dozen different data sources including provincial databases, Sunnybrook corporate mainframe systems and small departmental databases. The prototype Balanced Scorecard software consists of a relational database for each scorecard, a data acquisition subsystem and data display functions. The data acquisition subsystem has various degrees of automation ranging from direct SQL queries of source systems, to imports of user generated ASCII files and floppy disk extracts from non networked systems. Users can view the indicator data as a trend comparing current and historical data or as a table. Multiple indicators can be displayed simultaneously, facilitating an understanding of data patterns and interrelationships.

As with any new software tool, the new decision support system had to be integrated into PSU management processes. Once the Balanced Scorecard reached a critical mass of data, the analyst helped the PSU management team to design organizational mechanisms to complement their decision support processes.

Customer	***Internal***
patient satisfaction average waiting time cancellations	Average length of stay Turnaround time Complication rate Time to treatment
Innovation	***Financial***
Patients in clinical studies Day of admission procedures Patient focused care objectives:	Average cost per case Productivity

Most Significant Patient Populations
Cardiac valves with pump
Coronary artery bypass graft surgery
Acute myocardial infarction
Pacemaker implants
Coronary Angioplasty
Cardiac Surgery
Cardiology
Vascular Surgery

Figure 2 - Cardiovascular PSU balanced scorecard

For example, teams were encouraged to assign individual members to be accountable for specific indicators. The analyst also contributed to the data analysis that arose as trends suggested deeper lines of inquiry

Evaluation of the Balanced Scorecard project

After twelve months of use, we have evaluated the Balanced Scorecard systems using a combination of user satisfaction surveys and a focus group. The survey instrument consisted of the implementation attitudes measurement tool developed by Schultz and Slevin [6] and an end user satisfaction rating instrument developed by Doll and Torkzadeh[7]. Both tools use five point Likert scaled questions to measure overall attitudes towards the implementation of the Balanced Scorecard as well as specific factors such as manager's job performance; ability to understand PSU goals; content, accuracy, and timeliness, among others. The survey also includes open ended questions that assess changes caused by the Balanced Scorecard system and elicits suggestions for improving the system. Purposive sampling identified two information rich management teams who had been involved in the BSC project for at least twelve months. Twenty two surveys were distributed to these management teams and sixteen were returned.

We triangulated the survey results with a focus group. The research team used extreme case sampling and selected a group of operations directors who ranged from seasoned Balanced Scorecard users to managers who had never been exposed to a Balanced Scorecard project. The focus group was semi structured with a general interview guide, which correlated with the survey factors. Sample questions were designed to be open-ended, singular, non dichotomous and clear. The focus group was audiotaped, transcribed verbatim and coded by two investigators. Themes were developed from the coded focus group data.

Results

Highlights of the survey results combined with the focus group data are shown in Table 2. The percentage of respondents who were positive for each factor has been calculated as well as a 90% confidence interval. The confidence interval represents the minimum percentage of the management team, who would have answered positively, had the entire management team returned their surveys.

Discussion

The survey results indicate that management teams were generally very positive about the Balanced Scorecard project. The process of developing a Balanced Scorecard indicator system helped management teams to define meaningful strategic objectives and to gain a shared understanding of the PSU's goals. Participants were satisfied with the software, but not as satisfied with

Table 1 - Selected Cardiovascular PSU balanced scorecard indicators details

Indicator	Definition	Data source	Extract method	Comment
Average wait time - cardiac surgery	Time from acceptance for surgery to date of procedure for all patients accepted at Sunnybrook for coronary bypass surgery segmented by urgency rating	Provincial cardiac care tracking	SQL query, Oracle database, monthly	Data ownership issues
Average length of stay - acute myocardial infarct	Total days stay/total discharges for patients with acute myocardial infarction with cardiovascular complications	Patient abstracting	File extract, monthly	Data ownership issues
Complication rate - cardiac surgery	Severe and moderate intra-hospital and 3 month post discharge complication rate for coronary artery bypass graft and valve surgeries	Departmental patient tracking	SQL query, Dbase 3, monthly	
Average cost per case - coronary bypass surgery	Direct, fixed and variable costs for coronary bypass cases with no catheterization	Hospital patient costing	File extract from proprietary mainframe system monthly	Data is not current enough
Productivity - cardiac surgery	Total nursing dollars divided by number of weighted cases.	Patient abstracting and workload measurement	File extracts from both systems, monthly	Data must be reconciled across two different system
Day of admission surgery rate	Day of admission urgent and elective surgery rate, including cardiac, vascular and pacemaker surgeries excluding outpatient heart caths and PCTAs	Hospital utilization report	File extract, monthly	

Table 2 - Survey results combined with focus group themes and comments

Survey result / Focus group theme	Sample focus group comments
88% (at least 77%) overall positive about the scorecard project	"The benefit of the scorecard is that it provides a framework for thinking about the many different parts of the work that we do"
81% (at least 69%) feel that the Balanced Scorecard has made their goals more clear, congruent and achievable	"I think that {the Balanced Scorecard framework} helps build that common vision. or common understanding of what you are doing"
81% (at least 69%) think they will use the scorecard	"We've spent a lot of time investing in this...We've done training, its part of our culture now."
Participants are satisfied with system ease of use (80%, at least 67%), and format (87%, at least 75%)	"One thing that makes the scorecard from a management perspective is the way it is presented and the ease of access... So it is data that everybody can access, no matter how in depth their technological skills are."
Participants are not satisfied with timeliness (47%, at least 30%)	"The data should be as least as timely as the {monthly} CUUR report."
The scorecard is an integrating force	"The Balanced Scorecard summarizes a lot of innovations in management, no theories, but management direction, customer service... and quality."
Users like the ability to balance financial indicators with other objectives	"It gives you a nice framework for talking about ...the balance...in terms of finances and how they effect patient care"

the data timeliness. Providing aggregate level trends was the starting point in the additional use of information for effective management. Consistently, management teams questioned why patterns arose. This led to further focused analysis related to the strategic objectives of the PSU. Often, comparisons of multiple indicator trends led to the team developing a better shared mental model of the process being managed.

From an information delivery standpoint, people dependent data entry and extraction and data ownership issues impeded the development and use of indicators as often as technical obstacles. For example, some teams identified an indicator as critical, but then would not fund a data entry resource. In other cases, clinicians would not cooperate with the management team, either because they feared having their performance measured or because they did not wish to share data under their control. Issues such as these had to be resolved by the management team.

Conclusions

The Balanced Scorecard is an effective methodology for helping management teams to define their objectives and associated performance indicators. Providing indicator data within this framework assisted management teams to filter information and to focus on improving performance in strategically important areas. We conclude that a customized decision support system, which integrates multiple measures in a balanced Scorecard framework, is a powerful tool for enabling strategic management.

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