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The balanced scorecard: a foundation for the strategic management of information systems

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Abstract

The balanced scorecard (BSC) has emerged as a decision support tool at the strategic management level. Many business leaders now evaluate corporate performance by supplementing financial accounting data with goal-related measures from the following perspectives: customer, internal business process, and learning and growth. It is argued that the BSC concept can be adapted to assist those managing business functions, organizational units and individual projects. This article develops a balanced scorecard for information systems (IS) that measures and evaluates IS activities from the following perspectives: business value, user orientation, internal process, and future readiness. Case study evidence suggests that a balanced IS scorecard can be the foundation for a strategic IS management system provided that certain development guidelines are followed, appropriate metrics are identified, and key implementation obstacles are overcome.

Keywords: Balanced scorecard; Performance measurement and evaluation; Strategic decision-making; Information systems success; Multidimensional metrics; Case studies; Performance management

1. Introduction

Growing amounts of intellectual and financial capital are being invested to collect, process, store, and disseminate information. As the resource commitments to information systems (IS) continue to escalate, the following types of questions are being asked more frequently than ever before: Is that investment in IS or information technology (IT) really worthwhile? Is that IT application we implemented a success? Is our IS department (or function) productive and effective? Should we use outsourcing?

Recent surveys indicate that issues such as 'measuring the value of IT' and 'evaluating IS performance' are of great importance to managers in places like Hong Kong [8], the United States [4] and the United Kingdom [16]. Given the increasing role of IT in achieving business goals, the extensive interest of managers in measuring and evaluating both IS processes and outcomes is not surprising. The recent

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professional and academic literature further suggests that IS consultants and business professors are also concerned about the lingering difficulties in trying to determine the value of IT applications as well as performance in the IS area (see, e.g., Ref. [7]).

At another level of analysis, the *productivity paradox* has become a contentious issue among both economists and the IS community (see Refs. [20,40]). Several studies indicate that while the level of IT investment is correlated to corporate revenues, it is *not* correlated to either productivity *or* profitability [45,46]. Simply stated, the huge overall investment in computer and telecommunication technologies does *not* appear to have significantly raised economic productivity or corporate profits. Similar findings in individual enterprises have led many to believe that IT applications are simply a black hole. Managers have found it difficult to demonstrate tangible returns on the resources expended to plan, develop, implement and operate computer-based IS. For example, in one General Motors plant, US$650 million was invested in IT during the 1980s failed to result in any significant productivity or quality improvements [37].

This state of affairs may merely reflect the fact that recently-implemented, computer-based IS enhance value in ways that are not captured by conventional input–output accounting methods. For example, since effectiveness ('doing the right things') and innovation ('doing new things') cannot be readily quantified in terms of traditional outputs, these improvements are not reflected in economic efficiency statistics.

Business consultants and academics have also suggested that the productivity paradox may stem from the tendency to automate their existing ways of doing work. Very few organizations have redesigned their business processes in order to realize the full potential of modern IT. Brynjolfsson and Hirt [5,6] are among those who insist that many of the benefits from a technology investment will not be realized unless major organizational changes are made. Indeed, the growing popularity of this perspective contributed to the emergence of the re-engineering phenomenon in the early 1990s (see Ref. [30]). Nevertheless, the fundamental issue of measuring and evaluating IT applications and IS activities remains unresolved.

1.1. IS measurement and evaluation

Many methods and techniques have been suggested over the years to evaluate the investments made in IT and IS. Traditional methods focus on well-known financial measures, such as the return on investment (ROI), net present value (NPV), the internal rate of return (IRR), and the payback period. These methods are best-suited to measure the value of simple IT applications, such as transaction processing and office automation systems. The aforementioned types of IS were often the first to be introduced in a given organization.

Unfortunately, evaluation methods that rely on financial measures are not as well-suited for newer generations of IT applications. These computer-based IS typically seek to provide a wide range of benefits, including many that are intangible in nature. For example, it is difficult to quantify the full value of a decision support system (see Ref. [44]) or a knowledge-based system (see Ref. [26]). The productivity paradox has prompted calls for new approaches to measure and evaluate IT-related investments (see Refs. [3,36]).

One proposed approach is *information economics* [38], which should not be confused with the economics of information systems. Information economics seeks to account for a wider scope of IS benefits, by including less tangible items such as improved customer service or a higher degree of competitiveness. It also prescribes that the benefits and risks be separated into two domains, a business domain and a technological domain, and that each domain be evaluated separately. However, even the two domains of information economics fail to fully capture the range of business benefits offered by contemporary IT applications. As a result, we suggest that it may be appropriate to use a *balanced scorecard* to measure and evaluate IT and IS.

Robert Kaplan of Harvard University and David Norton, an American management consultant, have proposed the balanced scorecard as a means to evaluate corporate performance from four different perspectives: the financial perspective, the internal business process perspective, the customer perspective, and the learning and growth perspective. They compare their approach for managing a company to that of pilots viewing assorted instrument panels in an

airplane cockpit: both have a need to monitor multiple aspects of their working environment.

Many companies are adopting the balanced scorecard (BSC) as the foundation for their strategic management system. Some managers have used it as they align their businesses to new strategies, moving away from cost reduction and towards growth opportunities based on more customized, value-adding products and services. The BSC has even been coded into a software program that enables business performance indices to be created by extracting data from computer-based IS [33].

Martinsons [27] has suggested that the BSC may also help managers evaluate IT investments, as well as the performance of an IS organization, in a holistic manner. This paper builds upon that suggestion by elaborating a framework for evaluating IT and IS based on the BSC concept. We detail how the BSC can serve as a decision support tool for IS managers. It may be applied not only to assess the contribution of a specific information system or IS project, but also to evaluate the performance and guide the activities of an IS department or functional area.

2. The balanced scorecard

Kaplan and Norton [21–23] have presented the BSC concept in a series of articles published in the *Harvard Business Review*. They have argued that traditional financial accounting measures (like the ROI and payback period) offer a narrow and incomplete picture of business performance, and that a reliance on such data hinders the creation of future business value. As a result, they suggest that financial measures be supplemented with additional ones that reflect customer satisfaction, internal business processes, and the ability to learn and grow. Their BSC is designed to complement ''financial measures of past performance with measures of the drivers of future performance'' ([24], p. 8).

The name of their concept reflects an intent to keep score of a set of items that maintain a balance ''between short- and long-term objectives, between financial and non-financial measures, between lagging and leading indicators, and between internal and external performance perspectives'' ([24], p. viii). Management attention to such a broad set of performance measures should not only help to ensure good short-term financial results, but also to guide a business as it seeks to achieve its strategic goals.

During the evolution of their BSC concept in the 1990s, Kaplan and Norton have demonstrated an increasing awareness of the assumptions and theories that underlie business process re-engineering (BPR). Many advocates of BPR contend that traditional *industrial age* competition is being supplanted by a new form of *information age* competition (see Refs. [12,18]). Business success in the past was largely based on the efficient allocation of financial and physical capital in order to achieve economies of scale and scope [10]. However, the ability to mobilize and exploit softer and less tangible intellectual assets is becoming more important (see Table 1).

As a result, information age companies must focus on specific market segments or use technology-improved processes in order to efficiently produce and deliver their products and services. For example, Martinsons and Revenaugh ([31], p. 81) point out that ''rather than driving down employee numbers... (and cutting costs), it is ultimately necessary for organizations to deliver superior value. They must improve the numerator in the productivity equation.'' BPR stresses the role of quantitative goals and measures to guide the development and implementation of a new business model.

Kaplan and Norton appear to have taken the prescriptive re-engineering literature to heart by progressively enlarging the range of potential benefits

Table 1
Competitive advantage in the information age

Intangible assets enable a business to...
develop and maintain customer relationships
develop and maintain supplier relationships
develop and maintain strategic alliances
identify the products and services desired by different market segments
develop innovative products and services for designated market segments
produce highly-customized products and services that can be offered at attractive prices
deliver highly-customized products and services to designated market segments
continuously improve core business processes

Table 2
The four perspectives in a balanced scorecard

Customer perspective (value-adding view)	Financial perspective (shareholders' view)
Mission: to achieve our vision, by delivering value to our customers	Mission: to succeed financially, by delivering value to our shareholders
Internal perspective (process-based view)	**Learning and growth perspective (future view)**
Mission: to satisfy our shareholders and customers by promoting efficiency and effectiveness in our business processes	Mission: to achieve our vision, by sustaining our innovation and change capabilities, through continuous improvement and preparation for future challenges

From Refs. [23,24].

that come from using their concept. Recently, they proposed the BSC not only as a tool for clarifying and communicating strategy, but also as a foundation for actively managing it. A BSC-based system could come to resemble an *organizational activity support system* (see Ref. [9]). Despite the hype that has started to accompany some published reports about BSCs, such an action-oriented framework, which focuses on *customer-based* business *processes* rather than just financial *results*, should help managers to monitor and improve business performance on a real-time basis (see also Ref. [41]).

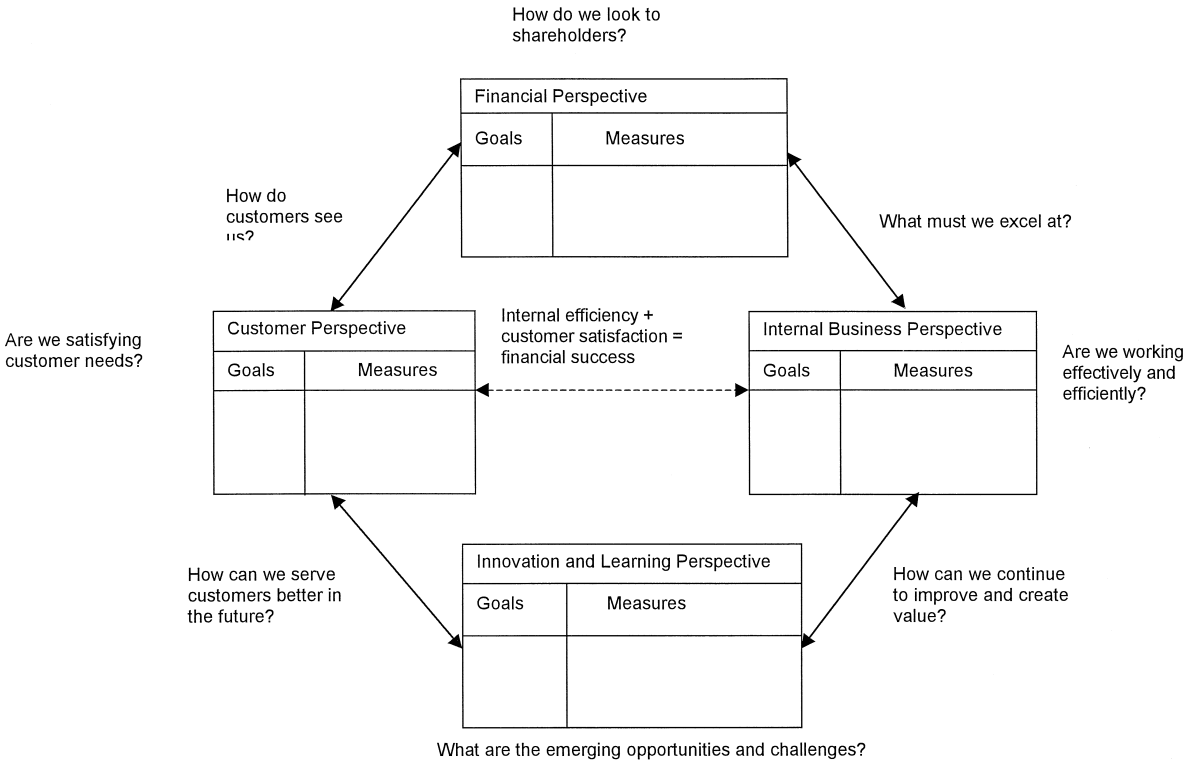

Fig. 1. Relationships between the four perspectives in the balanced scorecard (based on Ref. [21]).

Future-oriented, process-based metrics are seen as a key element in a strategic management system that drives performance improvement and enables the top management team to make well-informed decisions that prepare their organization for the future (see Refs. [7,42]). Such a strategic management system should include the following major elements: *mission*: that gives a sense of purpose to their organization (e.g., 'be a supplier of information management training and consulting services in Vancouver'); *vision*: an image of what the organization will look like and do in the future; *strategic objectives*: the mission and vision are translated into strategic objectives (e.g., 'to provide innovative seminars to senior managers in the retail industry'); *performance measures*: the objectives can be measured through well-chosen indicators (e.g., 'number of senior managers from the retail industry enrolled in seminars', 'client satisfaction with the seminars').

Table 2 outlines the four perspectives included in a balanced scorecard, and Fig. 1 shows the relationships between them.

3. Evaluating business functions, departments and projects

The BSC concept can also be applied to measure, evaluate and guide activities that take place in specific functional areas of a business. It can even be used to shed greater light on performance at the individual project level. The remainder of this article illustrates the application of the BSC concept to IS activities. We develop a BSC framework which can be adapted to IT application projects as well as the IS department or functional area as a whole.

The BSC-for-IS framework presented here is structurally similar to the BSC framework at the corporate management level. However, we have made substantial modifications to the perspectives and measures proposed by Kaplan and Norton. The changes stem from our view that: (1) the IS department is typically an internal (rather than external) service supplier; and (2) IS projects are commonly carried out for the benefit of both end-users *and* the organization as a whole (rather than individual customers within a large market).

The following four perspectives have been suggested for a balanced IS scorecard: user orientation, business value, internal processes, and future readiness [27]. Other modifications to the framework include the reanalysis of the internal business/process perspective such that it focuses on efficiency. Operational effectiveness more naturally belongs to the user orientation perspective, i.e., are we doing the right things and thereby satisfying customer needs. A framework based on these four new perspectives is shown in Table 3 and the relationships between them are illustrated in Fig. 2. The remainder of this article considers the development and implementation of a balanced IS scorecard.

The value or contribution of IS to the business as a whole must be considered from top management's point of view. This evaluation is comparable to the general management evaluation suggested by Dickson and Wetherbe [14]. They discuss the key success factors of the IS function and indicate that measures such as 'system availability and downtime' may be appropriate to evaluate these factors. However, the approach presented here goes further, in that a traditional IS focus on internal processes and business value is augmented with the user orientation and future readiness perspectives. Each of the four perspectives should be translated into corresponding metrics and measures that reflect strategic goals and objectives. The perspectives should be reviewed periodically and updated as necessary.

Potential IS measures are considered in the sections that follow. These measures are generic in nature, because each corporate mission and the strategic goals related to it will require a unique set of measures [3,24,25]. The proposed metrics are extracted from the mainstream IS management literature as well as the emerging literatures on information economics [38,39] and IS success [2,13,43].

The balanced IS scorecard does not only integrate these different approaches; it also extends them in two important ways: (1) by adding a future readiness perspective that incorporates concepts such as innovation and learning; and (2) by proposing that the monitoring and control of all the key measures be undertaken on an on-going basis. In fact, the measures included in a given BSC should be tracked and traced over time, and integrated explicitly into the strategic IS management process. This will let man-

Table 3
The four perspectives in a balanced IS scorecard

User orientation perspective (end-users' view)	Business value perspective (management's view)
Mission: deliver value-adding products and services to end-users	Mission: contribute to the value of the business
Key question: Are the products and services provided by the IS department/functional area fulfilling the needs of the user community	Key question: Is the IS department/functional area accomplishing its goals and contributing value to the organization as a whole?
Objectives	Objectives
Establish and maintain a good image and reputation with end-users	Establish and maintain a good image and reputation with management
Exploit IT opportunities	Ensure that IS projects provide business value
Establish good relationships with the user community	Control IS costs
Satisfy end-user requirements	Sell appropriate IS products and services to third parties
Be perceived as the preferred supplier of IS products and services	
Internal processes perspective (operations-based view)	**Future readiness perspective (innovation and learning view)**
Mission: deliver IT products and services in an efficient and effective manner	Mission: deliver continuous improvement and prepare for future challenges
Key question: does the IS department/functional area create, deliver and maintain its products and services in an efficient manner?	Key question: Is the IS department/functional area improving its products and services, and preparing for potential changes and challenges?
Objectives	Objectives
Anticipate and influence requests from end-users and management	Anticipate and prepare for IS-related problems that could arise
Be efficient in planning and developing IT applications	Continuously upgrade IS skills through training and development
Be efficient in operating and maintaining IT applications	Regularly upgrade IT applications portfolio
Be efficient in acquiring and testing new hardware and software	Regularly upgrade hardware and software
Provide cost-effective training that satisfies end-users	Conduct cost-effective research into emerging technologies and their suitability for the business
Effectively manage IS-related problems that arise	

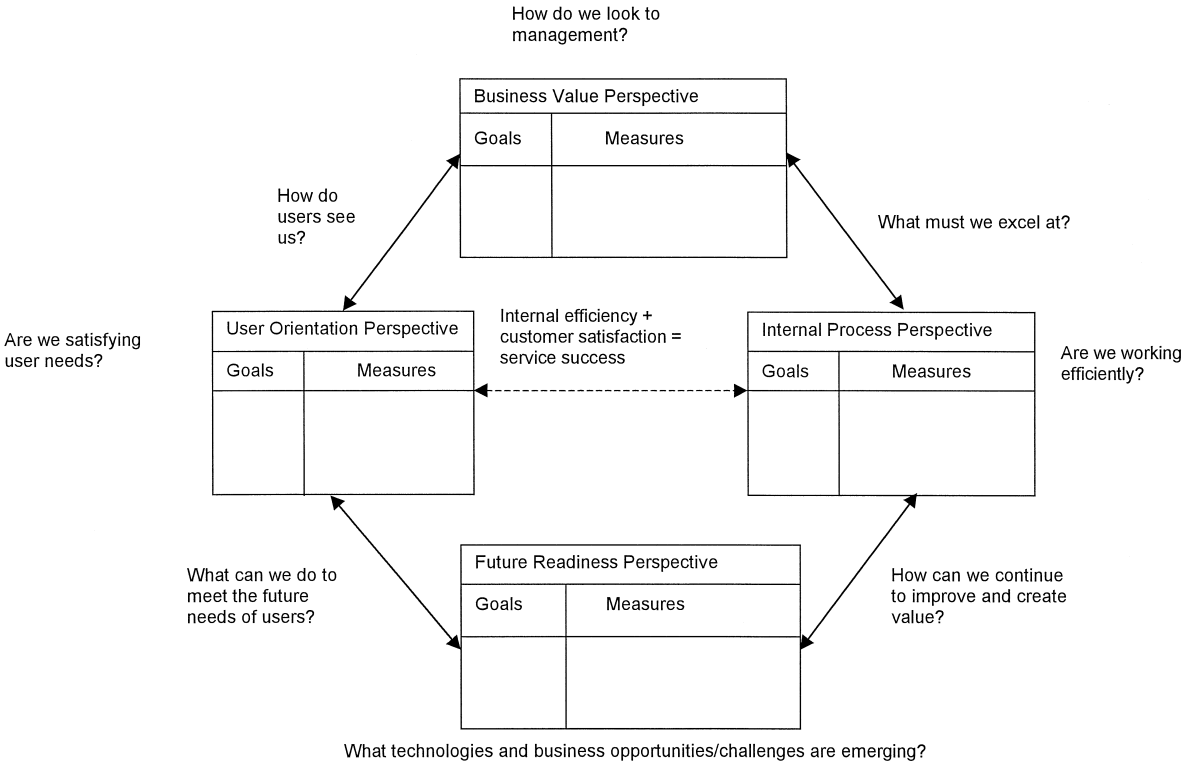

Fig. 2. Relationships between the four perspectives in the balanced IS scorecard (based on Ref. [27]).

agers know what is happening and why it is happening, enabling them to base their decisions and actions on solid information rather than intuition.

4. Measuring and evaluating business value

It is useful to distinguish between two categories of IT/IS performance evaluation: the short-term cost-benefit evaluation that is commonly applied to individual projects, and the longer-term perspective relevant to both IT applications and the IS department or function as a whole. Many of the business value measures fall into the latter category, as evident from Table 4. For example, although 'Cost control' and 'Selling to third parties' may be evaluated in the short-term, many of the measures within the 'Business value' dimensions will require an extended evaluation time frame.

The traditional financial perspective encompasses the control of the IS budget as well as the benefits arising from the sale of IT-related products and services to third parties. Although some pundits have encouraged the IS department or functional area to take on commercial activities, these remain the exception rather than the norm. Popular financial metrics are the IS budget expressed as either a percentage of sales turnover or as a percentage of total expenses.

Benchmarking to other companies in the industry [35] or even other economies around the world [29] may provide useful insights. However, differences that are identified should be interpreted with care, since they may be due to company-specific factors. A critical attitude towards these figures is necessary even if a number or a percentage is at the same level as the industry average.

Value is a much broader concept than benefits, and IS projects can generate business value in many ways. For example, the implementation of a menu-driven customer database may reduce the amount of IS specialist support needed to execute an ad hoc

Table 4
Measures for the business value perspective

Cost control
Percentage over/under overall IS budget
Allocation to different budget items
IS budget as a percentage of revenue
IS expenses per employee
Sales to third parties
Revenue from IT-related products and services
Business value of an IT project
Financial evaluation based on traditional measures (e.g., ROI, payback period)
Business evaluation based on information economics
- Value linking
- Value acceleration
- Value restructuring
- Technological innovation
Strategic match with business contribution to:
- Product or service quality
- Customer responsiveness
- Management information
- Process flexibility
Less
Risks
- Business strategy risk
Unsuccessful business strategy
- IS strategy risk
Unsuccessful IS strategy
- Definitional uncertainty
Low degree of project specification
- Technological risk
'Bleeding edge' hardware and software
- Developmental risk
Inability to put the pieces together
- Operational risk
Resistance to change
Human/computer interface difficulties
- IS service delivery risk
Business value of the IT department / functional area
Percentage of resources devoted to strategic projects
Percentage of time spent by IS manager in meetings with corporate executives
Perceived relationship between IS management and top management

query, and generate a modest amount of direct benefits. However, the real value of such a database will be reflected in marketing and sales performance. Salespeople would be expected to integrate the database into their activities, thereby improving the productivity of the sales process, and consequently raising revenue levels and/or profit margins.

A new concept called business value *complementarity* has been devised by Barua et al. [3], using a business value modeling approach to assess the impacts of re-engineering variables on performance measures. It is argued that IT is complementary with organizational characteristics and processes, and therefore IT investments will not produce significant improvements if they are undertaken in isolation. Referring to the concept of 'ideal types' [34,50], it is suggested that exogenous changes, such as technological advances, provide the opportunity to achieve a better design via complementary changes. The whole notion of complementarity can be addressed by the question: ''Does the value derived by increasing one factor increase by increasing the other factors in appropriate directions?'' ([3], p. 416). What is important is that the changes introduced through the complementary factors must be coordinated. This synergistic approach, that takes advantage of the value created through the synergy, presents a distinctly new method of supporting decisions about change.

Notwithstanding such benefits, value also implies risk. IS benefits have traditionally been measured by quite simple (at least in theory) financial measures like the return on investment and/or the payback period. However, these types of financial measures limit themselves to the financial benefits rather than the broader concept of business value. *Information economics* has sought to address this deficiency [38,39].

The information economics method is a scoring technique whereby value and risk categories are attributed a numerical score between zero and five. For a value category, '0' would signify 'no positive contribution' while a '5' would represent a 'large positive contribution'. For a risk category, '0' would mean 'no risk' while a '5' would signal a 'large risk'. Each of these categories is assigned a weight. By adding the weighted scores of the value categories and subtracting the weighted scores of the risk categories, one can calculate the total score of each project.

The value of the information economics method lies with the fact that the scores are assigned by all parties involved. End-users score risks and values in

the corporate domain, while IT specialists score IT-related categories. This way, the business contribution of the project can be assessed jointly, and a consensus reached on the evaluation of a specific project. Most value and risk categories associated with information economics are quite unambiguous. However, for a few of them, a short explanation may be appropriate (see also Ref. [39]).

Value linking incorporates the benefits and costs in other (functional) areas. A typical example of *value acceleration* is the interest savings that can be achieved by repaying an outstanding loan with the accelerated recovery of accounts receivable. Meanwhile, *value restructuring* refers to the efficiency and effectiveness of employees: Does the new system free up more time for employees to execute their own jobs? *Strategic IS architecture* assesses the degree to which the project fits into the IS plan.

Business strategic risk and *IS strategic risk* refer to the degree of risk in terms of how well the company and the IS department, respectively, succeed in achieving their strategic objectives. *Definitional uncertainty* indicates the degree of risk in terms of how clearly the functional requirements and specifications have been agreed upon. *Technical uncertainty* relates to the risk associated with dependence on immature, 'bleeding edge' technologies. *Operational risk* (or business organization risk) and *IS service delivery risk* reflect the degree of risk in terms of how well the company and the IS department, respectively, will be able to adapt to the changes invoked by the project.

The principles of information economics are clearly useful in determining the business value of an IS project or the IS function as a whole. However, they fail to account for other perspectives that are also important to IS measurement and evaluation. Measuring and evaluating IS from multiple perspectives (cf. Ref. [3]) and in assorted ways is helpful to assess its efficiency, effectiveness and transformative potential, both at present and in the future. Our balanced IS scorecard includes three additional perspectives that are detailed in the sections that follow.

5. Measuring and evaluating user orientation

The end-user of an IS may be an internal customer or in another company that is utilizing an inter-organizational system. However, in contrast to the large potential market for the products and services of most companies, an IS department or function usually has limited opportunities to attract new customers, although we acknowledge that this may change in the expanding electronic marketplace. Given these circumstances, the satisfaction of existing customers will be much more important than building up market share or acquiring new customers. Indeed, it will be critical to monitor existing customer satisfaction on a frequent basis, especially if they can select among alternative suppliers of IS services. As a result, we suggest that the metrics for the user perspective focus on three areas: (1) being the preferred supplier for applications and operations; (2) establishing and maintaining relationships with the user community; and (3) satisfying end-user needs.

The percentage of IT applications that are managed and delivered by the IS department will depend heavily on the company-specific situation. When a company sets the ratio of internal vs. external development, it makes a strategic choice. During this process, decision makers are likely to employ heuristics such as wanting to develop and support strategic, highly competitive projects with in-house expertise while outsourcing routine and non-strategic projects [28].

IS specialists will need to establish and maintain relationships with the community of current and potential users in order to understand and anticipate their needs. Such a relationship will also be the basis for building up the credibility of the IS department and function and creating trust between developers and users.

User satisfaction should play an important role in the overall evaluation of the IS department or function. From the end-user's perspective, the value of IS will be based largely on the extent to which it helps them do their jobs more efficiently and effectively. For example, managers will rely on IS outputs to monitor and control both the internal and external business environment, and help them make better decisions.

A broad cross-section of end-users (and ideally every member of the user community) should be surveyed periodically using quantitative methods. In addition, semi-structured interviews are recom-

mended in order to gain deeper insights. If the IS department 'loses' an important customer, detailed follow-up efforts to ascertain the reasons behind this loss would be appropriate.

The indices resulting from involvement surveys are very important, but they must be treated with care. It is useful to distinguish between objective and subjective measures (see Ref. [17]). The indices resulting from surveys are clearly subjective measures, as opposed to many of the other measures that are part of a balanced IS scorecard. More objective measures may be obtained from systems usage data. BSC does not explicitly prescribe a set integration of objective and subjective measures, since management must decide what it wants to do with the information presented, for example when weighting different measures in a DSS.

Table 5
Measures for the internal process perspective

Planning
Percentage of resources devoted to planning and review of IS activities
Development
Percentage of resources devoted to applications development
Time required to develop a standard-sized new application
Percentage of applications programming with re-used code
Time spent to repair bugs and fine-tune new applications
Operations
Number of end-user queries handled
Average time required to address an end-user problem

6. Measuring and evaluating internal processes

Internal operations may be assessed by measuring and evaluating three of the basic processes performed by the IS department: (1) the planning and prioritization of IS projects; (2) the development of new IT applications; and (3) the operation and maintenance of current IT applications. Other processes may also be considered, such as hardware and software supply and support, problem management, user education, the management of IS personnel, and their usage of efficient communication channels.

The IS department or function should aim to deliver high-quality services to its users at the lowest possible cost. This can only be achieved by managing its processes in a cost-efficient manner. Areas for improvement by monitoring the operational measures displayed in Table 5. These measures should not only be followed through time, but should also be compared to industry standards and averages. It is also important to use a standard set of metrics.

Our recommendations can be illustrated by considering software development. The lack of reliable size and complexity metrics in this activity area has contributed to notorious difficulties in setting and adhering to project budgets and schedules [49]. Standard metrics such as *lines of code* or *function points* have proved to be useful in overcoming these difficulties and enabling the evaluation of software programming productivity [49,51].

The lines of code metric has several variations, such as counting only executable lines or logical lines. Differences in counting methods can make it difficult to precisely define the number of lines of code. Perhaps more importantly, this metric is subject to misinterpretation, because more lines of code may reflect programming inefficiency rather than additional functionality or programming features. In the same way, the different levels of expressiveness inherent in different languages will also affect the number of lines of code that are typically generated for a given program. Given these provisos, however, it is a relatively simple and straightforward operational measure.

Function points measure software size based on a structured evaluation of user requirements [47]. They are independent of the development methodology, tools or language used to build the software. Function point analysis is used widely to measure the number of inputs, outputs, inquiries, and files used in an application. Such an analysis enables a calculation of the function points that a given programmer has completed in a specific unit of time. Despite its popularity for benchmarking the productivity of programmers, it must be recognized that the effort associated with the development of a given IT application will also be based on factors such as the language, tools, and methods employed, and the skills of the project team.

The measurement and evaluation of IS planning, development and maintenance activities should yield useful data about the productivity of different resources. Managers can be informed about the performance of specific people and technologies on specific projects and compare the productivity of internal staff with that of contractors. This will enable them to pinpoint problem areas more easily and produce better estimates of the time and resources needed to complete specific projects.

Demand for services can be expanded in two alternative ways: by finding new customers for existing services or providing additional services to existing customers. By monitoring both the customer and internal process perspectives, IS managers will know what the demand is for different services and how efficiently they can provide those services. As a result, this will put them in a better position to decide what services they will provide, and to whom, and what resources will be needed to meet particular levels of service demand.

7. Measuring and evaluating future readiness

In addition to managing current performance, there is also a need to measure and evaluate the readiness of the IS department or function for the future. The future readiness perspective is concerned with: (1) continually improving the skillset of IS specialists in order to prepare them for potential changes and challenges in the future; (2) regularly updating the applications portfolio; and (3) putting effort into researching emerging technologies and their potential value to the organization. Taken together, such preparations can establish an organizational vision for the assimilation and application of a new technology, such as knowledge-based systems (see Ref. [32]), or the re-engineering of a particular business process set [48].

The idea of a knowledge-based systems application may be extended to develop an enterprise modeling system, which is essentially a ''knowledge centric, enterprise wide decision support system'' ([1], p. 100). This system is designed to operate in conditions that are imprecise and uncertain, where human factors play a major role in business processes and the economic environment is incompletely known, while there is a considerable degree of ambiguity relating to future events. Such a system would automatically build and execute task-specific models in response to user requests employing AI techniques (see also Ref. [19]).

Clearly, the ability of IS to deliver quality services and to lead new technology assimilation efforts in the future will depend on the preparations that are made today and tomorrow. IS managers must assess future trends and anticipate them. Unanticipated circumstances can probably be dealt with through extensive external (often high-priced) support. However, the preferred course of action is to train and develop internal people so that when specific expertise is needed, it can be found in-house.

Table 6 reflects the need to (1) continually enhance the skills of IS specialists; (2) periodically upgrade the applications portfolio in order to take advantage of technological advances; and (3) gain a thorough understanding of emerging technologies as well as their specific suitability to the company's IS architecture. Meanwhile, Fig. 3 illustrates how innovation and learning efforts can raise competence levels that in turn will improve business performance

Table 6
Measures for the future readiness perspective

IS specialist capabilities
IS training and development budget as a percentage of the overall IS budget
Expertise with specific existing technologies
Expertise with specific emerging technologies
Age distribution of IS staff
Perceived satisfaction of IS employees
Turnover/retention of IS employees
Productivity of IS employees
Applications portfolio
Age distribution
Platform distribution
Technical performance of applications portfolio
User satisfaction with applications portfolio
Research into emerging technologies
IS research budget as a percentage of the overall IS budget
Perceived satisfaction of top management with the reporting on how specific emerging technologies may or may not be applicable to the company

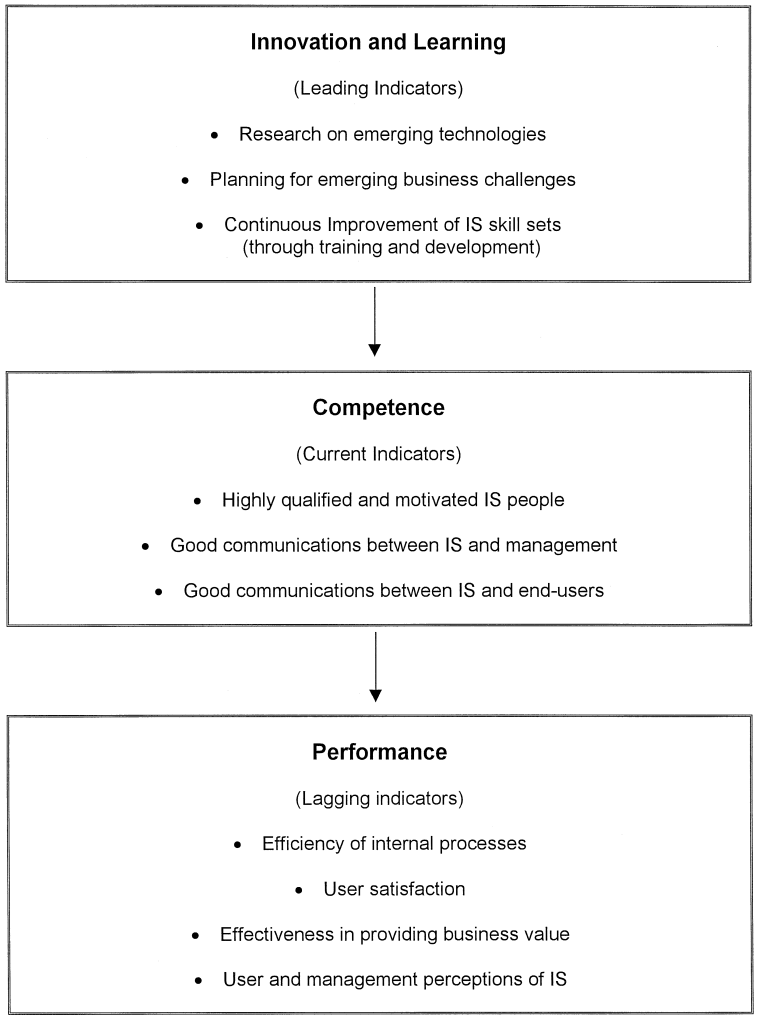

Fig. 3. How innovation and learning lead to future performance improvements.

in the future. Perhaps paradoxically, the current indicators (of competence) may be more difficult to measure than either the leading (innovation) or lagging (performance) indicators.

8. Building a balanced IS scorecard

In building a company-specific balanced IS scorecard, the following steps are recommended:

1. create an awareness for the concept of the balanced IS scorecard among top management and IS management;
2. collect and analyze data on the following items:
   - corporate strategy, business strategy, and IS strategy;
   - specific objectives and goals related to the corporate, business and IS strategy;
   - (traditional) metrics already in use for IS performance measurement; and
   - potential metrics related to the four balanced IS scorecard perspectives;
3. clearly define the company-specific objectives and goals of the IS department or functional area from each of the four perspectives;

4. develop a preliminary balanced IS scorecard based on the defined objectives and goals of the enterprise and the approach outlined in this paper;
5. receive comments and feedback on the balanced IS scorecard from management, and revise it accordingly;
6. achieve a consensus on the balanced IS scorecard that will be used by the organization; and
7. communicate both the scorecard and its underlying rationale to all stakeholders.

It is essential to have a common understanding of the corporate-level strategy and the IS strategy, and have well-defined specific goals related to each before developing the balanced IS scorecard. Such a scorecard need not dictate the relative emphasis that should be placed on the four perspectives, but will likely be useful to remind both business and IS managers that these different perspectives do exist.

The metrics included in the balanced IS scorecard should meet three criteria. They should be quantifiable, easy to understand, and ones for which data can be collected and analyzed in a cost-effective manner. It is recognized that certain attributes, such as the quality of decision-making, do not have metrics that can be measured directly in quantitative terms. In such cases, it will be important to relate these attributes to other ones that can be quantified, like the perceived effectiveness of a manager, as rated by others on a pre-determined scale.

Kaplan and Norton [24] also stress the importance of adhering to three principles in order to develop a balanced scorecard that is more than a group of isolated and eventually conflicting strategies and measures:

- build in cause-and-effect relationships;
- include sufficient performance drivers;
- provide a linkage to financial measures.

8.1. Cause-and-effect

A strategy is a set of assumptions about cause-and-effect. If cause-and-effect relationships are not adequately reflected in the balanced scorecard, it will not translate and communicate the company's vision and strategy. These cause-and-effect relationships can involve several or all four of the perspectives in the BSC framework. For example, better staff skills (future readiness perspective) will reduce the frequency of bugs in an application (internal operations perspective). An application with fewer bugs will be more likely to meet end-user expectations (user orientation perspective). This in turn will enhance the support of core business processes (business value perspective).

8.2. Performance drivers

A well-built balanced scorecard will include an appropriate mix of *outcome measures* and *performance drivers*. Outcome measures like programmers' productivity (number of function points per person per month) without performance drivers like staff education (number of educational days per person) do not communicate how the outcomes are to be achieved. Furthermore, performance drivers without outcome measures may enable the achievement of short-term operational improvements, but will fail to reveal whether the operational improvements have been translated into enhanced financial performance.

An IS services department may invest significantly in staff training in order to improve employee productivity. If, however, there is no outcome measure for employee productivity (e.g., lines of code or function points), if it will be difficult for IS management to determine whether its strategy has been effective. Outcome measures are more or less generic (user satisfaction, productivity, employee satisfaction), but performance drivers are more company-specific and will often be based on the particular strategy that is being pursued.

8.3. Linkage to financial measures

The ultimate aim of many balanced IS scorecards will be to support the management of IS performance in a manner that improves the overall financial outcomes of the enterprise. ''A failure to convert improved operational performance into improved financial performance should send executives back to the drawing board to rethink the company's strategy or its implementation plans'' [24]. Further, we must continuously keep in mind the fact that measure-

ments are not enough, since they must be used and acted upon by management. The balanced scorecard is not only an operational tool, but it can also be the foundation for a strategic management system.

The following steps may be appropriate in order to implement effectively the balanced IS scorecard as a strategic management system [24]:

- Clarify and translate the vision and strategy into specific action programs;
- Link strategic objectives to team and individual goals;
- Link strategic objectives to resource allocation;
- Review performance data on a periodic basis, and adjust the strategy as appropriate.

8.4. Format and content of outputs

The balanced scorecard that we are presenting here is essentially non-prescriptive, since all organizations are unique and management will weight different measures accordingly during its decision-making. However, we can envisage a situation where a balanced scorecard is implemented, for example, as an Executive Information System with data feeding into the system on-line rather than in quarterly or other asynchronous reports. Referring to Fig. 2, a manager would therefore be able to 'click' on the 'goals' or 'measures' of one of the perspectives, and thereby drill down to extract current data on measures previously selected as being relevant to those goals. Brynjolfsson et al. [7] note that managing and coordinating increasingly complex systems requires increasingly sophisticated tools. These tools must, however, be supported by mutually reinforcing practices. Existing practices may need to change and it is the cultural characteristics of a business organization that will determine its receptiveness to change. This organizational *distinctiveness* or *uniqueness* will influence both the format of outputs and the way that they are used.

9. Putting our proposal into practice

A few pioneering organizations have applied the balanced scorecard concept to their information systems management. The authors have recently observed the implementation of balanced IS scorecards in three large companies in Hong Kong. The evidence from these cases suggests that several common errors must be avoided when implementing this concept. Three of these errors are discussed below:

1. failure to include specific long-term objectives;
2. failure to relate key measures to performance drivers by means of cause-and-effect relationships; and
3. failure to communicate the contents of, and rationale for the balanced IS scorecard.

A balanced IS scorecard can easily become part of the operational-level management system rather than serving as the foundation for a strategic management system. In two of the three observed cases, this was due largely to the absence of specific long-term objectives, particularly related to the *future readiness* perspective. With a continuing emphasis on short-term goals, the performance objectives are unlikely to represent much of a change from 'business as usual' (see Ref. [15]).

The strategic performance objectives in the organizations we observed were sub-optimal and rather modest, or else peripheral to improvements in systems performance. As a result, we believe that the effectiveness of a BSC for IS will be enhanced by including stretch goals that require significant improvements in key areas.

Each of the observed companies was only able to identify a few cause-and-effect relationships and performance drivers during their development of a balanced IS scorecard. In one case, system availability, responsiveness to user requests, and timely delivery of new IT applications were agreed to be performance drivers for user satisfaction. However, the management team neglected to specify how the performance in these three areas would be improved.

We would suggest that such improvements are possible through different mechanisms, including the development of employee skills, the adoption of new development tools, and/or the employment of better project management methods. As a result, we propose that explicit cause-and-effect relationships be identified before a balanced IS scorecard is implemented. It is critical not only to relate performance drivers to the performance measures in each key area, but also to consider *how* each of the perfor-

mance drivers will significantly improve one or more key measures of performance.

We also observed a surprising lack of intra-organizational communication as the balanced IS scorecards were being developed. For example, in two cases, the draft version of the balanced IS scorecard was only circulated to two or three members of the top management team and the IS manager/chief information officer. The IS specialists were not told about the scorecard's content or rationale. Not surprisingly, they had little enthusiasm for a commitment to this concept.

Moreover, individual performance objectives and appraisal criteria for the IS specialists were not linked directly to the balanced IS scorecard. As a result, we wish to stress the importance of broadly communicating both the purpose and content of the scorecard and firmly integrating it into the company's performance management system. Scorecard templates and results that are communicated to employees using electronic mail or bulletin boards can motivate their efforts and reward them for meeting targets. Our discussions and limited testing with staff members in the three companies also suggest that graphical rather than tabular presentation formats be employed.

The cases we studied reinforced a belief that while the specifics of a balanced IS scorecard will differ from company to company, it is beneficial to build upon a standard framework, such as the one presented here, rather than starting from scratch. In one case where a clean-sheet approach was employed, the user perspective contained some measures that were clearly related to internal operations, the business value perspective was poorly developed, and the internal operations perspective neglected measures for hardware acquisition, problem management, and user training.

Additional case studies are likely to reveal other barriers, obstacles and errors that can hinder the success of balanced IS scorecards. We would like to encourage further study in this area as well as reporting that not only focuses on implementation barriers, but also considers the ways and means that may be used to overcome them. In particular, many organizations have now established software measurement systems that could serve as a useful foundation for the broader and more difficult task of developing and successfully implementing a balanced IS scorecard. For example, managers at Motorola identified seven software development goals and then developed metrics for specific attributes, such as the effectiveness of the defect detection and fault containment processes [11]. Research of efforts to subsequently expand these software measurement programs into a balanced IS scorecard is likely to interest a wide range of business practitioners and academics.

10. Conclusions and implications

We have proposed the application of the balanced scorecard concept to business functions, departments and even individual projects. This paper has considered the use of a BSC framework to measure and evaluate IT application projects and the IS department or functional area as a whole. A concept initially proposed as a decision-making tool for senior business managers (see Ref. [21]) was examined in the IS management domain by proposing and detailing four IS evaluation perspectives: business value, user orientation, internal processes, and future readiness. We have also considered specific metrics for each of the perspectives.

At this early stage of theorizing, the four perspectives and especially the related metrics represent a template rather than a definitive strategic IS measurement and management system. Future research is recommended in order to determine whether the proposed perspectives and measures are a necessary and sufficient set. Nevertheless, the framework does represent a strategic IS management tool that can be used to monitor and guide specific projects as well as general performance improvement efforts.

The balanced IS scorecard will allow managers to see the positive and negative impacts of IT applications and IS activities on the factors that are important to the organization as a whole. The value of the balanced IS scorecard rises if it is used to coordinate a wide range of IS management processes, such as individual and team goal-setting, performance appraisal and rewards for IS personnel, resource allocation, and feedback-based learning. The management of both IS people and projects are likely to benefit

from a systematic framework based on goals and measures that are agreed upon in advance.

Measurement is a prerequisite to management. Kaplan and Norton ([24], p. 21) suggest that ''If you can't measure it, you can't manage it.'' As a result, we are convinced that the balanced scorecard concept can be useful to IS managers as well as general managers. However, our experience indicates that the implementation and maintenance of a balanced scorecard, at either the enterprise or sub-enterprise level, faces several key obstacles. Business success with a balanced scorecarding approach requires a substantial commitment from key stakeholders. The total cost of implementing such a tool may be relatively small if data for many of the agreed-upon metrics is already being collected for other purposes.

Few of the metrics and measures considered here are new. However, with the balanced IS scorecard, they are used and combined in a novel way. The framework presented here builds upon a literature that goes back about two decades to Hamilton and Chervany [17]. They defined the primary IS goal as the development and maintenance of information systems that support corporate goals, and also distinguished between efficiency and effectiveness measures, 'doing things right' and 'doing the right things', respectively.

Building upon this viewpoint, IS can be evaluated in terms of (1) the efficiency of the activities associated with IS development and operations; and (2) its contribution to the effectiveness of those that use IS to improve personal productivity and strive to help attain corporate goals. The balanced IS scorecard integrates these two dimensions. Efficiency is most directly addressed by the internal processes perspective while effectiveness is addressed by the business value and user orientation perspectives. Significantly though, the future readiness perspective in our framework adds a dynamic and strategic dimension to earlier IS evaluation models by recognizing the importance of innovation and learning.

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