Constructing a strategy map for banking institutions with key performance indicators of the balanced scorecard

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ABSTRACT

This study presents a structural evaluation methodology to link key performance indicators (KPIs) into a strategy map of the balanced scorecard (BSC) for banking institutions. Corresponding with the four BSC perspectives (finance, customer, internal business process, and learning and growth), the most important evaluation indicators of banking performance are synthesized from the relevant literature and screened by a committee of experts. The Decision Making Trial and Evaluation Laboratory (DEMATEL) method, a multiple criteria analysis tool, is then employed to determine the causal relationships between the KPIs, to identify the critical central and influential factors, and to establish a visualized strategy map with logical links to improve banking performance. An empirical application is provided as an example. According to the expert evaluations, the three most essential KPIs for banking performance are customer satisfaction, sales performance, and customer retention rate. The DEMATEL results demonstrate a clear road map to assist management in prioritizing the performance indicators and in focusing attention on the strategy-related activities of the crucial indicators. According to the constructed strategy map, management could better invest limited resources in the areas that need improvement most. Although these strategy maps of the BSC are not universal, the research results show that the presented approach is an objective and feasible way to construct strategy maps more justifiably. The proposed framework can be applicable to institutions in other industries as well.

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1. Introduction

As a result of the global financial crises beginning in mid-2007, international stock markets have sharply crashed, and numerous enterprises have collapsed or have been bought out (Shah, 2009). Financial institutions in particular have encountered more competitive challenges worldwide during the chain effects of the financial "tsunami." It is therefore imperative that banking institutions enhance their competitive advantages in order to outperform the numerous competitors in the industry. These institutions must place more emphasis on improving internal operational performance (Davis & Albright, 2004; Littler, Aisthorpe, Hudson, & Keasey, 2000). Banking institutions must develop an effective way to align their strategies with corporate goals on the basis of performance analyses. The structural analysis of an evaluation model that links strategic objects as effective improvement paths becomes a critical issue for banking institutions if they are to sustain their competitive advantages.

Several analysis models have been applied to organizational performance measurement for years (e.g., ratio analysis, total production analysis, regression analysis, Delphi analysis, balanced scorecard (BSC), analytic hierarchical process (AHP), and data envelopment analysis (DEA)). These approaches vary regarding their basic concepts, aims, advantages, and disadvantages (Dessler, 2000). The analytical methods or tools chosen for performance analysis by management depend on the situation and the type of organization. Nevertheless, most successful organizations have common characteristics, including specific visions, positive actions, and effective methods of performance measurement (PwC, 2009a, 2009b). Moreover, performance management is most effective when objectives beyond operational variables are incorporated logically, with an understanding of strategic effectiveness enabled by the appropriate analytical systems (Barlas & Yasarcan, 2006; Wright & Taylor, 2001). Thus, the strategic steps aligning an organization's objectives with a corporation's specific visions are most important for organizations to achieve effective performance management (Schalock & Bonham, 2003; Sridharan, Go, Zinzow, Gray, & Gutierrez Barrett, 2007). Organizations can efficiently reach their goals by prioritizing their actions in order to fulfill corporate visions and by incorporating effective performance management. The BSC is an adequate evaluation methodology for achieving these goals (Davis & Albright, 2004). The BSC stresses financial and nonfinancial aspects, long-term and short-term strategies, and internal and external business measures (Kaplan &

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Norton, 1992). Through the BSC, management can not only communicate well with their employees but also control the progress of strategic development in order to improve organizational performance and to increase competitiveness.

Because of the intangible nature of the products and services provided by banking institutions, one cannot easily measure the efficiency and competitiveness of banking products and services. Most available research has focused on gauging the productivity and efficiency of the banking industry by measuring outputs, costs, and performance (Kosmidou, Pasiouras, Doumpos, & Zopounidis, 2006). Moreover, many of the studies only use financial ratios to evaluate banking performance. Most of the traditional performance measures in banking focus on external financial reporting (Hepworth, 1998). However, focusing solely on these external reports has kept banks from long-term learning, growing, innovating, and planning (Chia & Hoon, 2000; Davis & Albright, 2004; Ko & Lee, 2000). Furthermore, banks need to completely reassess their performance measurement in order to adapt to constantly changing customer needs and requirements. To achieve more effective performance, banks must align their goals with those of their clients' services (Nist, 1996).

Banking institutions as well as other organizations have widely applied the BSC not only as the key to achieving a successful execution of strategic plans (Frigo, Pustorino, & Krull, 2000) but also for strategic development and performance measurement (Aranda & Arellano, 2010; Banker, Chang, & Pizzini, 2004; Littler et al., 2000). A number of studies have researched the BSC implementation (Aranda & Arellano, 2010; Banker et al., 2004; Bhagwat & Sharma, 2007; Chan, Gaffney, Neailey, & Ip, 2002; Chen, Chen, & Peng, 2008; De Silva, Tadashi, & Kikuo, 2005; Fernandes, Raja, & Whalley, 2006; Hsu, 2005; Kaplan & Norton, 1992, 1996a, 1996b; Littler et al., 2000; McNamara & Mong, 2005; Mearns & Havold, 2003; Norton, Contrada, & LoFrumento, 1997; Wu, Tzeng, & Chen, 2009) and strategy maps (Kaplan & Norton, 2004a, 2004b) of the banking industry. However, most of the BSC-related studies have focused mainly on performance measures; only a few papers have examined the creation of a mechanism that distinguishes causal relationships between key performance indicators (KPIs) for the purposes of strategy implementation. To enhance banking performance, BSCs should be incorporated into performance measurement models not only through properly screening effective evaluation indicators for performance measurement but also through constructing feasible strategy maps motivated toward the development of improvement programs (Chia & Hoon, 2000; Schalock & Bonham, 2003; Sridharan et al., 2007; Wu, Lin, & Chang, 2011).

Of the related studies, almost none purposely presents a plan for the construction of strategy maps; rather, these studies mainly focus on the generic framework of the four BSC perspectives for performance measurement (Jassbi, Mohamadnejad, & Nasrollahzadeh, 2011). Strategy mapping is the most important procedure in building a BSC system since the strategy map can be viewed as the causality of hypothesis between strategic objectives (measured by KPIs) in the main structure of a BSC system (Kaplan & Norton, 2004a). Therefore, establishing strategy maps with clearly causal/ logical links leads to the establishment of strategic pathways throughout the organization (Evans, 2007). However, numerous companies dilute the efforts of their BSC systems as a result of basic mistakes in mapping (Makhijani & Creelman, 2008). In addition, there is a lack of the articulation of the cause-and-effect relationships between some of the suggested areas of measurement in the BSC (Malina, Nørreklit, & Selto, 2007; Malmi, 2001; Nørreklit, 2000, 2003). Although Thakkar, Deshmukh, Gupta, and Shankar (2007) have proposed an ISM model for the connection of strategic objectives, only causal directions are taken into account. Two other BSC-related studies by Tseng (2010) and Jassbi et al. (2011) use the Decision Making Trial and Evaluation Laboratory (DEMATEL) to

build strategy maps, but these studies categorize performance indicators into "cause groups" and "effect groups," with no in-depth analyses of the complex interactive relationships among indicators. As a result, our proposed model of the establishment of strategy maps, which takes into consideration the impact (including both influential directions and strengths) of KPIs, can fill the apparent gaps in the literature (Malina et al., 2007; Malmi, 2001; Nørreklit, 2000, 2003). In other words, the main theme of the current study is to propose a methodology to establish the BSC strategy map and provide profound analysis of the complicated interactive relationships (influential directions and strengths) among the KPIs. Therefore, the term "strategy" referred by the strategy map here, is specifically defined the "logical links" (causal relationships) among the KPIs, demonstrating the central KPIs and the prioritization of strategic steps linked by the KPIs.

Thus, according to the four perspectives of the BSC, the DEMATEL method (Gabus & Fontela, 1972, 1973) is proposed as a tool with which to scrutinize the cause-and-effect relationships between banking performance indicators in order to establish strategy maps. The purpose of this research is as follows: (1) to organize suitable KPIs for the evaluation of banking performance based on the BSC perspectives; (2) to use the DEMATEL technique to explore the complex causal relationships among KPIs and to identify the critical central indicators and effective prioritization of the strategic steps in order to construct the strategy map for banking performance improvements; and (3) to provide suggestions from the analytical results and references for the management of associated organizations as well as for future research.

The remainder of this paper is organized as follows: the literature related to banking performance measurement is reviewed in Section 2. In Section 3, the concepts of BSC and strategy maps are introduced. The proposed framework of constructing a strategy map by the DEMATEL method is described in Section 4. Section 5 illustrates an empirical example of a banking strategy map, including the selection of the indicators of BSC performance measurement, the construction of the strategy map, and the resulting analyses and discussions. Finally, some of the important managerial implications and suggestions for future research are proposed in Section 6.

2. Performance measurement of banking

The definitions of banking performance measurement and the related evaluation indicators selected by previous studies are briefly summarized as follows.

2.1. Definitions of performance measurement

Rue and Byars (2005) suggest that performance measurement includes the way employees refine their work and how they establish decision-making and the communication processes of improvement plans. Kaplan and Norton (1992) describe performance measurement as a way to review an organization's financial and nonfinancial goals. Numerous performance management topics and examples have been demonstrated in the literature on performance measurement (McNamara & Mong, 2005). Traditional performance rankings rely on simple and consistent financial data, such as return on earnings (ROE) and return on assets (ROA) data. However, these performance rankings may not highlight strategies that lead to top performance (Hanley & Suter, 1997). Nonfinancial criteria such as customer satisfaction, communities (e.g., "job creation and retention," "spurring community revitalization"), and employees (e.g., "employees' professional training," "employee stability") can be vital to a bank's winning strategy. Using only ROA or ROE for performance ranking does not necessarily indicate which institutions offer the highest

returns for their investors, and it does not accurately determine which institutions are the most profitable (Bhagwat & Sharma, 2007). Therefore, performance measurement should be integrated with the overall strategy of the business and should include comprehensive criteria (i.e., both financial and nonfinancial indicators) that an organization can establish within its programs, investments, and acquisitions for reaching the desired results. These criteria can help organizations identify performance problems, address root causes, drive improvement activities, and bridge the gap between short-term market or stakeholder expectations and the long-term business or organizational goals/ objectives. In addition, performance measurements must be prioritized and focused so that only the strategic terms of the KPIs for the business are measured.

There are many ways to evaluate banking performance (Kosmidou et al., 2006). Many related studies have investigated the economies of scale and economies of scope of banking performance by applying traditional statistical methods, such as canonical correlation analysis (Arshadi & Lawrence, 1987), translog cost function (Gilligann, Smirlock, & Marshall, 1984; Molyneux, Altunbas, & Gardener, 1997; Murray & White, 1983), loglinear models (Giokas, 1991), and other tools, such as DEA (Athanasso- poulos, 2000; Athanassopoulos & Giokas, 2000; Drake, 2001; Giokas, 2008). These studies adopted different analytical methods and mainly aimed to investigate the productivity and efficiency of banking institutions with regard to financial indicators. Some of the important research on the evaluation indicators of banking performance is explored in the next section.

2.2. Evaluation indicators of banking performance

Performance measurement can be defined as a system by which a company monitors its daily operations and evaluates whether it is attaining its objectives (Lebas, 1995). A series of indicators that properly reflects company performance should be set up to fully utilize the function of performance measurement. These indicators can be quantifiable or unquantifiable. For example, an indicator such as lead time is understood as a quantifiable (or financial) measure whereas the degree of customer satisfaction is catego- rized as an unquantifiable (or nonfinancial) measure. Table 1 summarizes the selection indicators (criteria) of banking perfor- mance measurement that have been investigated in several important studies, along with their main analytical methods. According to Table 1, the selection indicators (criteria) can consist of financial measures (e.g., interest costs, process quality errors, return on average assets) and/or nonfinancial measures (e.g., human resource management, service quality, competitive posi- tioning), depending on which methodology is used.

Referring to the relevant studies summarized in Table 1, the analytical methods, including transitional statistical analysis, structural equation modeling (SEM), DEA, multicriteria classifica- tion methodology, and case studies, have been adopted for banking performance measurement. For instance, two studies (i.e., Arshadi & Lawrence, 1987; Devlin & Gerrard, 2005) employ statistical analyses. Arshadi and Lawrence (1987) have conducted an empirical study on investigating the performance of newly chartered banks with canonical correlation analysis (CCA). In particular, they found that a bank's cost structure, size, and loan portfolio were the most critical determinants of a new bank's success. In the study by Devlin and Gerrard (2005), data were drawn from a questionnaire survey that collected the responses of 495 consumers regarding their financial service relationships. The authors performed a statistical analysis of consumer choice criteria and presented an itemized comparison of the relative importance of the selection criteria for main and secondary banking institutions. Of the 12 choice criteria reconciled with previous

studies (Table 1), these findings reveal that the four most important categories, including "Location (home)," "Family relationship," "Recommendation," and "Location (home)," are common for both main and secondary banks. Collier (1995) defined the performance relationships of banks' service processes using SEM. The results indicate that labor productivity, on-time delivery, and unit cost performance improve performance while process quality errors decrease performance. Employee turnover also has a significant impact on process productivity and on unit cost performance.

Two studies (i.e., Chen et al., 2008; Giokas, 2008) have used the DEA technique to analyze banking performance. Chen et al. (2008) combined the BSC concept with a DEA model to measure banking performance. The results show that, although a DEA-based evaluation of performance generates a comparable view of the firm's well-being (as does an analysis of financial indices), considering only the financial perspective will not be enough to reach the highest levels of technical efficiency. Giokas (2008) employed the DEA with internal costs as inputs and profitability as outputs in order to assess the Greek bank branches in terms of their performance in three different models: Production, Transaction, and Intermediation. Their research findings imply that there will be a substantially increasing profit produced for the bank if it can generate efficiency improvement at the worst-performing branches.

In addition, utilizing the financial ratios of the banking data, Kosmidou et al. (2006) took the PARCLAS approach, a multicriteria classification methodology, to explore the differences of perfor- mance between the large and small banks and to determine the performance factors that distinguish them. They found that small banks show higher overall performance than large banks. The performance factors including noninterest expenses/average assets, loan loss provisions/net interest, interbank ratio, equity/ total assets, and equity/net loans, can help to significantly differentiate small banks from large banks. Meyer and Markiewicz (1997) developed a case study to form a team to build a BSC for a bank institution. This study team concluded that a performance- measurement system should place great emphasis on executive, managerial, and operational performance within the new strategy. They interviewed more than 60 individuals and groups (including top managers, business unit managers as well as managers in the operational/administrative areas) to create scorecards established around each unit's declared strategy, the following critical success factors, and the most appropriate measures, grouped into eight categories (Table 1).

As stated previously, most prior studies have emphasized the evaluation of the productivity and efficiency of banking institutions by measuring outputs, costs, and performance (Kosmidou et al., 2006). In addition, many of these studies have mainly used financial indicators (e.g., bank assets, loan, deposits, liabilities, interest income, operating costs) to evaluate banking performance (Arshadi & Lawrence, 1987; Collier, 1995; Giokas, 2008; Kosmidou et al., 2006). A relatively large number of studies, such as Anderson, Cox, and Fulcher (1976), Boyd, Leonard, and White (1994), Chia and Hoon (2000), Devlin (2002), Devlin and Gerrard (2005), Elliot, Shatto, and Singer (1996), Lee and Marlowe (2003), and Martenson (1985), have focused on customers and their choices in the context of banking services (Devlin & Gerrard, 2005; Lymperopoulos, Chaniotakis, & Soureli, 2006). These studies recommend measuring performance using common performance indicators (e.g., price, speed, accessi- bility, customer service, location, image and reputation, modern facilities, interest rates, opening hours, incentives offered, product range, and service charge policies) rather than evaluating improve- ments in the implementation of the bank's strategy.

As we have articulated, the BSC is a successful strategic performance management tool suitable for the banking sector;

Table 1
Summary of selection indicators (criteria) of banking performance measurement investigated in the different studies with their main analytical methods.

Studies	Analytical methods	Selected indicators (criteria)	
Arshadi and Lawrence (1987)	Statistical analysis	• Cost structure • Size • Composition of the loan portfolio	• Operating costs • Deposit growth
Chen et al. (2008)	DEA-BSC	Inputs • Employee numbers • Bank asset • Bank deposit	Outputs • Bank loan • Member households • Fee income
Collier (1995)	Structural equation models	• Process quality errors • Employee turnover rate • Labor productivity	• On-time delivery • Unit cost
Devlin and Gerrard (2005)	Statistical analysis	• Image and reputation • Branch opening hours • Competitive interest rate paid • Low fees/overdraft charges • Location (near home) • Location (near work)	• Product range • Service expectation • Recommendation • Family relationship • Home banking option • Incentive offered
Giokas (2008)	DEA	Production efficiency Inputs • Personnel costs • Running and other operating costs Transaction efficiency Inputs • Personnel costs • Running costs and other operating costs Intermediation efficiency Inputs • Interest costs • Non-interest costs	Outputs • Value of loan portfolio • Value of deposits • Non-interest income Outputs • Loan transactions • Deposit transactions • Remaining transactions Outputs • Interest income • Non-interest income
Kosmidou et al. (2006)	PARCLAS (Mulicriteria classification methodology)	• Loan loss provisions/net interest • Equity/total assets • Equity/net loans • Equity/customer and short-term funding • Equity/liabilities • Capital funds/liabilities	• Net interest margin • Other operating income/average assets • Non interest expenses/average assets • Net interest income/average assets • Return on average assets (ROAA) • Recurring earning power
Meyer and Markiewicz (1997)	Case study-BSC	• Profitability • Efficiency and productivity • Human resource management • Risk management	• Interbank ratio • Sales effectiveness • Service quality • Capital management • Competitive positioning

banks can benefit from its applications in performance measurement and strategy alignment (Aranda & Arellano, 2010; Chen et al., 2008; Davis & Albright, 2004; Frigo et al., 2000; Littler et al., 2000; Meyer & Markiewicz, 1997). Therefore, numerous studies (e.g., Aranda and Arellano, 2010; Chen et al., 2008; Davis & Albright, 2004; Littler et al., 2000; Meyer & Markiewicz, 1997; Wu et al., 2009) have employed the BSC structure to focus on performance measurement for banking institutions rather than on creating strategy maps.

For instance, unlike most of the previous research on banking performance measurement using traditional statistical analysis (Arshadi & Lawrence, 1987; Devlin & Gerrard, 2005), SEM (Collier, 1995), and DEA (Giokas, 2008), Wu et al. (2009), Chen et al. (2008), and Meyer and Markiewicz (1997) adopt the four BSC perspectives, embracing both the financial and nonfinancial indicators, as a basic evaluation framework for measuring banking performance without attempting to establish strategy maps. Indeed, the above studies make no attempt at strategy mapping, which is nevertheless the vital part in constructing a BSC system that can assist management in identifying the causal relationships between performance indicators (Evans, 2007; Gonçalves, 2009; Kaplan & Norton, 2004a). As a result, there is a need not only to produce and properly screen effective criteria consisting of financial and nonfinancial indicators for banking performance measurement

but also to build efficient strategy maps that indicate the logical links between performance indicators in evaluating improvements for strategies (Chia & Hoon, 2000; Jassbi et al., 2011).

Generally, building a BSC strategy map can be viewed as a group decision-making process. The logical links among performance indicators are generated by the consensus of an expert group that assigns preferences between the indicators by rules of thumb. What is lacking is a systematic approach for the exploration of the complex interactive relationships in establishing a strategy map (Jassbi et al., 2011). Therefore, utilizing the selection criteria (KPIs) of the BSC, the current research attempts to probe the causal relationships among the bank's KPIs for constructing its strategy map by linking these indicators together meaningfully as the bank's strategic improvement paths. The concepts of the BSC and strategy map are introduced below.

3. Balanced scorecard and strategy map

3.1. Balanced scorecard

Kaplan and Norton (1992) proposed the concept of the BSC. The BSC has been widely adopted in the evaluation of organizational performance from four perspectives: finance, customer, internal

business process, and learning and growth. These perspectives are associated with the four functions of accounting and finance, marketing, value chains, and human resources, respectively. The essential tenet of the BSC is that standard financial measures must be balanced with nonfinancial measures (Norton et al., 1997). Moreover, the financial and nonfinancial measures serve as the common language to help align top management and employees toward the organization's vision (Kaplan & Norton, 1996b). The BSC can be employed to connect vision with objectives and to translate strategies into actions (Davis & Albright, 2004; Kaplan & Norton, 2004a, 2004b). With the BSC, there should be a balance between performance drivers (leading indicators) and outcome measures (lagging indicators). Performance drivers communicate the way to achieve goals, and they indicate early on whether strategies are being implemented successfully. Outcome measures may enable the business unit to accomplish long-term operational improvements and to enhance financial performance. The ideal BSC should have an appropriate mix of performance drivers and outcome measures that have been tailored to the business unit's strategy (Frigo et al., 2000). The BSC provides managers with the instrumentation they need to navigate future competitive success (Kaplan & Norton, 1992, 1996a, 1996b).

Since the introduction of the BSC by Kaplan and Norton, a combination of financial and nonfinancial measures in a performance measurement system has been favorable for both profit and nonprofit organizations (Ballou, Heitger, & Tabor, 2003; Sinclair & Zairi, 2001). Likewise, banks can save an enormous amount of time and money if they understand which measures are best suited to their needs (Davis & Albright, 2004; Littler et al., 2000). Intangible, nonfinancial measures, such as customer relationships, may account for more than half of the company's total assets (Mouritsen, Larsen, & Bukh, 2005). Thus, nonfinancial measures can help lead organizations to administer performance effectively and forecast their future profitability.

Norton et al. (1997) classified the advantages of the BSC into three aspects: communication and teamwork, commitment, and feedback and learning. The BSC enables senior management to clarify vision, develop strategy, foster teamwork, and foster the commitment to a customer focus across the organization. Moreover, the BSC emphasizes ownership across the value chain; it helps employees better understand how they contribute to the overall achievement of the organization. Therefore, it is crucial to demonstrate the links between measures by displaying how performance indicators in one area affect performance indicators in other areas (Aranda & Arellano, 2010; Banker et al., 2004; Littler et al., 2000).

The benefits of using the BSC for banks are as follows: (1) it provides a framework to assess and develop a bank's strategy, (2) it develops strategic objectives and performance measures to translate a bank's strategies into actions, (3) it provides a way to measure and monitor the performance of key performance drivers that can lead to the successful execution of a bank's strategies, and (4) it is an effective tool to ensure continuous improvement in the systems and processes of banks (Frigo et al., 2000). While there are a number of advantages of the BSC, few possible negative aspects of its use have been discussed in the research. Pessanha and Prochnik (2006) provide some critical observations from a survey of the critics of BSC implementation in private organizations. First, they indicate that the inclusion of new BSC perspectives is promoted as a possibility by Kaplan and Norton (1996b), but that the method for implementing additional perspectives into the BSC is not clarified. Second, they note that the causal relationships among performance indicators are linear and tend to simplify reality. In other words, the circular results of the feedback (that each action influences and is influenced by other actions) and the existence of time spaces (simultaneously implemented actions have different paces of accomplishment) among the cause-and-effect indicators are not considered. Moreover, their findings reveal that financial measures still prevail over nonfinancial measures in the reported experiences of BSC implementation.

Moreover, in another study, Petersen and Samuels (2007) assert that in a real world scenario, managers restricted by time and resources may underperform on some measures, particularly when managers devote time and attention to attaining or surpassing targets on more important strategically linked (or SL) measures and therefore underperform on less important non-strategically linked (or NSL) measures. However, if both SL and NSL measures are contained in a BSC, managers may find their efforts distracted away from a SL measure in order to meet a target on a less important NSL measure. Even though strategy maps that are able to help identify SL measures are regarded as more important to these organizations (Banker et al., 2004), this research shows that the effectiveness of strategy maps is constrained in the presence of negative performance. In other words, these authors imply that only SL measures are necessitated in a BSC.

Some research has demonstrated how the financial industry employs a BSC to evaluate performance and benefit from its application (Aranda & Arellano, 2010; Chen et al., 2008; Davis & Albright, 2004; Littler et al., 2000; Meyer & Markiewicz, 1997). For instance, Davis and Albright (2004) performed an analysis that found a positive effect of BSC implementation on a banking institution's financial performance. Using t-tests and regression models to compare the variables related to productivity measures (e.g., labor productivity ratio, market share, revenue, and profit, etc.) between two groups (high IT level banks versus low IT level banks), Kim and Davidson (2004) examined the BSC framework in order to assess the business performance of information technology (IT) expenditures in the banking industry. The outcome of their research suggests that bank managers should use a BSC approach to measure business performance in both IT and management strategies.

In summary, the BSC has been employed by many businesses to assess their performance across various aspects. It provides insight into corporate performance not only for managers who seek ways to improve performance but also for investors who want to gauge an organization's ongoing performance. However, studies of how to analyze causal relationships between evaluation criteria, distinguish influential factors, and create an effective mechanism for the establishment of a strategic implementation of evaluation criteria are scarce (Malina et al., 2007; Nørreklit, 2000, 2003). Consequently, managers are challenged by the delineation of strategies that can both analytically and organizationally link together performance indicators that contain outcome measures and performance drivers while allowing for the implementation of the BSC process.

3.2. Strategy map

Kaplan and Norton (1996a, 1996b, 1996c) introduced three principles that link an organization's BSC to its strategy: (1) cause-and-effect relationships, (2) performance drivers, and (3) linkage to financial goals. A strategy is made of hypotheses comprising causes and effects. Strategy maps express causal relationships in a sequence. The chains of cause-and-effect connect all the factors (i.e., performance indicators) through the four perspectives of BSC, which reflect dynamically the change of strategies and indicate how an organization creates its value (Kaplan & Norton, 2004a, 2004b). Strategy maps have been developed by companies in banking, insurance, manufacturing, healthcare, telecommunications, and e-business, as well as many nonprofit entities. These organizations have different industry types and sizes (a powerful

capability of strategy maps), and they adopt the strategy map concepts that can be adapted for diverse corporate contexts (Armitage & Scholey, 2003).

Strategy maps are built according to the four perspectives of the BSC, and they interface between strategy and the BSC. Strategy maps interpret all causal relationships so that effective strategies can be developed and deployed and then fulfilled optimally over time. Hence, strategy maps (the concrete expressions of the causal relationships of an organization's strategies) are employed to provide organizations with ways to create value (Kaplan & Norton, 2004a). Strategy maps provide a visual framework and a concise description of an organization's strategy, and they can convert intangible assets into tangible outcomes (Banker et al., 2004). Strategy maps can enhance the ability to define, evaluate, manage, and implement the desired strategy. Strategic management is to manage and maintain strategies by tracing execution and explanation of the strategies. Therefore, a BSC must be adapted to strategy changes. A strategy map proves that strategies are devised on the basis of dynamic changes over time. Strategy maps are also models for articulating interconnected strategies before and after strategy implementation.

Strategy maps are usually based on the following principles (Kaplan & Norton, 2004a): (1) strategies should be balanced against each other, (2) strategies should be advocated on the basis of value, (3) value should be created out of internal processes, (4) strategies should complement each other, and (5) the merger of strategies should determine the value of intangible assets. Strategy maps should be associated with a BSC of measures, performance drivers, targets, and initiatives. A major feature of strategy maps is that they distinguish between strategies, and they offer communication platforms for strategy implementation. The basic strategy map template, presented in Fig. 1 (Kaplan & Norton, 2004a), has the essential elements necessary for the four perspectives of a BSC.

For example, from the learning and growth perspective, which illustrates the intangible assets that can be improved to create more value in the future, intangible assets are classified into three categories: (1) human capital, (2) information capital, and (3) organizational capital.

However, strategy maps need not be restricted to the four BSC perspectives; each company can tailor the basic structure to fit its organization's needs. For example, some companies include more crucial perspectives, such as those of suppliers and employees. Others may add community responsibility as an additional perspective (Armitage & Scholey, 2003). Barad and Dror (2008) propose a strategy map combining the BSC with quality criteria to pinpoint and prioritize the improvement needs of an enterprise (Dror & Barad, 2006). To construct strategy maps suitable for the strategy implementation of different institutions, the proper KPIs must be selected by relevant experts (e.g., experienced managers and scholars). On the basis of the BSC, Quezada, Cordova, Palominos, Godoy, and Ross (2009) present a method for identifying strategic objectives in strategy maps using a modified SWOT (strengths, weaknesses, opportunities, threats) analysis in order to establish KPIs. Furthermore, BSC strategy maps are generally constructed by rules of thumb. As reported in previous studies, most companies have tried to develop evaluation indicators of performance measurement reasonably, but there is generally a lack of analysis of the links between strategy and measures (i.e., performance indicators) (Malmi, 2001). Littler et al. (2000) use an object-orientated approach to link the strategy formulation perspective of Hamel and Prahalad (1996a, 1996b) with the BSC strategy implementation method of Kaplan and Norton (1996b). Although they proposed a strategic architecture formulation process with bottom-up information, the causal connections among the performance indicators that they proposed appeared logically weak. In addition, Thakkar et al. (2007)
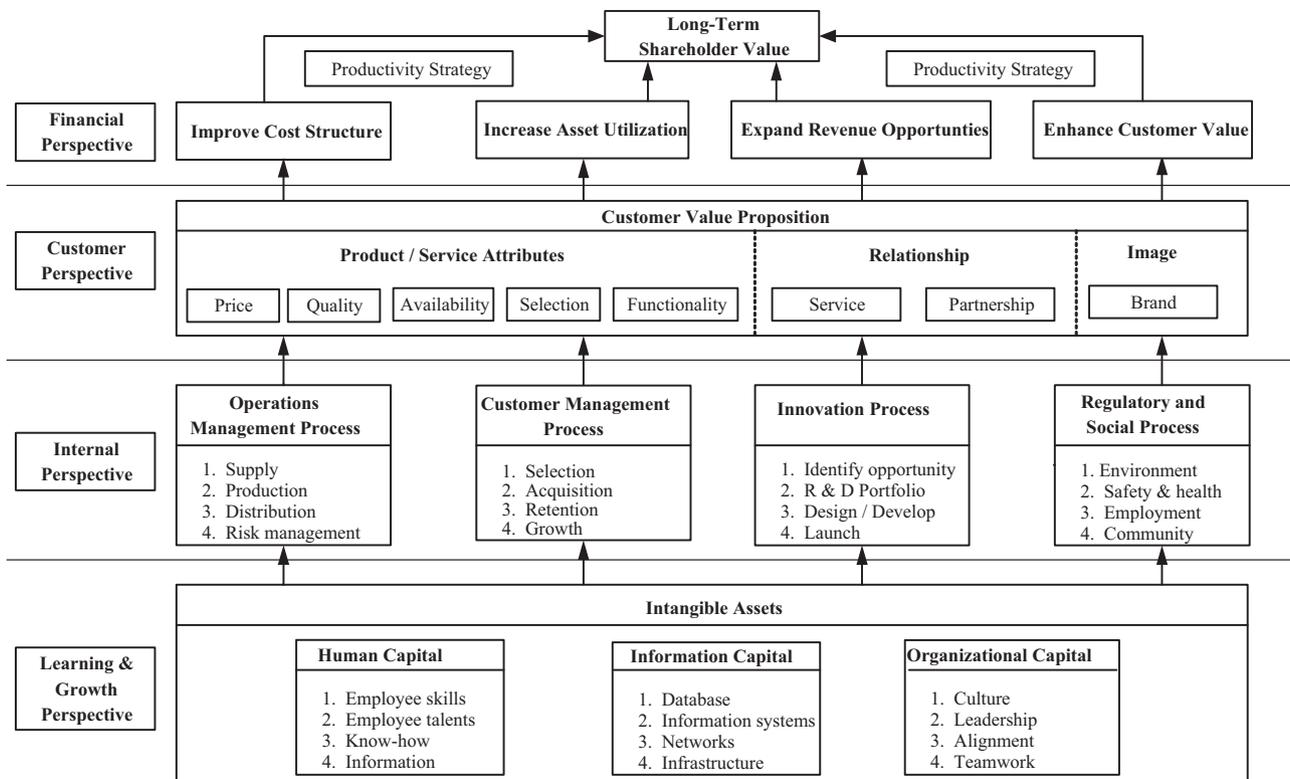

Fig. 1. Basic template for a strategy map.
Source: Kaplan and Norton (2004a).

proposed a framework that made use of a mixed approach, appropriating cause-and-effect diagrams, Interpretive Structural Modeling (ISM), and Analytic Network Process (ANP). On the basis of the BSC, Tseng (2010) and Jassbi et al. (2011) utilize the DEMATEL to build strategy maps, but they focus only on classifying performance indicators into two sets: a "cause group" and an "effect group." However, the influence strengths of cause-and-effect relationships between the indicators are seldom explored.

In summary, as with the literature reviewed above, most of the past research in its varied approaches focuses mainly on exploring the productivity and efficiency of banking institutions. Moreover, as shown in Table 1, many of these studies only include financial indicators (e.g., bank assets, loan, deposit, liabilities, interest income, and operating costs) to measure banking performance (Arshadi & Lawrence, 1987; Collier, 1995; Giokas, 2008; Kosmidou et al., 2006). The main advantage of this tendency is that quantitative financial data commonly used by these studies is likely to be considered more objective. The disadvantage, however, is that financial information may simply reflect past banking performance and nothing else. In addition, some of the related studies, such as Wu et al. (2009), Chen et al. (2008), and Meyer and Markiewicz (1997), apply a more comprehensive performance measurement consisting of the four BSC perspectives with both financial and nonfinancial indicators for evaluating banking performance, but these studies do not consider the construction of strategy maps that makes up such a crucial part of the BSC system. As discussed above, Tseng (2010) and Jassbi et al. (2011) employ the DEMATEL based on the four BSC perspectives to establish strategy maps, but these maps focus mainly on distinguishing performance indicators into a "cause group" and an "effect group" without any detailed discussion of the complicated interactive relationships among indicators.

Therefore, in order to fill the gap of the existing body of knowledge regarding the evaluation of banking performance and strategy development, the present study proposes a systematic approach using the DEMATEL method, which is a powerful group decision-making tool, to systemically integrate experts' knowledge in order to identify the causal relationships among the performance indicators for a strategy map (Wu & Lee, 2007; Jassbi et al., 2011). It attempts to help management investigate the complicated causal relationships of KPIs for building up the strategy map based on the basic BSC evaluation framework in a visual diagram. More precisely, the present study performs in-depth analyses of the logical links among KPIs, which provides important insight into the managerial implications of strategic steps for banking performance improvements.

4. Framework of constructing a strategy map by the DEMATEL method

The proposed framework of constructing a strategy map of the BSC and the analytical method, DEMATEL, are delineated in this section.

4.1. The proposed framework of constructing a strategy map

The proposed framework of constructing a strategy map from the BSC is illustrated in Fig. 2. First, according to the four perspectives of the BSC, the most appropriate indicators of performance measurement are synthesized from the relevant literature and screened by the committee of experts who have years of experience in banking-related industry. In this research, a total of 12 professionals from industry and academia were consulted. All of the experts had more than five years of related working experience and five of them had more than ten years. In addition, of the experts, eight of those from industry had been
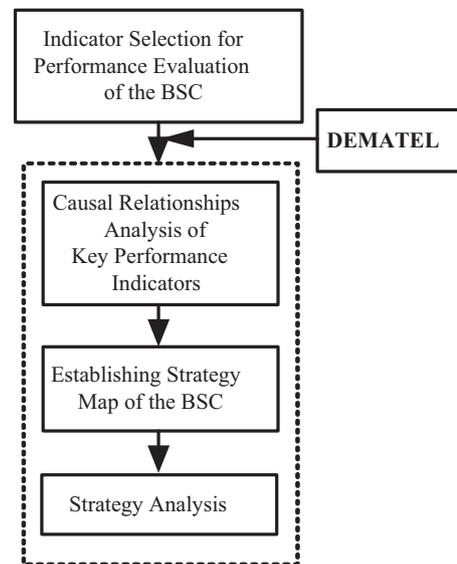
Fig. 2. Proposed framework of constructing a strategy map of the BSC.

managers/directors of banking institutions, and four from academia were professors/researchers with a business/finance background. Then, considering the synthesized generic evaluation indicators of banking performance, and targeting a case bank, our study conducted a causal relationships analysis on the selected KPIs through the DEMATEL technique in consultation with this committee of experts. Finally, a strategy map of the BSC was developed based on the results of both qualitative and quantitative analyses by the DEMATEL technique. The details of the DEMATEL method are elaborated below.

4.2. DEMATEL

The DEMATEL method is employed to visualize the structure of complicated causal relationships (or numerous available alternatives) between the elements of a system. The graphical output is called a digraph. The Battelle Memorial Institute conducted the DEMATEL project at its Geneva Research Centre in 1973 (Gabus & Fontela, 1972, 1973). The original DEMATEL was aimed at the fragmented and antagonistic phenomena of world societies, and it was designed to search for integrated solutions (Chiu, Chen, Tzeng, & Shyu, 2006). The digraph portrays a contextual relationship between the elements of systems. As shown in Fig. 3, the numbers among the nodes (e.g., criteria/indicators) represent strength of influence, and the arrows indicate direction of influence. The DEMATEL method has been successfully applied in various fields, such as management problems (Huang, Shyu, & Tzeng, 2007; Liou, Yen, & Tzeng, 2008; Tamura & Akazawa, 2005; Tzeng, Lin, & Opricovic, 2005; Tzeng, Chiang, & Li, 2007; Wu & Lee, 2007), control systems (Hori & Shimizu, 1999), reliability engineering (Seyed-Hosseini, Safaei, & Asgharpour, 2006), and others. The DEMATEL procedure is explained below.

Step 1: Calculate the average matrix. Using an integer scale ranging from 0 to 4, respondents are asked to indicate the direct
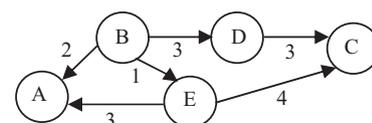
Fig. 3. A sample digraph of DEMATEL.

influence among elements, according to their own judgments. A higher score means stronger direct influence. Each element in the matrix is derived from the mean of the same elements in the different direct matrices of the group respondents.

Step 2: Formulate the initial direct influence matrix. The initial direct influence matrix ($Z_{n\times n}$) is constructed as Eq. (1), where z_{ij} represents the strength of influence from element i to element j.

$$Z = \begin{bmatrix} z_{11} & \cdots & z_{1j} & \cdots & z_{1n} \\ \vdots & & \vdots & & \vdots \\ z_{i1} & \cdots & z_{ij} & \cdots & z_{in} \\ \vdots & & \vdots & & \vdots \\ z_{n1} & \cdots & z_{nj} & \cdots & z_{nn} \end{bmatrix} \tag{1}$$

Step 3: Calculate the normalized direct influence matrix. The normalized direct influence matrix can be computed as Eq. (2).

$$X = \frac{Z}{\max\left(\max_{1\le i\le n}\sum_{j=1}^{n} z_{ij}, \max_{1\le j\le n}\sum_{i=1}^{n} z_{ij}\right)} \tag{2}$$

Step 4: Derive the matrix of total relations (full direct/indirect influence). The matrix of total relations (T) can be obtained by Eq. (3), where I is the identity matrix, $X = [x_{ij}]_{n\times n}$ is the direct influence matrix, and $\lim_{k\to\infty}(X^2 + \cdots + X^k)$ represents the indirect influence matrix; when $0 \le x_{ij} < 1$, then $\lim_{k\to\infty} X^k = 0$.

$$T = \lim_{k\to\infty}(X + X^2 + \cdots + X^k)$$
$$= \lim_{k\to\infty} X(I + X + X^2 + \cdots + X^{k-1}) = \lim_{k\to\infty} X\left[\frac{I - X^k}{I - X}\right]$$
$$= X(I - X)^{-1} \tag{3}$$

Step 5: Analyze the results of influences and relationships. According to the total-relation matrix ($T = [t_{ij}]$), the sum of columns (D) and the sum of rows (R), a level of influence and a level of relation are defined as Eqs. (4) and (5), where $i, j \in \{1, 2, ..., n\}$. The value of ($D + R$) shows the "degree of central role" (importance), indicating the strength of influence of both dispatch and receipt. The higher values of ($D + R$) the factors have, the more related they are. Similarly, the value of ($D - R$) shows the "severity of influence," indicating the prioritization of factors. If ($D - R$) is positive, then the factor is a "cause-factor," dispatching the influence to the other factors. If ($D - R$) is negative, the factor is an "effect-factor," receiving the influence from the others. The higher values of ($D - R$) the factors have, the more influence they have on the others, and with this influence, they are presumed to have higher priority. In other words, the lower values of ($D - R$) the factors have, the more influence they receive from the others, and the lower priority they are assumed to have.

$$D = (d_i)_{n\times 1} = \left[\sum_{j=1}^{n} t_{ij}\right]_{n\times 1} \tag{4}$$

$$R = (r_j)_{1\times n} = \left[\sum_{i=1}^{n} t_{ij}\right]_{1\times n} \tag{5}$$

5. An empirical example of constructing a strategy map for a banking institution

In this research, a sample bank is used as an illustrative example. Referring to the proposed strategy map construction framework depicted in Fig. 2, the four perspectives of the BSC are used to establish the KPIs skeleton. According to the structure, the DEMATEL method is adopted to determine the cause-and-effect

relationships among indicators, to differentiate influential factors and significant factors, and to construct the strategy map in order to improve banking performance. The indicator selection of the BSC performance measurement, the construction of strategy maps, and the analyses and discussion of the bank example are described in this section.

5.1. Indicators selection of BSC performance measurement

In the early stage of BSC development, it is important to collect as many performance measurement ideas as possible in order to cover all possible areas of evaluation. These ideas can be collected by interviewing business managers about their business visions and missions. We may assume that the vision statement of the case bank involves the goal of being the leading regional financial institution, providing superior returns for all stakeholders, and helping to drive business growth. Then, on the basis of this vision statement, the opinions of the panel experts are solicited and synthesized for determining the KPIs (i.e. the performance indicators of most relevant and important attributes with respect to strategic objectives of each BSC perspective). For example, from the "Customer perspective" of the BSC, in order to achieve the bank's vision, including "superior returns" and "business growth," the banking institution may make the most of its intrinsic advantages and resources in order to distinguish its differences with its competitors and to increase the market segmentation of customers. Consequently, "Enhancing customer service" is set as one of the strategic objectives to attract more customers by higher customer value. The core measurements (i.e., KPIs) such as "Customer satisfaction," "Profit per on-line customer," and "Market share rate" are then used as measures for this strategic objective. Correspondingly, from the other three BSC perspectives, the remaining KPIs can be derived by the same way. For further commentary on the detailed procedure of the generation of KPIs associated with BSC perspectives for the strategic objectives derived from the vision/mission of the organization, see Littler et al. (2000) and Quezada et al. (2009).

However, in practice, too many measures can cause vagueness and distract decision-makers (Youngblood & Collins, 2003). The indicators used in BSC implementations generally total between 10 and 25, as suggested by Kaplan and Atkinson (1998). Therefore, from the four BSC perspectives, the evaluation indicators related to banking performance are first synthesized from the literature (Davis & Albright, 2004; Kim & Davidson, 2004; Littler et al., 2000; Price & Bohner, 2007; Shoaib, 2006) and screened by the selected expert committee, comprising 12 professionals from industry and academia. As described previously, the senior managers who are familiar to the case bank are then consulted to suggest supplementary criteria and to agree on the key indicators for banking performance measurement in accordance with the bank's vision statement. For each item (performance indicator), a scale range of 0~10 points (10 = highest) is developed to determine the degree of importance of each among the evaluation indicators. Indicators with average scores of at least five points are selected. The descriptions of the 23 KPIs for banking that were chosen on the basis of the BSC (Wu et al., 2009) are listed in Table 2. The KPIs are grouped into the four BSC perspectives, "F: Finance (F1–F6)," "C: Customer (C1–C6)," "P: Internal Process (P1–P6)," and "L: Learning and Growth (L1–L5)."

5.2. Construction of the strategy map

To construct a strategy map, the DEMATEL questionnaires are administered to inquire of the case bank's committee of senior managers about the direct influence (scores ranging from 0 to 4)

Table 2
Descriptions of the key performance indicators selected for banking.

No.	Key performance indicator	Description
F: Finance		
1	(F1) Operating revenues	Sales revenue.
2	(F2) Debt ratio	Debts divided by assets.
3	(F3) Return on assets (ROA)	After-tax profit/loss divided by average total assets.
4	(F4) Earnings per share (EPS)	After-tax net earning minus preferred share dividends divided by weighted average number of shares outstanding.
5	(F5) Profit margin	After-tax profit/loss divided by total operating revenues.
6	(F6) Return on investment (ROI)	After-tax profit/loss divided by total cost.
C: Customer		
7	(C1) Customer satisfaction	Customer satisfaction of products and service.
8	(C2) Profit per on-line customer	After-tax earnings divided by total number of on-line customers.
9	(C3) Market share rate	Sales volumes of products and services divided by total market demands.
10	(C4) Customer retention rate	Capability of keeping existing customers.
11	(C5) Customer increasing rate	Growth rate of new customers.
12	(C6) Profit per customer	After-tax earnings divided by total number of customers.
P: Internal process		
13	(P1) No. of new service items	Total numbers of new service items.
14	(P2) Transaction efficiency	Average time spent on solving problems occurring during transactions.
15	(P3) Customer complaint	Customer criticisms due to dissatisfaction about products and services.
16	(P4) Rationalized forms and processes	Degree of procedures systemized by documentations, computer software, etc.
17	(P5) Sales performance	Successful promotion of both efficiency and effectiveness of sales
18	(P6) Management performance	Improvement of effectiveness, efficiency, and quality of each objective and routine tasks
L: Learning and growth		
19	(L1) Responses of customer service	Numbers of suggestions provided by customers about products and services
20	(L2) Professional training	Numbers of professional certifications or training programs per employee
21	(L3) Employee stability	Turnover of employees.
22	(L4) Employee satisfaction	Employee satisfaction about both hardware and software provided by the company.
23	(L5) Organization competence	Improvement of project management, organizational capability, and management by objectives (MBO).

Source: Wu et al. (2009).

among the selected criteria (i.e., perspectives and indicators) according to their own judgments on the strategic themes. Then, after averaging all the senior managers' scores, the initial direct influence matrix ($Z_{n \times n}$) of the four BSC perspectives for banking performance can be obtained, as shown in Table 3. From the matrix $Z_{n \times n}$, the normalized direct influence matrix ($X = [x_{ij}]_{n \times n}$), as shown in Table 4, is computed by Eq. (2). The matrix of total relations between the four BSC perspectives for banking performance is calculated using Eq. (3) as presented in Table 5. Similarly, the matrix of total relations of the evaluation indicators for banking performance is derived as summarized in Table 6. The $(D + R)$ (relation) and $(D - R)$ (influence) of the criteria obtained by Eqs. (4) and (5) are given in Table 7.

5.2.1. The rankings of $(D + R)$ and $(D - R)$

According to Table 7, the ranking of $(D + R)$ values of the four BSC perspectives are "C: Customer (6.6457)," "F: Finance

(6.3263)," "P: Internal Process (5.7937)," and "L: Learning and Growth (5.7698)." The top five central indicators with the highest $(D + R)$ values are "C1: Customer satisfaction (23.9567)," "P5: Sales performance (23.7257)," "C4: Customer retention rate (23.4761)," "C3: Market share rate (23.3131)," and "P6: Management performance (23.2150)." The ranking of $(D - R)$ values of the four BSC perspectives are "F: Finance (1.3285)," "P: Internal Process (−0.1025)," "L: Learning and Growth (−0.4729)," and "C: Customer (−0.7532)." The top three indicators with the highest $(D - R)$ values are "C3: Market share rate (0.8100)," "F6: Return on Investment (0.5972)," and "F2: Debt ratio (0.5112)." The top three indicators with the lowest $(D - R)$ values are "C5: Customers increasing rate (−0.5155)," "C1: Customer satisfaction (−0.5079)," and "F5: Net profit margin (−0.4877)."

Furthermore, as indicated in Table 7, the central roles (i.e., indicators with the highest $D + R$ value), main-cause factor (i.e., indicators with the highest $D - R$ value), and main-effect factor (i.e., indicators with the lowest $D - R$ value) in each perspective are determined. For example, in the "L: Learning and Growth" perspective, "L3: Employee stability" is the central role and main cause-factor among the five indicators (L1–L5) whereas "L5: Organization competence" is the main "effect-factor."

5.2.2. The causal diagrams

According to Table 7, the causal diagrams mapping the dataset $(D + R, D - R)$ of the four BSC perspectives and 23 indicators in

Table 3
The initial direct influence matrix ($S_{n \times n}$) of the four BSC perspectives.

Perspectives	F	C	P	L
F	0.00	3.75	2.50	2.75
C	2.00	0.00	2.25	2.25
P	1.75	2.50	0.00	2.00
L	1.50	2.50	1.75	0.00

Table 4
The normalized direct influence matrix ($X = [x_{ij}]_{n \times n}$) of the four BSC perspectives.

Perspectives	F	C	P	L
F	0.0000	0.4167	0.2778	0.3056
C	0.2222	0.0000	0.2500	0.2500
P	0.1944	0.2778	0.0000	0.2222
L	0.1667	0.2778	0.1944	0.0000

Table 5
The matrix of total relations (T) of the four BSC perspectives.

Perspectives	F	C	P	L
F	0.6279	1.2264[a]	0.9565[a]	1.0166[a]
C	0.6636	0.7126	0.7684[a]	0.8017[a]
P	0.6293	0.9044[a]	0.5492	0.7627
L	0.5780	0.8560[a]	0.6741	0.5404

[a] Indicates the value of indicator is greater than the threshold (0.7667).

Table 6
The matrix of total relations of evaluation indicators for banking performance.

	F1	F2	F3	F4	F5	F6	C1	C2	C3	C4	C5	C6
F1	0.4516	0.4398	0.4983	0.5129[a]	0.4725	0.4727	0.5304[b]	0.4905	0.5040	0.5239[a]	0.4902	0.4803
F2	0.4625	0.3703	0.4608	0.4787	0.4566	0.4410	0.4920	0.4448	0.4599	0.4805	0.4544	0.4411
F3	0.5014	0.4496	0.4530	0.5207[a]	0.4991	0.4804	0.5356[b]	0.4874	0.4901	0.5253[a]	0.4994	0.4878
F4	0.5014	0.4454	0.4974	0.4635	0.4969	0.4783	0.5290[a]	0.4873	0.4943	0.5248[a]	0.4971	0.4920
F5	0.4677	0.4215	0.4639	0.4821	0.4174	0.4587	0.4972	0.4540	0.4648	0.4918	0.4572	0.4609
F6	0.5013	0.4448	0.5078	0.5162[a]	0.4967	0.4357	0.5362[b]	0.4937	0.4922	0.5211[a]	0.5015	0.4942
C1	0.5125[a]	0.4512	0.5061	0.5234[a]	0.5074[a]	0.4882	0.5188[a]	0.5140[a]	0.5215[a]	0.5490[b]	0.5223[a]	0.5143[a]
C2	0.4830	0.4218	0.4789	0.4870	0.4745	0.4624	0.5276[a]	0.4359	0.4849	0.5084[a]	0.4815	0.4829
C3	0.5414[b]	0.4661	0.5329[b]	0.5443[b]	0.5254[a]	0.5079[a]	0.5862[c]	0.5169[a]	0.4908	0.5655[c]	0.5381[b]	0.5214[a]
C4	0.5128[a]	0.4438	0.5150[a]	0.5279[a]	0.5058	0.4845	0.5649[c]	0.5078[a]	0.5150[a]	0.4982	0.5224[a]	0.5061[a]
C5	0.4822	0.4173	0.4739	0.4880	0.4630	0.4490	0.5222[a]	0.4755	0.4800	0.4970	0.4385	0.4715
C6	0.4892	0.4291	0.4872	0.5081[a]	0.4849	0.4641	0.5386[b]	0.4906	0.4933	0.5196[a]	0.4899	0.4425
P1	0.4803	0.4272	0.4803	0.4924	0.4696	0.4595	0.5293[a]	0.4838	0.4927	0.5122[a]	0.4915	0.4757
P2	0.4760	0.4207	0.4720	0.4840	0.4632	0.4530	0.5347[b]	0.4822	0.4868	0.5170[a]	0.4900	0.4804
P3	0.4994	0.4373	0.4995	0.5141[a]	0.4881	0.4775	0.5596[c]	0.4986	0.5102[a]	0.5457[b]	0.5113[a]	0.5011
P4	0.4386	0.3880	0.4368	0.4436	0.4307	0.4155	0.4956	0.4365	0.4472	0.4650	0.4374	0.4264
P5	0.5408[b]	0.4698	0.5280[a]	0.5457[b]	0.5269[a]	0.5117[a]	0.5786[c]	0.5308[b]	0.5342[b]	0.5581[c]	0.5371[b]	0.5269[a]
P6	0.5203[a]	0.4608	0.5182[a]	0.5312[b]	0.5108[a]	0.4958	0.5646[c]	0.5148[a]	0.5287[a]	0.5483[b]	0.5214[a]	0.5128[a]
L1	0.4460	0.3894	0.4483	0.4576	0.4400	0.4285	0.5043	0.4546	0.4588	0.4812	0.4641	0.4573
L2	0.4703	0.4159	0.4708	0.4827	0.4618	0.4500	0.5258[a]	0.4680	0.4747	0.5046	0.4822	0.4662
L3	0.4960	0.4349	0.4962	0.5085[a]	0.4870	0.4768	0.5425[b]	0.4910	0.4937	0.5249[a]	0.4993	0.4806
L4	0.4725	0.4157	0.4728	0.4824	0.4617	0.4520	0.5197[a]	0.4701	0.4725	0.5046	0.4842	0.4617
L5	0.4551	0.4044	0.4576	0.4668	0.4447	0.4374	0.4988	0.4485	0.4614	0.4862	0.4625	0.4485
D	11.2023	9.8649	11.1557	11.4617	10.9847	10.6805	12.2323	11.0772	11.2515	11.8527	11.2735	11.0326

	P1	P2	P3	P4	P5	P6	L1	L2	L3	L4	L5	R
F1	0.4956	0.4897	0.4821	0.4274	0.5127[a]	0.5038	0.4443	0.4832	0.4786	0.4860	0.4723	11.1427
F2	0.4642	0.4647	0.4593	0.4000	0.4781	0.4636	0.4200	0.4462	0.4443	0.4531	0.4400	10.3761
F3	0.5013	0.4973	0.4851	0.4300	0.5100[a]	0.4984	0.4427	0.4820	0.4817	0.4912	0.4773	11.2267
F4	0.4990	0.4906	0.4806	0.4234	0.5137[a]	0.5002	0.4406	0.4838	0.4772	0.4804	0.4706	11.1670
F5	0.4692	0.4717	0.4514	0.4018	0.4876	0.4665	0.4117	0.4529	0.4489	0.4558	0.4424	10.4970
F6	0.4989	0.5015	0.4957	0.4404	0.5161[a]	0.4985	0.4488	0.4863	0.4836	0.4891	0.4773	11.2777
C1	0.5211[a]	0.5223[a]	0.5295[a]	0.4636	0.5413[b]	0.5232[a]	0.4783	0.5130[a]	0.4971	0.5092[a]	0.4973	11.7244
C2	0.4872	0.4855	0.4760	0.4223	0.5059[a]	0.4864	0.4346	0.4683	0.4573	0.4688	0.4595	10.8805
C3	0.5392[b]	0.5360[b]	0.5344[b]	0.4731	0.5534[c]	0.5433[b]	0.4864	0.5241[a]	0.5124	0.5163[a]	0.5060[a]	12.0615
C4	0.5130[a]	0.5266[a]	0.5211[a]	0.4534	0.5265[a]	0.5169[a]	0.4680	0.5026	0.4952	0.5051	0.4910	11.6235
C5	0.4887	0.4782	0.4751	0.4157	0.4922	0.4749	0.4343	0.4634	0.4567	0.4638	0.4569	10.7580
C6	0.4976	0.4897	0.4927	0.4231	0.5102[a]	0.4991	0.4441	0.4787	0.4675	0.4813	0.4634	11.0843
P1	0.4442	0.4932	0.4775	0.4215	0.5051	0.4793	0.4338	0.4697	0.4671	0.4659	0.4630	10.9146
P2	0.4804	0.4475	0.4873	0.4332	0.5015	0.4888	0.4345	0.4837	0.4701	0.4736	0.4706	10.9308
P3	0.5037	0.5154[a]	0.4637	0.4540	0.5194[a]	0.5145[a]	0.4514	0.5002	0.4907	0.5028	0.4932	11.4514
P4	0.4341	0.4543	0.4519	0.3583	0.4586	0.4511	0.4006	0.4386	0.4300	0.4369	0.4347	10.0102
P5	0.5238[a]	0.5371[b]	0.5228[a]	0.4638	0.5086[a]	0.5365[b]	0.4772	0.5258[a]	0.5161[a]	0.5242[a]	0.5202[a]	12.0447
P6	0.5201[a]	0.5342[b]	0.5243[a]	0.4686	0.5540[c]	0.4870	0.4683	0.5191[a]	0.5137[a]	0.5280[a]	0.5181[a]	11.8628
L1	0.4567	0.4594	0.4591	0.4082	0.4681	0.4539	0.3774	0.4516	0.4428	0.4499	0.4368	10.2938
L2	0.4749	0.4778	0.4814	0.4156	0.4919	0.4875	0.4358	0.4319	0.4696	0.4833	0.4719	10.7945
L3	0.4958	0.5013	0.5023	0.4469	0.5266[a]	0.5111[a]	0.4527	0.5058[a]	0.4459	0.5086[a]	0.4907	11.3190
L4	0.4766	0.4862	0.4811	0.4260	0.5089[a]	0.4917	0.4333	0.4828	0.4802	0.4347	0.4743	10.8458
L5	0.4674	0.4644	0.4573	0.4165	0.4907	0.4761	0.4194	0.4654	0.4610	0.4660	0.4107	10.4666
D	11.2527	11.3243	11.1916	9.8865	11.6810	11.3522	10.1382	11.0588	10.8874	11.0738	10.8377	

Note: The threshold is set on the third quartile (0.5058) of the total relations and F2, P4, and L1 are eliminated.
[a] The strength of influence is between 0.5058 and 0.5300.
[b] The strength of influence is between 0.5300 and 0.5500.
[c] The strength of influence is between 0.5500 and 0.5862.
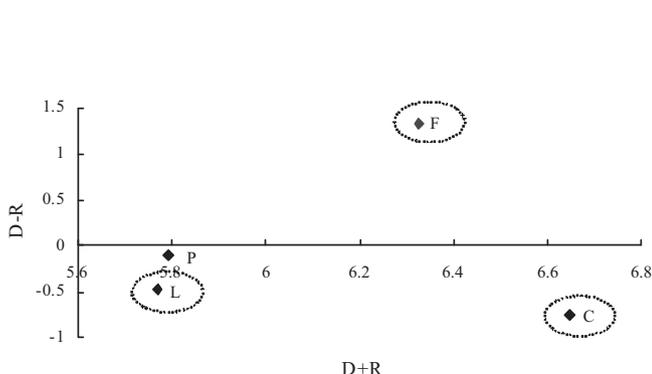
Fig. 4. A causal diagram of the four BSC perspectives for banking.

terms of $D - R$ (Y-axis) and $D + R$ (X-axis) are depicted in Figs. 4 and 5, respectively. In Fig. 4, "C: Customer" with the highest value of $(D + R)$ has the most relationships with other roles, and it is the central role among the perspectives. Moreover, in Fig. 5, "C1: Customer satisfaction," with the highest value of $(D + R)$, has the most relationships with other roles, indicating its central role among the indicators. The value of $(D - R)$ represents the severity of influence (i.e., criteria with higher $D - R$ values have greater influence on the others and a higher priority). In Fig. 4, "F: Finance," with the highest $(D - R)$ value dispatches the strongest influence on the others, and it is thus called the "main cause-factor" among the perspectives. "C: Customer," with the lowest $(D - R)$ value, receives the strongest influence from the others, and it is thus called the "main effect-factor" among the perspectives. Moreover, in Fig. 5, "C3: Market share rate," with the highest $(D - R)$ value,

Table 7
Results of the $(D + R)$ (relation) and $(D - R)$ (influence).

Criteria (perspectives/indicators)	$D + R$		Rank	$D - R$		Rank
(F) Finance	**6.3263**		**2**	**1.3285[a]**		**1**
(F1) Sales		22.3451	9		−0.0596	12
(F2) Debt ratio[d]		20.2410	22		0.5112	3
(F3) Return on Assets		22.3824	8		0.0710	10
(F4) Earnings per share		22.6287[c]	7		−0.2946	17
(F5) Net profit margin		21.4817	19		−0.4877[b]	21
(F6) Return on Investment		21.9582	15		0.5972[a]	2
(C) Customer	**6.6457***		**1**	**−0.7532[b]**		**4**
(C1) Customer satisfaction		23.9567[c]	1		−0.5079	22
(C2) Profit per on-line customer		21.9577	16		−0.1967	13
(C3) Market share rate		23.3131	4		0.8100[a]	1
(C4) Customer retention rate		23.4761	3		−0.2292	15
(C5) Customers increasing rate		22.0315	14		−0.5155[b]	23
(C6) Profit per customer		22.1169	13		0.0518	11
(P) Internal Process	**5.7937**		**3**	**−0.1025**		**2**
(P1) No. of new service items		22.1673	12		−0.3381	18
(P2) Transaction efficiency		22.2550	10		−0.3935[b]	20
(P3) Customer complaints		22.6430	6		0.2598	7
(P4) Rationalized forms and processes[d]		19.8967	23		0.1237	9
(P5) Sales performance		23.7257[c]	2		0.3637	6
(P6) Management performance		23.2150	5		0.5105[a]	4
(L) Learning and Growth	**5.7698**		**4**	**−0.4729**		**3**
(L1) Responses of customer service[d]		20.4319	21		0.1556	8
(L2) Professional training		21.8533	18		−0.2643	15
(L3) Employee stability		22.2064[c]	11		0.4316[a]	5
(L4) Employee satisfaction		21.9196	17		−0.2280	14
(L5) Organization competence		21.3044	20		−0.3711[b]	19

[a] "main cause-factor" (highest $D - R$ value): dispatching the strongest influence to others.
[b] "main effect-factor" (lowest $D - R$ value): receiving the strongest influence from others.
[c] The central role in each dimension.
[d] The indicators (influence level under the set threshold value) are eliminated.

dispatches the strongest influence on the others, and it is called the "main cause-factor" among the indicators whereas "C5: Customers increasing rate," with the lowest $(D - R)$ value, receives the strongest influence from the others, and it is called the "main effect-factor" among the indicators.

5.2.3. A strategy map of KPIs for banking

When constructing the strategy map, the threshold value of each factor is decided by the experts to eliminate the trivial connections derived from the DEMATEL analysis (Liou et al., 2008). In this research, in consultation with the experts, the thresholds are set to be 0.7667 and 0.5058 for the four BSC perspectives and for the 23 indicators, respectively. According to Table 5, the strategy map is constructed as shown in Fig. 6. The "dotted" lines represent weak relationships between perspectives whereas "bold solid" lines stand for strong relationships. The head of an arrow indicates the direction of influence. As can be seen in Fig. 6, for

banking performance, the "F: Finance" perspective, as the main-cause factor, has a stronger influence on the other three BSC perspectives whereas the "C: Customer" perspective is the main effect-factor and is influenced more by the other three.

In addition, according to Table 6, the strategy map of the indicators is constructed in Fig. 7. Three indicators ("F2: Debt ratio," "P4: Rationalized forms and processes," and "L1: Responses of customer service") have been removed because of the threshold set on the third quartile (0.5058) of the total relationship. Consequently, the BSC strategy map consists of the remaining 20 evaluation indicators. With a cross-reference to Fig. 7, Table 8 summarizes the numbers of dispatching and receiving indicators for each BSC performance indicator. As can be seen in Table 8, three critical indicators, including "C1: Customer satisfaction," "C4: Customer retention rate," and "P5: Sales performance," with indicators of dispatching influence to and receiving influence from greater than 10, are marked as "bold circles" in Fig. 7. Moreover,
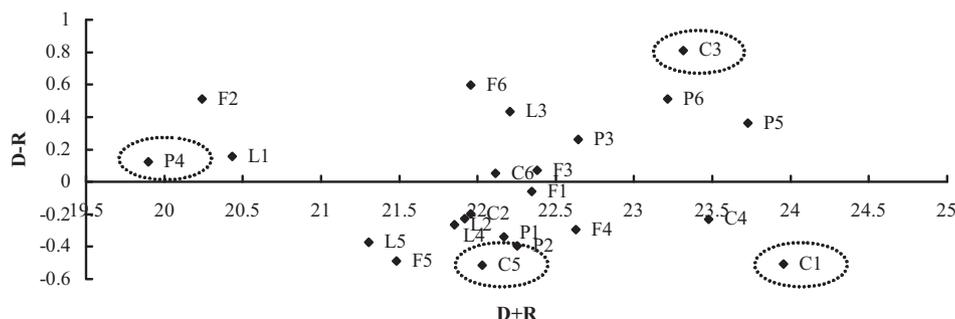
Fig. 5. A causal diagram of the key performance indicators for banking.
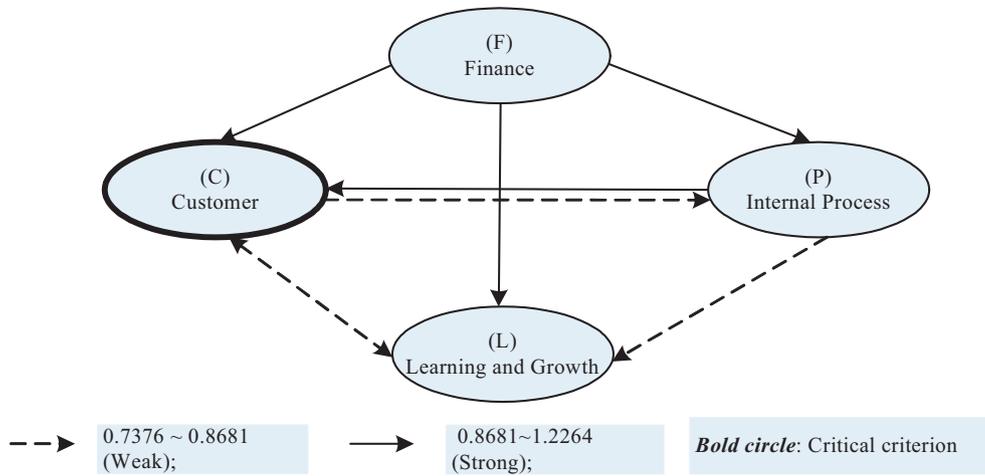
**Fig. 6.** A strategy map of the four BSC perspectives for banking.
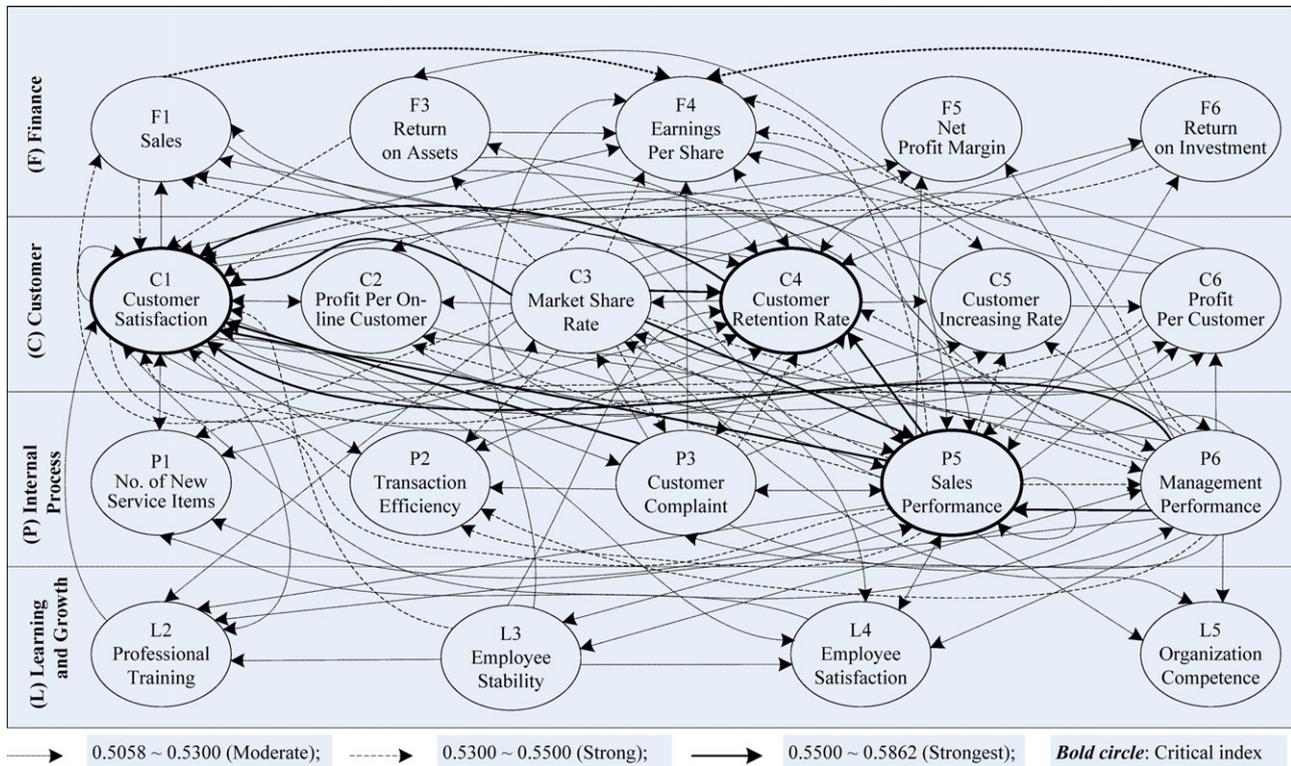
Fig. 7. A strategy map of key performance indicators based on the BSC for banking.

both "C3: Market share rate" and "P6: Management performance" have more than 10 dispatching indicators but fewer than 10 receiving indicators.

"P5: Sales performance" and "P6: Management performance" are the central indicators, with the highest $(D + R)$ values. "P5: Sales performance" is one of the critical indicators, influencing 20 indicators and being influenced by 14 indicators; "P6: Management performance" influences 18 indicators. These two indicators (i.e., P5, P6) are the main cause-factors affecting the other indicators, especially "C1: Customer satisfaction" (see Fig. 7 and Table 8). "P6: Management performance" has the strongest influence on "P5: Sales performance" and "P6: Management performance" have higher $(D - R)$ value (i.e., a higher priority) than

"P5: Sales performance." Table 9 summarizes the analysis results obtained by the DEMATEL method according to Tables 7 and 8.

5.3. Analyses and discussions

The present work performs a strategic analysis on the basis of the BSC strategy map. It applies the DEMATEL method to analyze the interdependence and interactive relationships among the KPIs in order to establish a strategy map. Strategy, which can indicate complicated multilayered plans for accomplishing objectives, is, when referred to in a BSC strategy map, specifically the "logical links" (causal relationships) among the KPIs. The expression of strategy in this map is thus articulated in terms of the KPIs that are

Table 8
Dispatching and receiving indicators for each BSC performance indicator.

No.	Key performance indicators	Dispatching to (indicators)	Total	Receiving from (indicators)	Total
1	(F1) Sales	F4[c], C1[d], C4[c], P5[c]	4	C1[c], C3[d], C4[c], P5[d], P6[c]	5
2	(F3) Return on asset	F4[c], C1[d], C4[c], P5[c]	4	C3[d], C4[c], P5[c], P6[c]	4
3	(F4) Earning per share[b]	C1[c], C4[c], P5[c]	3	F1[c], F3[c], F6[c], C1[c], C3[d], C4[c], C6[c], P3[c], P5[d], P6[d], L3[c]	11
4	(F5) Net profit margin		0	C1[c], C3[c], P5[c], P6[c]	4
5	(F6) Return on investment	F4[c], C1[d], C4[c], P5[c]	4	C3[c], P5[c]	2
6	(C1) Customer satisfaction[a,b]	F1[c], F4[c], F5[c], C1[c], C2[c], C3[c], C4[d], C5[c], C6[c], P1[c], P2[c], P3[c], P5[d], P6[c], L2[c], L4[c]	16	F1[d], F3[d], F4[c], F6[d], C1[c], C2[c], C3[e], C4[e], C5[c], C6[d], P1[c], P2[c], P3[e], P5[e], P6[e], L2[c], L3[d], L4[c]	18
7	(C2) Customer per on-line customer	C1[c], C4[c], P5[c]	3	C1[c], C3[c], C4[c], P5[d], P6[c]	5
8	(C3) Market share rate[a]	F1[d], F3[c], F4[d], F5[c], F6[c], C1[c], C2[c], C4[e], C5[d], C6[c], P1[d], P2[d], P3[d], P5[e], P6[c], L2[c], L4[c], L5[c]	18	C1[c], C4[c], P3[c], P5[d], P6[c]	5
9	(C4) Customer retention rate[a,b]	F1[c], F3[c], F4[c], C1[e], C2[c], C3[c], C5[c], C6[c], P1[c], P2[c], P3[c], P5[c], P6[c]	13	F1[c], F3[c], F4[c], F6[c], C1[d], C2[c], C3[e], C6[c], P1[c], P2[c], P3[d], P5[e], P6[d], L3[c]	14
10	(C5) Customer increasing rate	C1[c]	1	C1[c], C3[d], C4[c], P3[c], P5[d], P6[c]	6
11	(C6) Profit per customer	F4[c], C1[d], C4[c], P5[c]	4	C1[c], C3[c], C4[c], P5[c], P6[c]	5
12	(P1) No. of new service items	C1[c], C4[c]	2	C1[c], C3[d], C4[c], P5[c], P6[c]	5
13	(P2) Transaction efficiency	C1[d], C4[c]	2	C1[c], C3[d], C4[c], P3[c], P5[d], P6[d]	6
14	(P3) Customer complaint	F4[c], C1[e], C3[c], C4[d], C5[c], P2[c], P5[c], P6[c]	8	C1[c], C3[d], C4[c], P5[c], P6[c]	5
15	(P5) Sales performance[a,b]	F1[d], F3[c], F4[d], F5[c], F6[c], C1[e], C2[d], C3[d], C4[e], C5[d], C6[c], P1[c], P2[d], P3[c], P5[c], P6[d], L2[c], L3[c], L4[c], L5[c]	20	F1[c], F3[c], F4[c], F6[c], C1[d], C2[c], C3[e], C4[c], C6[c], P3[c], P5[c], P6[c], L3[c], L4[c]	14
16	(P6) Management performance[a]	F1[c], F3[c], F4[d], F5[c], C1[e], C2[c], C3[c], C4[d], C5[c], C6[c], P1[c], P2[d], P3[c], P5[e], L2[c], L3[c], L4[c], L5[c]	18	C1[c], C3[d], C4[c], P3[c], P5[d], L3[c]	6
17	(L2) Professional training	C1[c]	1	C1[c], C3[c], P5[c], P6[c], L3[c]	5
18	(L3) Employee stability	F4[c], C1[d], C4[c], P5[c], P6[c], L2[c], L4[c]	7	P5[c], P6[c]	2
19	(L4) Employee satisfaction	C1[c], P5[c]	2	C1[c], C3[c], P5[c], P6[c], L3[c]	5
20	(L5) Organization competence		0	C3[c], P5[c], P6[c]	3

[a] The numbers of indicators dispatching influence to are greater than 10.
[b] The numbers of indicators receiving influence from are greater than 10.
[c] The strength of influence is between 0.5058 and 0.5300 (moderate).
[d] The strength of influence is between 0.5300 and 0.5500 (strong).
[e] The strength of influence is between 0.5500 and 0.5862 (strongest).

Table 9
Summary of results analyzed by DEMATEL.

Criteria (Perspectives and Indicators)	$D+R$	$D-R$	No. of indicators dispatching influence to	No. of indicators receiving influence from
(F) Finance	**6.3263 (2)**	**1.3285 (1)**	**4**	**0**
(F1) Sales	22.3451 (9)	−0.0596 (12)	4	5
(F2) Debt ratio[c]	20.2410 (22)	0.5112 (3)	–	–
(F3) Return on assets	22.3824 (8)	0.0710 (10)	4	4
(F4) Earnings per share[b]	22.6287 (7)	−0.2946 (17)	3	11
(F5) Net profit margin	21.4817 (19)	−0.4877 (21)	0	4
(F6) Return on investment	21.9582 (15)	0.5972 (2)	4	2
(C) Customer	**6.6457 (1)**	**−0.7532 (4)**	**2**	**3**
(C1) Customer satisfaction[a,b]	23.9567 (1)	−0.5079 (22)	16	18
(C2) Profit per on-line customer	21.9577 (16)	−0.1967 (13)	3	5
(C3) Market share rate[a]	23.3131 (4)	0.8100 (1)	18	5
(C4) Customer retention rate[a,b]	23.4761 (3)	−0.2292 (15)	13	14
(C5) Customers increasing rate	22.0315 (14)	−0.5155 (23)	1	6
(C6) Profit per customer	22.1169 (13)	0.0518 (11)	4	5
(P) Internal Process	**5.7937 (3)**	**−0.1025 (2)**	**2**	**2**
(P1) No. of new service items	22.1673 (12)	−0.3381 (18)	2	5
(P2) Transaction efficiency	22.2550 (10)	−0.3935 (20)	2	6
(P3) Customer complaints	22.6430 (6)	0.2598 (7)	8	5
(P4) Rationalized forms and processes[c]	19.8967 (23)	0.1237 (9)	–	–
(P5) Sales performance[a,b]	23.7257 (2)	0.3637 (6)	20	14
(P6) Management performance[a]	23.2150 (5)	0.5105 (4)	18	6
(L) Learning and Growth	**5.7698 (4)**	**−0.4729 (3)**	**3**	**1**
(L1) Responses of customer service[c]	20.4319 (21)	0.1556 (8)	–	–
(L2) Professional training	21.8533 (18)	−0.2643 (15)	1	5
(L3) Employee stability	22.2064 (11)	0.4316 (5)	7	2
(L4) Employee satisfaction	21.9196 (17)	−0.2280 (14)	2	5
(L5) Organization competence	21.3044 (20)	−0.3711[b] (19)	0	3

Note: (): ranking of each criterion.
[a] The numbers of indicators dispatching influence to are greater than 10.
[b] The numbers of indicators receiving influence from are greater than 10.
[c] The indicators are eliminated by the set threshold.

rationally linked (Littler et al., 2000). Hence, there are different logical links (paths) that make up a strategy map. In this paper, the strategic improvement paths indicate the "strategic steps" (i.e., the paths linked by the KPIs with their influential directions and strengths). Since organizations may be restricted by resources, strategy mapping with priority can guide management to direct its efforts toward the most important areas both effectively and efficiently. According to the analysis results, the essential findings are outlined and discussed as follows.

5.3.1. The central indicators of the BSC perspectives for the banking institution

As shown in Table 9, the study reveals that the "C: Customer" perspective plays the central role as the main effect-factor among the four BSC perspectives. In addition, two KPIs of the "C: Customer" perspective, "C1: Customer satisfaction" and "C4: Customer retention rate," are the central roles among the 20 KPIs according to the DEMATEL analysis. This finding demonstrates that "C1: Customer satisfaction" is the most critical lagging indicator used to measure banking performance, because "C1: Customer satisfaction" is the main effect-factor with the lowest $(D - R)$ value and is affected by 18 indicators. As with the strategy map depicted in Fig. 7, "C1: Customer satisfaction" can be determined by many other indicators, particularly "C4: Customer retention rate," "P3: Customer complaint," "P5: Sales performance," and "P6: Management performance" (Table 8).

In the "L: Learning and Growth" perspective, "L3: Employee stability" is found to be the most crucial indicator, with "strong" influence on "C1: customer satisfaction" and "moderate" influences on "L2: Professional training," "L4: Employee satisfaction," "C4: Customer retention rate," and "F4: Earning per share." In addition, "P6: Management performance" and "P5: Sales performance" have positive effects on "L3: Employee stability." In other words, to reduce employee turnover and retain capable employees, the bank should prioritize its strategies of perfecting management performance and making progress in sales achievement.

In the "F: Finance" perspective, "F4: Earning per share" is the central indicator and can be seen as the main effect-factor; it is influenced by 11 indicators, especially "C3: Market share rate," "P5: Sales performance," and "P6: Management performance." Moreover, "C3: Market share rate" is strongly affected by "P5: Sales performance." This finding reflects Kaplan and Norton's theory that the internal process measure (i.e., P5) drives the measures (i.e., C3) belonging to the customer perspective, and that these measures (i.e., C3, P5, P6) are the drivers of financial performance (Fernandes et al., 2006). In other words, organizations should achieve success with regard to key nonfinancial measures before achieving success with regard to key financial measures.

5.3.2. The prioritization and interdependence analyses of the critical indicators

As indicated in Section 4.2, if the factors have higher positive values of $(D - R)$, implying that they influence other factors much more than other factors influence them, they are considered to have a higher priority for improvement. From the analysis results, as shown in Table 9, the top five priorities of KPIs for the banking institution are "C3: Market share rate," "F6: Return on investment," "P6: Management performance," "L3: Employee stability," and "P5: Sales performance." In other words, these five KPIs are considered to be the critical cause-factors in the constructed strategy map. Referring to Table 8 and Fig. 7, "C3: Market share rate," as the top priority, is perceived as the most critical cause-factor with the highest $(D - R)$ value and influences 18 indicators, especially "C1: Customer satisfaction," "C4: Customer retention rate," and "P5: Sales performance." "P5: Sales performance" has a strong influence on "C3: Market share rate" and the strongest

influence on both "C1: Customer satisfaction" and "C4: Customer retention rate." In addition, "C4: Customer retention rate" also has the strongest influence on "C1: Customer satisfaction." Therefore, increasing the sales volume of products and services ("C3: Market share rate") by promoting both efficiency and effectiveness of sales ("P5: Sales performance") tends to drive the retention of existing customers ("C4: Customer retention rate"), the enhancement of customer satisfaction ("C1: Customer satisfaction"), and the improvement of sales performance ("P5: Sales performance"). Such findings are consistent with Thakkar et al. (2007) and demonstrate that the goal to "Increase market share" (i.e., C3) can lead to "Long-term contracts with contractors" (i.e., C4), and then to the attainment of "Business expansion" (i.e., P5).

In addition, feedback relationships exist among these indicators in both the present work and Thakkar et al. (2007). These relationships imply that management should be also aware of the impact of reinforcement visualized in the logical links. For instance, among the top five prioritized KPIs (i.e., C3, F6, P6, L3, P5) shown in Table 8, the strongest mutual influence existing between the two KPIs is that between "P5: Sales performance" and "P6: Management performance," where "P5: Sales performance" has at least moderate influence on all the other four important KPIs but receives the strongest influence from "P6: Management performance." From this finding, we can infer that the improvement of management performance can help promote sales performance and can thus further increase market share rate. Similarly, banks with better market share position (i.e., higher sales return) can reinforce management capability, since there will be more resources to purchase new facilities or equipment as well as to hire and train quality employees to deliver innovative technologies (products/services) to customers.

As discussed previously, both "P5: Sales performance" and "P6: Management performance" have the strongest influence on "C1: Customer satisfaction," which has at least a moderate influence of feedback on them in return. Moreover, "L3: Employee stability" has moderate mutual influence (feedback relationships) with both "P5: Sales performance" and "P6: Management performance." This finding implies that management performance and sales performance drive increasing employee stability and the achievement of higher customer satisfaction. The logical links of feedback relationships present evidence that increasing employee stability is an effective strategy. Such a conclusion is consistent with the argument offered by Collier (1995).

Overall, the derived improvement paths that indicate the priorities of the strategic steps (linked by the KPIs) should be followed based on the strategy map developed by the DEMATEL. Taking account of the interactive interdependent relationships among the KPIs as a whole, a suggested strategic improvement path from the constructed strategy map can be inferred as follows: Improving management performance should be the first step to enhancing sales performance, growing customer retention rate, and achieving higher customer satisfaction for banking institutions. These conclusions are consistent with Meyer and Markiewicz (1997), who propose that a performance-measurement system should emphasize executive, managerial, and operational performance in the articulation of a new strategy.

5.3.3. Discussions and comparisons with other studies

The purpose of DEMATEL analysis is to decide causal relationships between factors in a complex system. This research used the DEMATEL method to construct a strategy map of banking performance by extensively synthesizing the relevant literature and by objectively evaluating expert opinions, a method different from the conventional approach of building strategy maps from the four BSC perspectives only by experts' rules of thumb (Brewer, Albright, & Davis, 2004; Chia & Hoon, 2000; Littler et al., 2000;

Meyer & Markiewicz, 1997). Recently, other BSC related studies have investigated the interactive relationships among the strategic objectives (or performance indicators) using causal analysis tools such as ISM and DEMATEL. For example, in a similar study, Thakkar et al. (2007) developed an ISM model for linking up strategic objectives with merely causal directions. In comparison, the qualitative and quantitative analysis results obtained by the DEMATEL in the present study can determine not only the direction of influence (quality) but also the strength of relationships (quantity) between the KPIs. Therefore, as can be seen in Fig. 7, the construction of the interrelationships (including the influential directions and strengths among the KPIs) offered by the current study may help to prioritize the deployment of strategic steps for banking institutions.

In addition, unlike the fuzzy network BSC approach proposed by Tseng (2010), which focuses on criteria weights for the performance measurement of an educational institution by considering the dependence and interaction among the criteria, the present work emphasizes constructing a detailed strategy map that illustrates visualized causal chains for banking performance improvements. In a more recent study, Jassbi et al. (2011) also employ the DEMATEL method to explore the cause-and-effect relationships of an organization's BSC strategic objectives, but there is no further discussion about the complex causal relationships among the indicators. In other words, both Tseng (2010) and Jassbi et al. (2011), which are based on the BSC, apply the DEMATEL to simply divide criteria into a "cause group" and an "effect group." This use of DEMATEL can hardly provide the required insight into how to construct a strategy map because of its lack of further analyses/explanations of the causal relationships as a whole. Therefore, compared with other studies related to the use of BSC, the results of the current study demonstrate strategies that can be both logically and directorially linked together by the KPIs through outcome measures (lagging indicators) and performance drivers (leading indicators) in the implementation of the BSC process.

5.3.4. Thresholds set for the construction of strategy map

As addressed previously, to curtail the indicators that had little impact and to distinguish the severity of influence, thresholds were chosen in consultation with the experts (Liou et al., 2008). Thus, thresholds were used to eliminate the trivial connections of the complex causal relationships derived from the DEMATEL analysis. In this research, the threshold was set to 0.7667 for the four BSC perspectives (Table 5) and 0.5058 for the total relationships among the KPIs (Table 6). These were decided through the input of the experts (i.e., senior managers of the case bank) involved in the study. A threshold made of a consensus value can filter out negligible effects while maintaining the complexity of the system as a whole to a manageable level. In this study, as we note in Table 6, three indicators (F2, P4, and L1) are eliminated as a result of their weak connections (influence level under the set threshold value) with the other indicators, even though the $(D - R)$ value of "F2: Debt ratio" is ranked third (as shown in Table 7). According to the strategy map created by the remaining 20 KPIs of the BSC (Fig. 7), the prioritization of the logical links by the vital KPIs for banking performance improvements are well illustrated in a visual presentation. In this case, and for the sake of simplicity and clarity, the threshold value is not set too low. However, it is possible that the threshold value may be not set too high for the retention of information that would in some cases be valuable.

6. Conclusions

The study has contributed to providing decision makers with a systematic approach for establishing a visual strategy map with a consideration of the intricate causal relationships among KPIs

along with in-depth analyses of important strategic improvement paths. As stated previously, the four perspectives of the BSC serve merely as a template, and the relevant measures are not evident from this template alone. In other words, the specifics of BSC vary from organization to organization, and the strategic processes are situation dependent. Since each organization is unique, it should have its own way of choosing different measures (i.e., performance indicators) to sufficiently reflect its performance. Nevertheless, the basic knowledge of BSC implementation can be generic. Therefore, the BSC strategy map construction framework proposed in this research would be a useful and valuable reference for other organizations.

6.1. Managerial implications

In this research, strategic analysis is performed to create logical links between the KPIs based on the content of the BSC evaluation criteria that are most appropriate for banking performance. By synthesizing the relevant experts' opinions, the DEMATEL method was used to determine the causal relationships and strengths of influence among the KPIs to establish a strategy map. The results of this prioritization of the strategic steps indicate a path for management to better invest resources in the aspects needing improvement most. Compared with the conventional method of devising strategy maps subjectively, the DEMATEL is a more logical approach to disclose causal relationships among the KPIs. In other words, the complex cause-and-effect relationships between the KPIs displayed by the DEMATEL are more rational and provide a clearer road map to help management choose the crucial indicators (including the main cause-factors and effect-factors) and focus on the strategy-related activities.

However, numerous causes exist related to any specific effect that may also have influence on others (causes or effects). The use of "cause and effect" analysis helps to identify the mix of possible improvement paths (linked directly and/or indirectly by KPIs) for the organization's performance in all of the four BSC perspectives. Therefore, the proposed strategy map with the relative influential strengths of KPIs can provide a reference of priority for management in determining strategic improvement paths. Moreover, in addition to weighing the influence among KPIs, management is advised to link up the organization's strategies with its competencies and to further transform the strategies into significant tasks and results-oriented program services and supports (Hamel & Prahalad, 1996a; Schalock & Bonham, 2003). According to our research findings, some of the important managerial implications are summarized as follows.

First, based on the strategy maps systematically constructed here, the DEMATEL method can provide feasible references for the prioritization of strategic steps in practice since the causal links between all the KPIs are logically exposed. Especially under constraints of limited time and resources, focusing on the vital few indicators with stronger influential degree among these KPIs would be useful as managers' first concern.

For example, referring to the strategy map developed by the case bank, several leading indicators (performance drivers) have influence specifically on the one lagging indicator (outcome measure), namely, "Customer satisfaction," which is a main effect-factor with a relatively lower priority. This result implies that as customer complaint, sales performance, and management performance improve, customer satisfaction increases. That is, management can take customer satisfaction as a major lagging indicator (outcome measure) for banking performance measurement. In addition, for the case bank, depending on its current core competencies (e.g., workforce, skills, and technologies), the strategy implementation (improvement path) for accomplishing objectives may consist of planning better management mecha-

nisms (e.g., effective personal appraisal system, sound compensation system, and attractive benefit programs) in order to increase employee stability, reduce customer complaints, and achieve higher customer satisfaction.

Second, management should pay more attention to the interdependences (feedback relationships) among the KPIs, since the influence of feedback relationships can be that of positive reinforcement among the KPIs. For example, in terms of cause-and-effect relationships, enhancing management performance is the first priority for a bank to improve its sales performance. Moreover, higher sales performance can drive the retention of more loyal customers, resulting in increased customer satisfaction. In addition, the results show that the first priority for a bank to improve its "Learning and growth" perspective is employee stability. It is suggested through our results that management can decrease employee turnover rate by implementing relevant policies (e.g., professional training, benefit system) to satisfy employees and increase employee retention. Consequently, with higher personnel stability, organizational competence is also enhanced.

Third, the results reveal that "Customer satisfaction," "Sales performance," and "Customer retention rate" are the three most essential evaluation indicators of banking performance. Two out of these three critical indicators, "Customer satisfaction" and "Customer retention rate," are effect-factors and belong to the customer perspective of the BSC. Thus, we can conclude that, instead of the financial measures generally used by the traditional BSC implementations as final outcome measures shown in the top (financial perspective) of the basic template of the strategy map illustrated by Kaplan and Norton (2004a), nonfinancial measures, in particular those within the customer's perspective, may be more effectively emphasized by the service sector as the foremost outcome measures. In other words, for banking institutions, setting up the strategic objectives of strategy maps should be driven by a customer-orientation and should take the customer-related indicators as final outcome measures.

6.2. Lessons learned

In this research, since it possesses advantages over other methods, the DEMATEL was used to investigate the interactive relationships among KPIs for the constructing of the strategy map of a banking institution. In comparison with traditional SEM, the DEMATEL method uses the knowledge of experts to lay out the structural model of a system (i.e., performance measurement system) in order to determine the casual relationships among KPIs and requires no pre-hypotheses and large-data verifications. Moreover, as noted earlier, compared with the ISM approach for linking up KPIs by merely taking into account causal directions, the DEMATEL method not only helps us to visualize the cause-and-effect relationships among KPIs through causal diagrams but also indicates the strengths of influence among KPIs. Moreover, based on the DEMATEL analysis, the influential directions and strengths among the KPIs can be used to identify critical KPIs as well as to prioritize alternatives (logical links) in decision making.

However, there are some limitations of the current study. First, in the DEMATEL questionnaire survey, like all the other professional questionnaires, responses are necessarily limited to human subjective consciousness because of the nature of decision making reflected in the subjective ability of human beings. Second, it is inevasible that forming an expert panel will result in a bias in the selection of indicators. Third, the subjective judgments of related experts about the different BSC perspectives may vary from each other. To reduce the variation of opinions, in this study, the results of the DEMATEL analysis, which is derived from an average

of the inputs from the experts, were further confirmed by interviews with the committees of experts as part of an attempt to ensure consensus through a more complex perspective. It is advisable to use common techniques (e.g., Delphi method, focus groups, and nominal group techniques) and any other effective communication tools to help reach a consensus (Aranda & Arellano, 2010; Thakkar et al., 2007). Fourth, the selected KPIs with respect to the BSC that were adopted by the case bank may not be suitable to other institutions because KPIs need to be derived from an organization's vision, mission, and strategic objectives, and this distinction is not the main focus of the presented approach. Therefore, necessary precautions should be taken about the applicability of the results to other sectors/ situations. In addition, for the details of the important concept, architecture, and process involved in the BSC development, it is recommended to refer to relevant prior studies (e.g., Littler et al., 2000; Meyer & Markiewicz, 1997; Thakkar et al., 2007).

Furthermore, as years of debate, quantitative data or quantitative analysis is no guarantee of rigorous research. Nevertheless, the DEMATEL method was adopted in this study. This systematic approach involves quantitative data to analyze both the influential directions and strengths of the logical links among the KPIs; therefore, it is somehow more "objective" than the "subjective" measurements acquired only from an expert group that assigns preferences between the indicators by rules of thumb. In addition, a follow up qualitative study with an in-depth analysis might help to minimize bias and therefore assist in achieving reliable results.

6.3. Future research

In summary, according to the conclusions and limitations of this study, the following suggestions are drawn to aid future research. First, since no one performance indicator fits all scenarios, future studies are suggested to tailor performance indicators to meet the organization's overall goals as well as the objectives of each individual unit. Second, the results reveal that the KPIs of the BSC perspectives may not be mutually exclusive. That is, there exists some degree of interdependence among the KPIs. Other analytical techniques (e.g., fuzzy integral, Analytic Network Process) can be employed to solve the interactive and feedback relationships between the indicators and to further explore the relative importance among the KPIs. Finally, more cases and empirical studies are recommended as tools to validate the usefulness of the proposed model of establishing strategy maps in depth.

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References

Anderson, W., Jr., Cox, J. E. P., & Fulcher, D. (1976). Bank selection decisions and marketing segmentation. *Journal of Marketing, 40*(1), 40–45.

Aranda, C., & Arellano, J. (2010). Consensus and link structure in strategic performance measurement systems: A field study. *Journal of Management Accounting Research, 22,* 271–299.

Armitage, H., & Scholey, C. (2003). Mapping mavens. *CMA Management, 77*(3), 15–18.

Arshadi, N., & Lawrence, E. C. (1987). An empirical investigation of new bank performance. *Journal of Banking and Finance, 11*(1), 33–48.

Athanassopoulos, A. (2000). Assessing the efficiency in operations of bank branch networks using data envelopment analysis: An illustrative application to specialized mortgage. *Conference Proceedings.*

Athanassopoulos, A., & Giokas, D. (2000). On-going use of data envelopment analysis in banking institutions: Evidence from the Commercial Bank of Greece. *Interfaces, 30*(2), 81–95.

Ballou, B., Heitger, D. I., & Tabor, R. (2003). Nonfinancial performance measures in the healthcare industry. *Management Accounting Quarterly, 5*(1), 11–16.

Banker, R. D., Chang, H. M., & Pizzini, J. (2004). The balanced scorecard: Judgmental effects of performance measures linked to strategy. *The Accounting Review, 79*(1), 1–23.

Barad, M., & Dror, S. (2008). Strategy maps as improvement paths of enterprises. *International Journal of Production Research, 46*(23), 6627–6647.

Barlas, Y., & Yasarcan, H. (2006). Goal setting, evaluation, learning and revision: A dynamic modeling approach. *Evaluation and Program Planning, 29*(1), 79–87.

Bhagwat, R., & Sharma, M. K. (2007). Performance measurement of supply chain management: A balanced scorecard approach. *Computers & Industrial Engineering, 53*(1), 43–62.

Boyd, W., Leonard, M., & White, C. (1994). Customer preferences for financial services: An analysis. *International Journal of Bank Marketing, 12*(1), 9–15.

Brewer, P. C., Albright, T., & Davis, S. (2004). Security regional bank: Implementing a balanced scorecard using the business. *The Journal of Corporate Accounting & Finance, 15*(5), 73–83.

Chan, Y. K., Gaffney, P., Neailey, K., & Ip, W. H. (2002). Achieving breakthrough performance improvement: Results of implementing a fit-for-purpose total management system. *The TQM Magazine, 14*(5), 293–296.

Chen, T. Y., Chen, C. B., & Peng, S. Y. (2008). Firm operation performance analysis using data envelopment analysis and balanced scorecard: A case study of a credit cooperative bank. *International Journal of Productivity and Performance, 57*(7), 523–539.

Chia, A., & Hoon, H. S. (2000). Adopting and creating Balanced Scorecards in Singapore-based companies. *Singapore Management Review, 22*(2), 1–15.

Chiu, Y. J., Chen, H. C., Tzeng, G. H., & Shyu, J. Z. (2006). Marketing strategy based on customer behavior for the LCD-TV. *International Journal of Management and Decision Making, 7*(2/3), 143–165.

Collier, D. A. (1995). Modeling the relationships between process quality errors and overall service process performance. *International Journal of Service Industry Management, 6*(4), 4–19.

Davis, S., & Albright, T. (2004). An investigation of the effect of the balanced scorecard implementation on financial performance. *Management Accounting Research, 15*(2), 135–153.

Da Silva, J. G., Tadashi, O., & Kikuo, N. (2005). Looking through and beyond the TQM horizon. *The TQM Magazine, 17*(1), 67–84.

Dessler, G. (2000). *Human resource management* (8th ed.). New Jersey: Prentice Hall.

Devlin, J. F. (2002). Customer knowledge and choice criteria in retail banking. *Journal of Strategic Marketing, 10*(7), 273–290.

Devlin, J., & Gerrard, P. (2005). A study of customer choice criteria for multiple bank users. *Journal of Retailing and Consumer Services, 12*(4), 297–306.

Dror, S., & Barad, M. (2006). House of Strategy (HOS): From strategic objectives to competitive priorities. *International Journal of Production Research, 44*(18-19), 879–3895.

Drake, L. (2001). Efficiency and productivity change in UK banking. *Applied Financial Economics, 11*, 557–571.

Elliot, M. B., Shatto, D., & Singer, C. (1996). Three customer values are key marketing success. *Journal of Retail Banking Services, 18*(1), 1–7.

Evans, N. (2007). Assessing the balanced scorecard as a management tool for hotels. *International Journal of Contemporary Hospitality Management, 17*(5), 376–390.

Fernandes, K. J., Raja, V., & Whalley, A. (2006). Lessons from implementing the balanced scorecard in a small and medium size manufacturing organization. *Technovation, 26*(5/6), 623–634.

Frigo, M. L., Pustorino, P. G., & Krull, G. W. (2000). The Balanced Scorecard for community banks: Translating strategy into action. *Bank Accounting and Finance, 13*(3), 17–29.

Gabus, A., & Fontela, E. (1972). *World problems, an invitation to further thought within the framework of DEMATEL*. Geneva, Switzerland: Battelle Geneva Research Center.

Gabus, A., & Fontela, E. (1973). Perceptions of the world problematique: Communication procedure. Communicating with those Bearing Collective Responsibility (DEMATEL Report No. 1). Battelle Geneva Research Centre, Geneva, Switzerland.

Gilligann, T., Smirlock, M., & Marshall, W. (1984). Scale and scope economics in the multi-product banking firm. *Journal of Monetary Economics, 13*(3), 393–405.

Giokas, D. I. (1991). Bank branch operating efficiency: A comparative application of DEA and the loglinear model. *Omega, 19*(6), 393–405.

Giokas, D. I. (2008). Assessing the efficiency in operations of a large Greek bank branch network adopting different economic behaviors. *Economic Modelling, 25*(3), 559–574.

Gonçalves, H. S. (2009). Proposal of a strategy model planning aligned to the balanced scorecard and the quality environments. *The TQM Journal, 21*(5), 462–472.

Hamel, G., & Prahalad, C. K. (1996a). *Competing for the future*. Boston, MA: Harvard Business School Press.

Hamel, G., & Prahalad, C. K. (1996b). Competing in the new economy: Managing out of bounds. *Strategic Management Journal, 17*(3), 237–242.

Hanley, C. A., & Suter, M. P. (1997). Banking's top performance. *ABA Banking Journal, 89*(7), 36–40.

Hepworth, P. (1998). Weighing it up—A literature review for the balanced scorecard. *The Journal of Management Development, 17*(8), 559–563.

Hori, S., & Shimizu, Y. (1999). Designing methods of human interface for supervisory control systems. *Control Engineering Practice, 7*(11), 1413–1419.

Huang, C. Y., Shyu, J. Z., & Tzeng, G. H. (2007). Reconfiguring the innovation policy portfolios for Taiwan's SIP Mall industry. *Technovation, 27*(12), 744–765.

Hsu, K. H. (2005). Using Balanced Scorecard and fuzzy data envelopment analysis for multinational R&D project performance assessment. *The Journal of American Academy of Business, 7*(1), 189–196.

Jassbi, J., Mohamadnejad, F., & Nasrollahzadeh, H. (2011). A Fuzzy DEMATEL framework for modeling cause and effect relationships of strategy map. *Expert Systems with Applications, 38*(5), 5967–5973.

Kaplan, R. S., & Atkinson, A. A. (1998). *Advanced management accounting* (3rd ed.). New Jersey: Prentice-Hall.

Kaplan, R. S., & Norton, D. (1992). The Balanced Scorecard measures that drive performance. *Harvard Business Review, 70*(1), 71–79.

Kaplan, R. S., & Norton, D. (1996a). Using the Balanced Scorecard as a strategic management system. *Harvard Business Review, 74*(1), 75–85.

Kaplan, R. S., & Norton, D. (1996b). *The Balanced Scorecard: Translating strategy into action*. Boston: Harvard Business School Press.

Kaplan, R. S., & Norton, D. (1996c). Link the Balanced Scorecard to strategy. *California Management Review, 39*(1), 53–79.

Kaplan, R. S., & Norton, D. (2004a). *Strategy maps: Converting intangible assets into tangible outcomes*. Boston: Harvard Business School Press.

Kaplan, R. S., & Norton, D. (2004b). The strategy map: Guide to aligning intangible assets. *Strategy and Leadership, 32*(5), 10–17.

Kim, C. S., & Davidson, L. F. (2004). The effects of IT expenditures on banks' business performance: Using a Balanced Scorecard approach. *Managerial Finance, 30*(6), 28–45.

Ko, A. S. O., & Lee, S. F. (2000). Implementing the strategic formulation framework for the banking industry of Hong Kong. *Managerial Auditing Journal, 15*(9), 469–477.

Kosmidou, K., Pasiouras, F., Doumpos, M., & Zopounidis, C. (2006). Assessing performance factors in the UK banking sector: A multicriteria methodology. *Central European Journal of Operations Research, 14*(1), 25–44.

Lebas, M. J. (1995). Performance measurement and performance management. *International Journal of Production Economics, 41*(1), 23–35.

Lee, J., & Marlowe, J. (2003). How consumers choose a financial institution: Decision-making criteria and heuristics. *International Journal of Bank Marketing, 21*(2), 53–71.

Liou, J. J. H., Yen, L., & Tzeng, G. H. (2008). Building an effective safety management system for airlines. *Journal of Air Transport Management, 14*(1), 20–26.

Littler, K., Aisthorpe, P., Hudson, R., & Keasey, K. (2000). A new approach to linking strategy formulation and strategy implementation: An example from the UK banking sector. *International Journal of Information Management, 20*(6), 411–428.

Lymperopoulos, C., Chaniotakis, I. E., & Soureli, M. (2006). The importance of service quality in bank selection for mortgage loans. *Managing Service Quality, 16*(4), 365–379.

Makhijani, N., & Creelman, J. (2008). How leading organizations successfully implement corporate strategy with the balanced scorecard. *The OTI Thought Leadership Series, 1*(1), 1–16.

Malina, M., Nørreklit, H., & Selto, F. (2007). Relations among measures, climate of control and performance measurement models. *Contemporary Accounting Research, 24*(3), 935–982.

Malmi, T. (2001). Balanced scorecards in Finnish companies: A research note. *Management Accounting Research, 12*(2), 207–220.

Martenson, R. (1985). Consumer choice criteria in retail bank selection. *International Journal of Bank Marketing, 3*(2), 64–75.

McNamara, C., & Mong, S. (2005). Performance measurement and management: Some insights from practice. *Australian Accounting Review, 1*(15), 14–26.

Mearns, K., & Havold, J. I. (2003). Occupational health and safety and the Balanced Scorecard. *The TQM Magazine, 15*(6), 408–423.

Meyer, D. W., & Markiewicz, M. (1997). Developing a Balanced Scorecard at Wachovia Corporation. *Bank Accounting and Finance, 11*(1), 13–19.

Molyneux, P., Altunbas, Y., & Gardener, E. (1997). *Efficiency in European Banking*. New York: John Wiley and Sons.

Mouritsen, J., Larsen, H. T., & Bukh, P. N. (2005). Dealing with the knowledge economy: Intellectual capital versus balanced scorecard. *Journal of Intellectual Capital, 6*(1), 8–27.

Murray, J. D., & White, R. W. (1983). Economies of scale and economies of scope in multiproduct financial institutions: A study of British Columbia Credit Unions. *The Journal of Finance, 38*(3), 887–902.

Nist, T. J. (1996). For best service, match needs to bank's delivery process. *Corporate Cashflow, 17*(7), 30–32.

Nørreklit, H. (2000). The balance on the Balanced Scorecard: A critical analysis of some of its assumptions. *Management Accounting Research, 11*(1), 65–88.

Nørreklit, H. (2003). The Balanced Scorecard: What is the score? A rhetorical analysis of the Balanced Scorecard. *Accounting, Organizations and Society, 28*(6), 591–619.

Norton, D. P., Contrada, M. G., & LoFrumento, T. (1997). Case study: How Chase Manhattan Bank uses the Balanced Scorecard. *Banking Accounting and Finance, 11*(1), 3–19.

Petersen, M. J., & Samuels, J. (2007). Missing non-strategic targets: Are managers penalized for emphasizing important measures? American Accounting Association (AAA) 2008 Management Accounting Section (MAS) Meeting Paper. Available at SSRN: http://ssrn.com/abstract=1004053.

Pessanha, D. S. da S., & Prochnik, V. (2006). Practitioners' opinions on academics' critics on the balanced scorecard. Available at SSRN: http://ssrn.com/abstract=1094308.

Price, D. A., & Bohner, C. (2007). Taking scorecards beyond theory. *Bank Accounting and Finance*, 29–32.

PricewaterhouseCoopers (PwC) (2009a). Effective performance management practices drive superior performance. http://www.pwc.com/ca/en/media/release/2009-06-02-performance-management-report.jhtml Accessed 05.07.11.

PricewaterhouseCoopers (PwC) (2009b). Performance management matters. Sustaining superior results in a global economy, CA. http://www.pwc.com/ca/en/finance/performance-management/global-performance-management-research-study.jhtml Accessed 05.07.11.

Quezada, L. E., Cordova, F. M., Palominos, P., Godoy, K., & Ross, J. (2009). Method for identifying strategic objectives in strategy maps. *International Journal of Production Economics, 122*(1), 492–500.

Rue, L. W., & Byars, L. L. (2005). *Management: skills and application* (11th ed.). Homewood: McGraw-Hill.

Schalock, R. L., & Bonham, G. S. (2003). Measuring outcomes and managing for results. *Evaluation and Program Planning, 26*(3), 229–235.

Seyed-Hosseini, S. M., Safaei, N., & Asgharpour, M. J. (2006). Reprioritization of failures in a system failure mode and effects analysis by Decision Making Trial and Evaluation Laboratory technique. *Reliability Engineering and System Safety, 91*(8), 872–881.

Shah, A. (2009). Global financial crisis 2008. http://www.globalissues.org/article/768/global-financial-crisis Accessed 18.01.09.

Shoaib, Y. (2006). The balanced scorecard and its implementation in Wells Fargo Online Financial Services. http://www.grin.com/en/preview/63220.html Accessed 20.09.07.

Sinclair, D., & Zairi, M. (2001). An empirical study of key elements of total quality-based performance systems: A case study approach in the service industry sector. *Total Quality Management, 12*(4), 535–550.

Sridharan, S., Go, S., Zinzow, H., Gray, A., & Gutierrez Barrett, M. (2007). Analysis of strategic plans to assess planning for sustainability of comprehensive community initiatives. *Evaluation and Program Planning, 30*(1), 105–113.

Tamura, H., & Akazawa, K. (2005). Structural modeling and systems analysis of uneasy factors for realizing safe, secure and reliable society. *Journal of Telecommunications and Information Technology, 3*, 64–72.

Thakkar, J., Deshmukh, S. G., Gupta, A. D., & Shankar, R. (2007). Development of a balanced scorecard: An integrated approach of interpretive structural modeling (ISM) and analytic network process (ANP). *International Journal of Productivity and Performance Management, 56*(1), 25–59.

Tzeng, G. H., Chiang, C. H., & Li, C. W. (2007). Evaluating intertwined effects in e-learning programs: A novel hybrid MCDM model based on factor analysis and DEMATEL. *Expert Systems with Application, 32*(4), 1028–1044.

Tzeng, G. H., Lin, C. W., & Opricovic, S. (2005). Multi-criteria analysis of alternative-fuel buses for public transportation. *Energy Policy, 33*(11), 1373–1383.

Tseng, M. L. (2010). Implementation and performance evaluation using the fuzzy network balanced scorecard. *Computers & Education, 55*(1), 188–201.

Wright, G., & Taylor, A. (2001). Informing effective performance management. *Journal of Finance and Management in Public Services, 1*(1), 7–27.

Wu, H. Y., Lin, Y. K., & Chang, C. S. (2011). Performance evaluation of extension education centers in universities based on the balanced scorecard. *Evaluation and Program Planning, 34*(1), 37–50.

Wu, H. Y., Tzeng, G. H., & Chen, Y. H. (2009). A fuzzy MCDM approach for evaluating banking performance based on Balanced Scorecard. *Expert Systems with Applications, 36*(6), 10135–10147.

Wu, W. W., & Lee, Y. T. (2007). Developing global managers' competencies using the fuzzy DEMATEL method. *Expert Systems with Applications, 32*(2), 499–507.

Youngblood, A. D., & Collins, T. R. (2003). Addressing Balanced Scorecard trade-off issues between metrics using multi-attribute utility theory. *Engineering Management Journal, 15*(1), 11–17.

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