

A DSS for Strategic Management Based on the Balanced Scorecard Model

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Abstract. This paper focuses on the adoption of the Balanced Scorecard model [1] for strategic management by a Portuguese insurance company and presents the Decision Support System (DSS) that has been conceived and developed to embody this adoption. A special emphasis is given to the definition of a strategy, the selection of the strategic measures to analyse and monitor and to the selection of initiatives taken to operationalize the identified strategy. The DSS was designed in close interaction with senior executives and was conceived aiming at enabling the company to more effectively analyse and control indicators relevant for its strategic decisions. The achievements resulting from the implementation of the system are presented and reveal that the BSC integrated with a DSS can be an effective strategic management tool for an SME.

Keywords. Strategic Management, Strategic Decision Support Systems, Balanced Scorecard.

Introduction

Nowadays, the competitive and highly changeable environment where companies operate, due to globalisation and the economic crisis, pushes organisations to continuously pursue their strategic goals and implement effective strategies for this achievement.

The Balanced Scorecard (BSC) [1,2] is a model capable of measuring the strategic performance of organizations. This model has been continuously extended and has become one of the most widely applied tools for strategic planning and implementation of management strategies. Besides providing a broad view over the organization objectives, it allows for the alignment of the several units within it, while improving internal communication between them, as well as providing evaluation and potential to manage exogenous and endogenous risks. The BSC promises, as impacts, strategic alignment, internal communication, monitoring and operationalization of the strategy.

The BSC has been widely adopted across the world and its fusion within Decision Support Systems (DSS) and Business Intelligence (BI) systems fits well to support strategic management, though most times this integration is not explicitly identified. In fact, DSS and BI systems have evolved as critical IT systems in companies to provide valuable data analysis, judgment, support decision-making, and orient and control organizational performance. However, the BSC has received strong criticism [3,4] and its adoption among small and medium enterprises (SMEs) is still low, especially in

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Portugal [5], mainly because it requires a high initial investment on technology, and also because managers have difficulties in perceiving its utility.

The objective of this paper is to demonstrate how an SME can effectively benefit from the implementation of the BSC integrated within a Strategic Management Decision Support System (SMDSS).

This paper is organised as follows. Section 1 reviews the BSC and its integration with DSS. Section 2 presents the company, how the company perceived the need to put into practice strategies to attain its mission and how the BSC model was adopted and implemented. The developed SMDSS is described in Section 3. Section 4 discusses the results achieved, while Section 5 frames the research as design science and analyses its assessment. The paper ends with a perspective of the future developments and some final remarks.

1. The BSC and Decision Support for Strategic Management

The basic principles of the BSC are *vision*, *mission*, and *strategy* integrated in four perspectives: *financial*, *customers*, *internal business process*, and *learning and growth* [1,2]. The first premise, *vision*, aims at determining in anticipation an image of the future scenario, which intends to set an objective founded on the present scenario. This vision is materialized by the *mission* that should be based on the values, social framing and purpose of the organization. It relies on the *strategy* that must be defined and is to be measured and monitored through the so called key performance indicators (KPI). These indicators should allow for correcting, updating or redefining the strategy as needed. The *financial* perspective concerns the growth of income and productivity. The *customers'* perspective describes the channels through which value for costumers is built and the reasons that drive the buy of the product/service. It allows for the alignment of KPI related with customers (satisfaction, retention, new customer acquisition) and specific market segments. The *internal business process* (IBP) perspective deals with measuring the available resources and identifying directions for improving the product/service quality. Finally, the *learning and growth* perspective focuses on the human and technological structure needed to ensure the execution of the strategy and provides the foundation for the remaining others, as the resources (human, technologies and processes) establish the building blocks to achieve the proposed goals. The model assumes the following causal relationship between perspectives' measures: *learning and growth* → *internal business process* → *customers* → *financial*.

The difficulty in assessing this cause and effect relationship has received strong criticism [3]. The model relies on a top-down performance measurement and, therefore, in such a framework, invalid assumptions can cause anticipation of performance indicators that are faulty. Other critics of the BSC regard the incapacity of the model to enclose external influences that effect companies' performance, such as, the interaction along the extended value chain and the interaction with the operating environment [4].

“Strategic management is built on a search for organisational intelligence, an attempt to make actions lead to outcomes that are consistent with desires or conceptions of appropriateness. The objective is one that is both ambiguously defined and imperfectly achieved. (...) Earlier approaches to strategic management focused on the use (or lack of use) of analytically rational decision processes and pictured the task of intelligent management as that of facilitating to act rationally.” [6]. Simon's model [7] of managerial decision-making: 1) intelligence; 2) design; 3) choice and 4)

implementation; set up the concept of organisational intelligence, albeit it assumes limited information processing and use of rules. The use of information is crucial to support decision making, however the knowledge of the world is imperfect and, therefore, decision makers must aspire to make sub-optimal decisions, which Simon refer to as “satisficing” decisions. This concept goes against the theory of Savage [8] according which all possible decisions could be evaluated and ranked through a utility function, thus assuming decision makers to have a perfect knowledge of the world.

Nevertheless, the current vision of strategic planning and management is still based upon the concept of rationality despite the criticisms it has triggered [9].

Several studies identify successful applications of the BSC by large companies [10-12]. However, this is not the case of SMEs with some few exceptions. At the end of 2011, a survey on strategic management (SM) in Portuguese companies confirmed the low adoption rates of the BSC by SMEs: only 17% of the inquired companies use a BSC based SM tool, while 18% are implementing one, other SM tools are used by 37% companies and 28% still don't use SM tools, [5]. BSC is preferred by large companies, public institutions and the state-owned company sector (around 50%). Nevertheless, the BSC is only used by 22% of Portuguese SMEs which constitute around 99% of the Portuguese enterprise sector. Among the main reasons for discarding the adoption of this model, managers pointed it out as inappropriate to align with the company structure, as requiring a high initial investment on technology, and also mentioned difficulties in understanding its benefits and utilization.

Managers use the BSC model for decision-making and decision rationalising, for coordination of activities within an organizational unit, and for self-monitoring [13]. Another criticism around the adoption of the BSC by managers concerns the usage of black box software, without any information available about the design of the scorecard, its implementation, or system sophistication. To control such deficiencies modelling, firm specificities should be taken. In addition, strategic planning “must involve both analysis, critical thinking and formal processes. (...) Formal planning processes with computerized support can reinforce and enhance planning in organizations, but poorly designed processes and DSS can be and usually are detrimental to effective planning” [14]. The BSC goes ahead at providing monitoring mechanisms thus contributing to assessment and control. Therefore, it embodies a managerial model appropriate to fuse within DSS foundations. Current state-of-the-art managerial decision support applications propose this integration grounded on the most recent technological developments for enterprise information processing, and in most of the cases the IT products are presented by the industry as BI systems. However, the utility, quality, and efficacy of these new products should be rigorously evaluated.

Keeping in mind these results as well as the directions pointed by Arnott [15] regarding the way senior managers use business IT, any DSS fusing both approaches should be designed in direct interaction with the company senior executives.

2. Implementing the Balanced Scorecard in Mútua dos Pescadores

2.1. The Company

Mútua dos Pescadores (Fishermen's Mutual) – MP – is an insurance company that began operations in 1942, in the fisheries sector. In 2000, it began working with other maritime sectors. In 2004, MP adopted the legal status of a cooperative (consumer

cooperative), thus becoming the first and only cooperative insurance company in Portugal. It became Portugal's largest association in the maritime sector, with 16,000 members, spread among activities such as professional and sport fishing, leisure boating and coastal communities, diving, and aquaculture. Recently, it expanded its activities to France.

MP actively takes part in the federative structure of the social and cooperative sector, is committed to the sustainable development of coastal communities, and has been recognized for its social activity. It has a share capital of five million euro and an annual billing of ten million euro, employing around 50 employees.

A consumer cooperative company, as is MP, is ruled by cooperative principles and is concerned with community service rather than pecuniary profit, although profit is essential to guarantee its continuity and independence.

2.2. Adoption of the BSC

In 2007, in order to deal with the fierce competition in this financial sector, which leads to the reduction of insurance policy prices and to the huge reduction of the fishing endeavour in Portugal due to a depletion in the fleets and in the number of fishermen, MP's senior executives perceived the need to seriously pursue the company's mission and goals. In MP's technical and commercial national conferences, where topnotch and second-line figures of MP gather, a series of informal meetings using open space methodology were held [16]. These meetings, with their different goals and groups, resulted in the definition of vision, mission and SWOT analysis (Strengths, Weaknesses, Opportunities and Threats), after all contributions were presented.

The MP's senior executives understood that it was essential to follow a coherent strategy and implement a system capable to assess and control performance. The Balanced Scorecard management model was chosen, despite its low adoption rates by SME's, because it is easy to understand, communicate and has presented several cases of success. The following mission was defined: "To provide a platform of insurances for maritime, cooperative and social sectors, designing and delivering products tailored to these realities and acting with competence, proximity and humanism, being a reference insurance company".

To head the implementation and follow-through of the project, it created a Strategic Implementation Committee (SIC), formed by four members, all of them senior executives, of different fields of knowledge: business (value chain), IS (information systems) and financial systems. All the involved people committed to track the company performance as well as to establish an accurate planning of its activities. The SIC members met regularly to review, discuss, and finally agree on the strategic direction, thus defining the following strategy:

1. Maintaining and reinforcing leadership of the fishing insurance sector;
2. Defining four vectors: Fishing, Recreational Nautics and Sea Cluster, and Cooperative (Social Economy);
3. Growing in terms of insurance policies of recreational nautics and touristic activities;
4. Asserting itself as an insurance company of the coastal communities and sea, through the establishment of many insurance contracts;
5. Developing connections to the cooperative movement, by providing a platform of credible insurance policies.

2.3. Definition of the Strategic Indicators

In order to operationalize the MP strategy, the SIC established a set of indicators that would keep track of the success rate of the initiatives (projects).

The SIC was responsible for the definition of the KPI's and performed an analysis of commonly used indicators for insurance companies. After five SIC meetings, all KPI's were selected with a perspective of quality improvement and increase in the Economic Value Added (EVA).

Table 1 presents and describes the adopted KPI, as follows: the first column displays the KPI name, the second column states its computation expression, the third column indicates the BSC perspective in which the KPI is relevant, and finally the fourth column points out the initiative adopted to correct the KPI.

Table 1. Key performance indicators adopted by MP

indicator	expression	perspective	initiatives
Cycle time of 'policy application-to-policy issuance' (PAPI)	Variation between the date of the policy application and the date of policy issuance	IBP	Adoption of direct issuance via Web system (eGIS)
Cycle time of additional policy emission period (APEP)	Variation between the date of the change in policy application and the date of new policy issuance	IBP	Automatic issuance via ERP at the time the change is requested
Time to close claim (TCC)	Variation between the date of a notification claim and the date of closure of the process	IBP	Improvement on the clinical information management
Customers' retention (CR)	Sum (over all customers) the total number of consecutive years each customer has at least an active policy (at today date)	customer	Improvement on CRM SMS, increase quality of account extracts
Cross-selling (CS)	Sum (over all customers) the total number of different products hold by each customer (at today date)	customer	Partnerships, campaigns, new products
Issued premiums (IP)	Sum of issued premiums	customer	Promoting agents' sells, using ranking and production incentives

The first point of the company's strategy is to maintain and reinforce the leadership position in the maritime insurance sector. To achieve this objective it was necessary to increase the number of policies (contracts) (indicators CS and IP). By its hand, this increase is closely related to improving customer relationship and consequently decreasing the amount of work in tasks related to the production of the physical documents for policy contracts and minutes, thus related with IBP (indicators PAPI and APEP).

In the customer perspective the main objective was to maintain and reinforce customer loyalty, as this is easier than selling new products to existing customers or attracting new customers for such a specialised business (CR). The duration of the loss in the field of work-related accidents is proportional, on average, to the value of the compensation and costs concerning the loss. This drove the adoption of an indicator to measure the average time taken to resolve the claim (indicator TCC).

KPI monitoring has been assigned to the responsibility of the SIC and reported to the senior executives. Though the adopted KPI's covered only two BSC perspectives, learning and growth initiatives were undertaken (Table 2, initiatives i and j), however,

these initiatives are difficult to measure and their results are reflected in the customer perspective, by the CS and IP KPIs. Due to the cooperative character of the company, a special focus is given to the customer perspective. The financial perspective embraces the distribution of revenues to members of cooperative, better services, a democratic management, integration of revenues in the cooperative capital. In addition, all the measures adopted, except the issued premiums, were non-financial.

2.4. Implementation of Initiatives to Attain MP Strategy

Table 2 presents the initiatives taken by MP in pursuing its strategy.

Table 2. Description of the initiatives taken

Initiatives
a) Adoption of an E-insurance platform of on-line policy subscription that allows the implementation of front-office solutions (such as browsers) that suit different channels of commercialization (delegations, mediators, home insurance), easily integrated with other systems, both internal and external to the company. The eGis system is connected through Web services available on the ERP. The whole subscription process (selling insurance policies) is integrated in this system: quotation, subscription, printing of the legal documentation and data integration in the ERP.
b) Implementation of automatic issuance of minutes (changes in the contract) at the moment of the change: contrary to what happened before, when changes in the insurance contracts (minutes) had to be performed in batch (indirectly and all together), now the changes, issuance and printing of the change in the contract is performed in the presence of the insured person in real time/online. This change is made directly on the ERP. Specific printers for printing additional minutes had to be bought and installed.
c) Improvement of clinical information management: an information system was bought to manage the clinical information of the whole medical network. MP has a network of medical and physiotherapy centres spread throughout the country's coast. This initiative intended to shorten the process of clinical information for claims, providing additional information to the clinical board. The clinical director may assess the more complex claims in a stricter, more appropriate and timely manner.
d) Implementation of a CRM SMS (text) application that: warns claimants that their compensations are up for payment, warns customers that payment of the premium receipts are approaching the deadline for payment, and sends friendly messages (birthdays, best wishes).
e) Improvement of the quality of account extracts.
f) Establishment of partnerships: protocols with organisms that have common grounds (Social Economy).
g) Set up of campaigns: granting discounts to insured persons who subscribe new products.
h) Set up of new products: addition of new risks to products that already existed.
i) Promotion of incentive for production (sells): Creation of production rankings per producer (branches, agencies and mediators), with the attribution of prizes for the leaders.
j) Promotion of professional training: insurance theory and sales techniques.

2.5. Implementation of the E-insurance Platform

The development of a new platform to perform online policy subscription was identified as the most pertinent and all-encompassing initiative. The requisites of this platform included: 1) that the platform be integrated in the company's ERP; 2) that the platform promote a significant decrease in the issuance time (in number of days), the pending time between the opening of a new contract and the policy issuance, as well as the policy changes' documentation (minutes). To develop this platform, MP adopted the e-insurance architecture eGIS, fully integrable in GIS [17], the computer solution that supports MP's ERP. Table 3 presents a comparison of the workflow steps in the process of policy and receipt issuance before and after the adoption of the eGIS platform.

Table 3. Policy and receipt issuance workflow steps: changes introduced by eGIS usage

Policy and receipt issuance without using eGIS	Policy and receipt issuance using eGIS
<ol style="list-style-type: none"> 1. Introduction of the policy simulation and proposal (web system operating independently from the ERP) and production of a provisional receipt; 2. Send paper documentation (proposal and provisional receipt) to the central services; 3. Upload policy on ERP and print receipt of the definitive premium and policy; 4. Mail policy documentation and receipt (documents in paper) to the customer (ordinary mail); 5. Control (by comparison) of proposals introduced via Web and provisional documentation; 6. Collect definitive premium. 	<ol style="list-style-type: none"> 1. Introduction of the policy simulation, proposal, policy contract and final receipt in the ERP; 2. Automatic delivery of documentation to customer and automatic collection of definitive premium.

3. The DSS Developed

3.1. Infra-structures and Interconnection between Systems

MP's ERP is lodged in an IBM iSeries system [18], with the operational system OS400. The core applicational system was developed in RPG ILE over DB2. Initially developed in the 90s, the ERP (GIS) has been enhanced with other applicational coatings in synchrony with the requirements of the World Wide Web (WWW), of the client/server architectures and of web services.

In the initial configuration of the ERP, no decision support features were integrated. However, due to MP analysts' and programmers' profound knowledge of the database design, building queries to feed the extraction phase of the ETL proved to be quick and simple. These queries, developed in SQL Standard, were then replicated in the information integration module of the MS SQL Server, the Integration Service.

Figure 1 displays the information flow through the several information systems of MP. Extraction of the indicators is based on an operational system (ERP) and an analytical system (datamart), both implemented in SGBD DB2. From these systems, an extraction motor (MS SQL Server) extracts information regularly to an intermediate database. From this point on the whole system runs on Intel servers. In the last stage, Qlikview uploads the information and provides the user with a navigation panel, allowing him to filter the information viewed so as to define specific contexts of analysis.

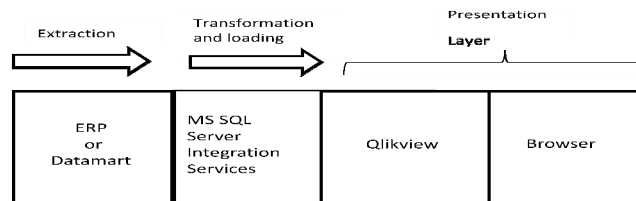


Figure 1. Information flow through the systems

The Qliktech application Qlikview [19] is responsible for an ETL sub-module that fills in the navigation tables in perspective, and these are determined by the defined analysis dimensions: geographic, temporal, products, branches (set of products) or else, in greater detail, by agency.

The indicator of *Issued premiums (accumulated)* gets information from an analytical system – a datamart. All the others extract information from the operational information systems.

The requirements analysis, the functional analysis and the construction of the Qlikview navigation panel were produced over a number of meetings between the development team and the users (SIC members), by using the SCRUM methodology [20], which is based on several quick, incremental stages of development in an iterative manner, thus allowing users to adjust and add requirements to the application.

3.2. Monitoring Strategic Indicators

The strategic indicators mentioned in Table 1 were settled according to SIC stipulations, and their monthly analysis is carried out by MP's senior executives. Of all the indicators, three are picked to paradigmatically illustrate the functionalities of analysis and navigation provided by the SMDSS.

Each indicator was provided with the navigation panel of the SMDSS, with all the vital dimensions for exploring information of several perspectives: geographic zone, product, branch (set of products) and agency. In the top part of the screen two temporal navigation tables were placed: years (2000 to 2011) and trimesters (T1, T2, T3 e T4).

In the chart in Figure 2, the line represents the average *Cycle time of 'policy application-to-policy issuance'* in number of days. This measure can be seen to have decreased throughout 2011, from 25 days in January 2011 to 5 days in September, corresponding to an average of 12.8 days for a total of 3.571 issued policies. The bars in the chart represent the number of policies issued monthly. The bottom view of the screen displays all the contracts represented cumulatively in the chart. This information gives the user a greater sense of confidence. In the top corner, a search box allows the search by any of the columns of the displayed table.



Figure 2. Cycle time of 'policy application-to-policy issuance'

Figure 3 presents a screen for analysis of the *customers' retention* measure. The analysis reveals four classes of members of cooperative/customers according to the number of consecutive years they hold at least a product as such {"<1year", "> 1year", ">5 years", ">9 years"} (represented by bars). In this indicator the homolog periods cannot be compared, because this information is directly taken from the operational system. Unlike analytical systems, which are collections of snapshots of operational systems over time (a feature that allows us to make comparisons *a posteriori*),

operational systems only keep the last state of an object (for instance: Contract, Receipt or Insured Person). We may conclude that MP customers are mostly loyal customers. Proof of this information is that most customers have been so for over 1 year and less than 9 years. MP's specialization in fishing insurance policies and its close relationship with customers (as they are members of cooperative) are the two factors that most contribute to this result.



Figure 3. Customers' retention at 2011-10-04

For the measure *Issued premiums (cumulative)*, the DSS presents a chart of the total cumulative values allowing for a comparison with homolog periods (Figure 4). This feature also allows for the evaluation of the total issued premiums by different dimensions, across which the navigation is made in the left part of the screen.

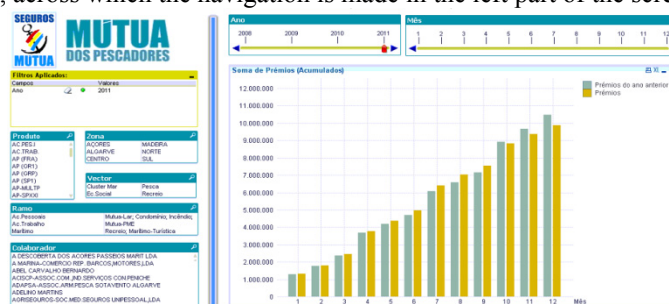


Figure 4. Issued premiums (cumulative)

4. Analysis of the Results

In April 2011, MP went ahead with the production of the eGis platform, with the aim of improving the indicators of time period of issuance of insurance contracts and minutes. To guarantee the correspondence between the eGis (production system) and on-line delivery of accountability, the financial department and the IS department are concluding the implementation phase of on-line delivery of accountability.

Data has been collected on a daily basis and analysed on a monthly basis by comparison to homolog periods, since 2008. The most relevant achievements since the implementation of the initiatives concern 1) the reduction of the *Cycle time of 'policy application-to-policy issuance'* from 12 to two days (85%); 2) the reduction of the *Time to close claim* from 226 to 168 days (75%); and 3) the increase of *Issued premiums* in 13%.

Figures 5a and 5b present the evolution of the measure *Cycle time of 'policy application-to-policy issuance'* across the years 2010 and 2011. The eGIS platform was set from April 2011 onwards and the significant reduction it encompassed can be noted.

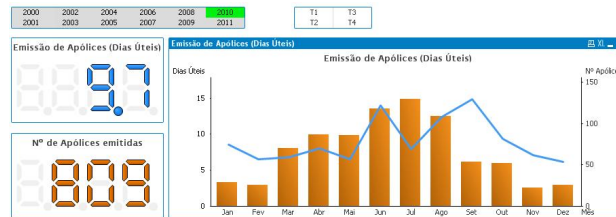


Figure 5a. Cycle time of 'policy application-to-policy issuance' in 2010 (before the eGis)

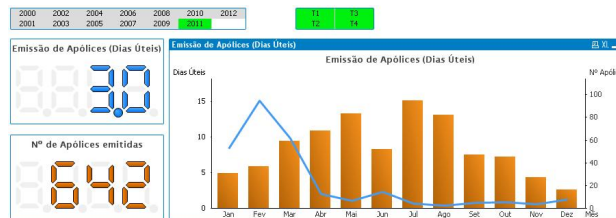


Figure 5b. Cycle time of 'policy application-to-policy issuance' in 2011 (with eGis from April onwards)

As for the years 2009 and 2010, growth of the cumulative issued premiums was very real, as shown by Figure 6, as a result of the strategy designed in 2008. The development of connections to the cooperative movement and the investment in the economic and social sectors close to the fishing communities (Sea cluster) determined a constant production growth in 2009 and 2010.

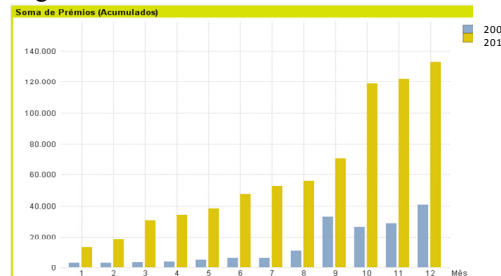


Figure 6. Comparison of the issued premiums of the cooperative vector, between 2009 and 2010

5. Assessment of the Research

Design science creates and evaluates IT artifacts intended to solve identified organizational problems [21]. This research produced an artifact responding the fundamental questions for design-science research: What utility does the new artifact provide? and What demonstrates that utility? The new artifact – the SMDSS – is an effective tool supporting the strategic management and its utility has been demonstrated through its evaluation (in design and production iterations) and through its intensive usage. Thus, the research guidelines for assessment of IS, by Hevner et al. [21], have been used to assess the SMDSS as analysed in Table 4.

Table 4. Assessment of the DSS design and development according to the Hevner et al. guidelines [21].

Guideline	Analysis
Design as an artifact	The artifact is the DSS to manage and control the company's strategy. The DSS should allow for evaluating initiatives through the performance measures defined by application of the BSC.
Problem relevance	The problem addressed is of significant strategic importance for the company: attain the company's mission.
Design evaluation	The utility, quality, and efficacy of the DSS have been rigorously evaluated at each stage of the iterative development through software and usability tests, expert panels and intensive case study (intensive usage in day-to-day measures control).
Research contributions	The definition of the specific DSS requirements – to manage and control the company's strategy, defined through the BSC model.
Research rigor	Rigorous methods have been used in both the construction and evaluation of the DSS: literature analysis and focus groups.
Design as a search process	Each stage of design and development has comprised iterations of model's revision and DSS development, using the available data and technology artifacts to reach desired ends while satisfying laws in the problem environment.
Communication of research	The results of the research have been presented to technology-oriented as well as management-oriented audiences (in Portuguese forums), will be presented at academic conferences, and will be published in scientific Journals.

6. Final Remarks and Future Developments

The adoption of the BSC allowed MP's senior executives to define a strategy and to implement it based on a series of initiatives. They adapted MP technological infrastructure in an effort to comply with objectives and created a monitoring group that met regularly, correcting important details because of the contextual changes that arose.

This paper presented a successful application of DSS for strategic management using the BSC. As success factors we can emphasize the genuine commitment and collaboration effort of all the people involved, from the senior executives, to the SIC, to senior management, and to the employees. Without such commitment a successful implementation would be unlikely. Due to the success of its usage, in 2010, the MP DSS for strategic management was nominated for the Portuguese IDC CIO Awards [22].

The MP DSS for strategic management, though positioned in the immersion face of the IS [23], allows a fusion view of the company's performance, as it provides the senior executives with complementary perspectives of this performance.

As for claims, and despite the control kept by the indicators, results were not that good, although the average time to close claims did decrease. A wave of mortal accidents and shipwrecks that took place in 2009 and 2010, due to the degradation of structural fishing conditions in Portugal and the poor results of the financial assets (Lehman Brothers bankruptcy), worsened MP's technical and financial results. As a consequence of these results, SIC is preparing to launch new indicators for 2012. Two indicators are currently being integrated: accident ratio and recovery ratio. The accident ratio, between the value of the compensations paid out and the value of the premiums received, is important in analysing the technical results of a branch. Through this indicator we can evaluate whether the price for the transfer of risk to the insurance company is adjusted to the claims payment. By studying this ratio through platforms designed for multi-dimensional research, MP intends to put into context and find

accident patterns that allow for an adjustment *a posteriori* of the insurance price. The recovery ratio may be defined as the ratio between issued premiums (billing) and premiums collected. This new indicator will allow MP to put into context, measure and establish a pattern of the dynamics of what is charged at a time when the economic crisis is hitting families and companies.

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