

Balanced Scorecard as a Driver to the Corporative Database Use on Product Development Processes.

Paulo Carlos Kaminski

*Polytechnic School of University of São Paulo
Mechanical Engineering Department
e-mail: pckamins@usp.br*

Renato Vizioli

*Polytechnic School of University of São Paulo
Mechanical Engineering Department
e-mail: renato.vizioli@bol.com.br*

Abstract: Nowadays, the productive sector works in a scenario of constant technological innovation, improvement of information resources and access, new purposes of organizational structures, global competition and so on. The main problem to be faced is how to get advantages to the organization through opportunities identification inside this scenario. This text suggests the use of the Balanced Scorecard tool to identify and analyze enterprise information in a holistic way and, paradoxically, specifically enough to turn information useful to local applications such as in the product development process.

Key-words: Product Development, Balanced Scorecard, and Knowledge Management.

1. Introduction

A lot of product development tools or methods are used today, such as CAD/CAM/CAE, planning and production control, transactional systems information, executive information systems, simulation tools and marketing researches, among so many other tools available. They still usually work in an independent way. Despite the improvement in the relationship among the computer systems using networks, Internet and a lot of communication and translation resources, this isolation still causes an effort redundancy or even gaps on information understanding and use. To increase quality from the product requirements identification step to its extinction process, it is necessary to use to the maximum synergy and this should be possible through a correct integration of several techniques involving project, production, logistics, costs, consumption and marketing, among others. The acquisition, storage and distribution of information inside the company often happen in quite a complex and uncontrolled way, causing substantial losses of useful information. (KAMINSKI and VIZIOLI, 2002)

According to CORRÊA and SLACK (1994), the effect of the variability in the industry generates a broad analysis and it contemplates the whole group of organizational

interrelationships. The environment uncertainties of the industries are the main motivational factor to adopt a high level of flexibility in the company.

To control the uncertainties reduces the flexibility needs (that represent costs) and this aspect is verified in the fast and correct interchange of information among areas in companies and, in a global and virtual company, among different companies.

How to capture and how to transform the customer's information, considering all kinds of customers in the production chain, in subsidies for the development of products is, therefore, the critical point of this process.

According to TRONCHIN (1997), data is a basic component from which information is generated. Information is data on a specific context and context is a situation that is being analyzed. From information, companies get the knowledge and this knowledge helps on many decisions making processes, bringing a competitive advantage.

Considering only corporative information that is stored on ERP (Enterprise Resource Planning) systems, it is important to state that data obeys some basic criteria (RUMBAUGH et al, 1991) of reliability, accessibility, durability and safety that are needed for relational databases.

Also due to the ERP systems, companies have a good processes map and this kind of information is better understood inside the company. ISO initiatives have a considerable weight on this, too.

The kind of company that better fits this profile is that called by STABELL and FJELDSTAD (1998) a “chain” company, that is a manufacturer company that usually acts only on a part of the whole process from raw material extraction to the consumption of the final product. In those companies, the new products development is becoming one of the most vital activities to growth. Table 1 shows a comparison between the three kinds listed by STABELL and FJEDSTAD (1998). The third column shows the “network” kind, which does not produce goods, but catalyzes and makes the process possible. The “shop” kind – better represented by a car manufacturer – is also very affected by the need of fast product development cycles, and a huge preoccupation with final consumers is a clear point to be addressed.

Many prerequisites to face this competitive environment are needed, and not all companies are well prepared. In a

context of sustainable development, JANSEN (2001) lists three aspects where the company has to be prepared: culture, structure and technology. In Table 3, these three aspects are crossed with different characterizations of actions that are involved in product development.

Table 2: Culture-structure-technology for a product development strategy (JANSEN, 2001)

	Optimization	Improvement	Renewal
Culture	Carefulness, thriftiness, discipline	Ambitious, proactive initiative taking	Visionary, sweeping, integral
Structure	Cost saving, regulative, image building	Sectored cooperative, chain principle, progressive regulation	‘Inter-inter’ cooperative, niche-policies
Technology	Recycling, energy efficiency, emission, prevention	Process/product redesign, material choice	New systems for functions and needs

Table 1: Overview of alternative value configurations (STABELL and FJELDSTAD, 1998)

	Chain	Shop	Network
Value creation logic	Transformation of inputs into products	(Re)solving customer problems	Linking customers
Primary technology	Long-linked	Intensive	Mediating
Primary activity categories	Inbound logistics Operations Outbound logistics Marketing Service	Problem-finding and acquisition Problem-solving Choice Execution Control/evaluation	Network promotion and contract management Service provisioning Infrastructure operation
Main interactivity relationship logic	Sequential	Cyclical, spiraling	Simultaneous, parallel
Primary activity interdependence	Pooled Sequential	Pooled Sequential Reciprocal	Pooled Reciprocal
Key cost drivers	Scale Capacity utilization		Scale Capacity utilization
Key value drivers		Reputation	Scale Capacity utilization
Business value system structure	Interlinked chains	Referred shops	Layered and interconnected networks

2. Data and information inside the company

A tendency adopted by many companies, which also reflects in management software suppliers, is the focus on data as a link between the company's several departments. However, many companies use a functional and administrative structure instead of a systemic one. One does not annul or exclude the other: they are just visions with different objectives.

However, the reality is that the administrative and functional vision predominates in the company operations, while the systemic vision is the structure in which the company makes its long-term planning, determining their objectives directions. A start to the correct interface and exchange of information in the company is its systemic analysis. For this, the "Balanced Scorecard" method can be used. (VIZIOLI, 2001)

2.1 "Balanced Scorecard" methodology

Created by KAPLAN and NORTON (1992), it is a collection of measurements (indexes) which makes available a fast but comprehensible business view to managers and executives. The "Balanced Scorecard" (BSC) includes financial indexes about actions already taken or to be taken and complements it with operational measures concerning:

1. Customer's satisfaction;
2. Internal processes;
3. Innovation and implementation in the organization.

These indicators direct the future financial performance.

The BSC allows managers to have business views from important perspectives, which bring answers to questions originated in the requirements definition step. These four perspectives are presented below:

Customers perspective: How do our customers see us?

Internal perspectives: In which aspect must we stand out?

Innovation and learning perspective: Can we go on improving and creating value?

Financial perspective: How do our stockholders see us?

The BSC forces the manager to focus on real important information and more critical measurements. Therefore, in order to determine which aspects are really critical to manage its business, the company must use its efforts in methods such as the SCF (Success Critical Factors) analysis method.

According to this method, even if the company constantly presents a lot of problems, only a few of them will really affect the company success and, therefore, its strategy must be focused on these problems.

Then, data about time, quality, performance, service, core competence (PRAHALAD, 1990), productivity, employee training, critical technologies, costs and so on are used.

The methodology is applied to the product development activity, illustrating how, from established targets, measurements (or indicators) are defined to answer the questions formulated.

3. Information system support to product development

3.1 Balanced Scorecard application

The product development area has not yet made reasonable use of data available in the company. It is limited to the use of some operational data from reports and mainly external sources, such as marketing researches and auto-evaluations. This happens because the process of information bases definition, which is the datawarehouse design (GUPTA, 1997), and the structure of interrelationship inside the company and between other companies exclude the product development area most of times.

This paper proposes the use of KAPLAN and NORTON (1993)'s methodology considering the product development area as a whole business. It means that it proposes that the methodology be particularized in a specific business area, as has frequently been done in commercial and financial areas, considering the company as a collection of operations done by interrelated areas, which can be seen as different businesses. In Figure 1, several questions were formulated in order to answer the requisites of present market discussed previously.

Then, the BSC makes available to the product development area views of its core business (new products) from the previously presented perspectives.

Therefore, the questions to be asked can be:

Financial perspective: The financial card basic aspect is related, on the one hand, to the product development cost reduction because this activity has been done more and more inside the company lately and, on the other hand, the growth of earnings and profitability generated by the whole product life-cycle in the market.

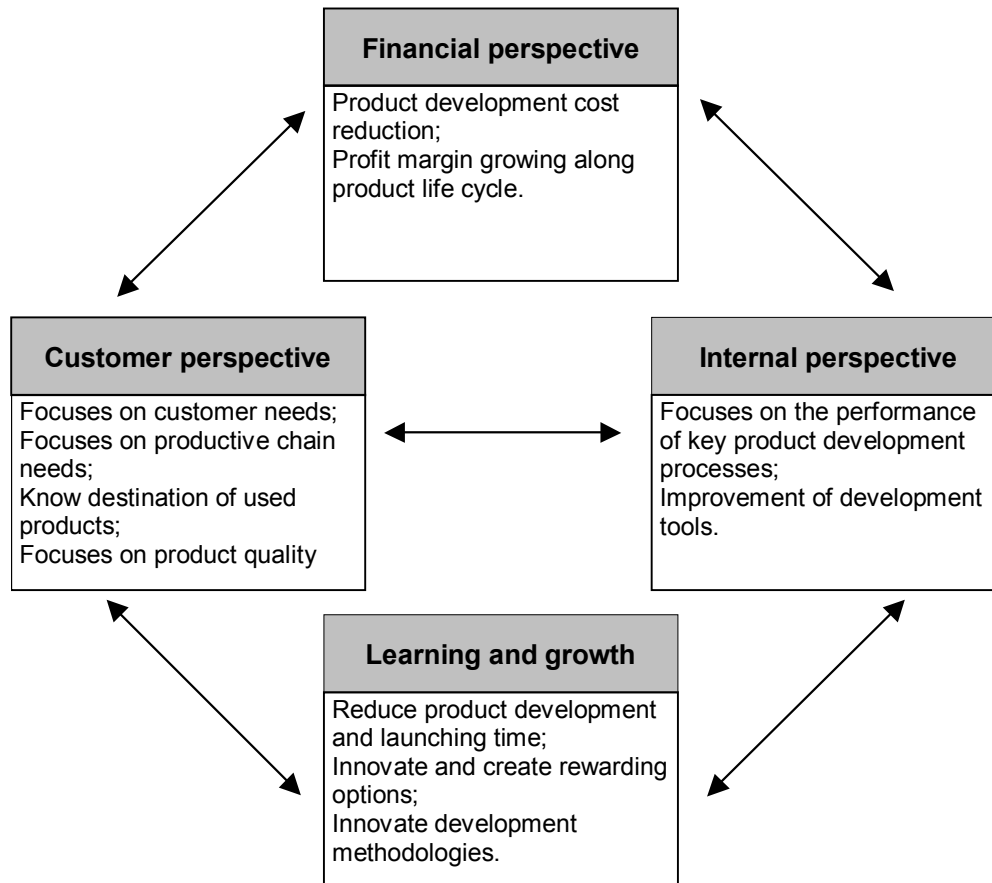


Figure 1: Defined goals to a product development business.

Customer perspective: Identify in details final customer's explicit necessities and infer latent ones. Focus on translating implicit necessities to quantified requirements. In the same way, identify intermediate customer's necessities in other business areas of the company's productive chain.

Determine the appropriation of the product destination after its consumption or use, that is how packing material and used components are disposed in the environment or recycled. In spite of this aspect not being often considered by the end consumer, its importance for the sustainable development makes it inevitable.

Internal perspectives: Functioning as a link between all other BSC cards, this card offers the necessary tools to the strategy development, such as equipment, systems and processes.

Innovation and learning perspective: Due the current scenery, there is usually a larger number of new products,

which medium life-cycles are shorter, which brings a necessity for constant time reduction in project development without affecting the quality of the product, the characteristics of consumer requirements answer or efforts for cost reduction, productive and logistical processes optimization, which are more and more demanding.

Therefore, constant improvement and innovation of product development methodologies with planning, creativity and quality is very necessary.

Then, it is possible to map information necessities simply and with some direction; that is, in agreement with the objectives previously established by the company as a whole.

Once the targets are stated by the questions in the cards, defining measurement methods which ensure their accomplishment is necessary. Although establishing immeasurable targets is desirable, it is unfeasible in BSC, because this method just deals with information which can be quantified in the company.

Table 3: Product development involved (gray) areas and activities responsible (black square)

	Sales	Marketing	Engineering	Manufacturing	Logistic	Supply	Controllershship	Direction	Activities
Viability									Ideas generation
									Ideas analysis
									Marketing information
									Technical product features
									Strategic planning adherence
									Technical viability analysis
									Financial analysis
Development									Product development planning
									Product design
									Prototypes, sampling and tests
									Critical project analysis
									Providers development
									Processes development
									Critical processes analysis
									Packages definition
									Request of brands and patents
	Implantation								
									Try-out/First batch
									Process Validation
									Technical Standard Specification
									Product Validation
Launching									Marketing Strategy for Launching
									Elaboration of External Documentation
									Price definition
									Marketing Test
									Definition of inbound and outbound logistics
									Product Development Final Validation

Table 4: Common ERP involved modules to each business area (based on SAP)

	Commercial	Financial			Manufacture		Relationship	
	Sales and distribution	Financial Accounting	Controllershship	Assets management	Production Planning	Quality Assurance	Customer Care	Marketing Database
Sales								
Marketing								
Engineering								
Manufacture								
Logistic								
Supply								
Controllershship								
Direction								

In the product development area, tasks such as knowing the customer, identifying his desires, respecting costs, legal and environmental requirements, break-even simulations and so on are part of the routine. In KAMINSKI (2000), a sequence of tasks and responsibilities shows the main steps of a product development (Table 3).

As in other company areas, many of these tasks are executed with the support of ERP's system modules or other local systems. Therefore, there is already a large quantity of available information in the company. Most of the time, the product development area does not use the ERP integral transactional capacity and reports, but a convenient datawarehouse can avail to product development subsidies from other areas, which use ERP constantly.

In Table 4, the interactions between different business areas originated by the map in table 3 are summarized, considering an ERP typical structure.

It is important to register that the BSC does not prescribe any control tool, but just a vision or a strategy. As already presented, the method establishes the targets, but assume that people may adopt any behavior or action to get them. The measures obtained are ways to direct people in a business area.

Therefore, it is not intended to indicate methods to get the identified targets, but bring knowledge to people involved in the product development, represented by indicators to support decisions. It is a method to improve the information level available to this area.

3.2 Balanced Scorecard measures definition.

Crossing Table 3 and the established goals, it is possible to identify which systems in which areas are in fact important in the methodology of the "Balanced Scorecard" and in what "cards" it would be possible to include each of them.

In the following tables, a mapping is made, omitting the systems that are not related with the process of product development.

Table 5 shows how transactional systems data of the sales area – that includes the sales order, credit verifications, sales approvals until billing – contributes in the four identified cards, answering the formulated questions that represent the established goals.

Table 6 shows the marketing area contribution, similarly to table 5. This is one of the greatest contribution that the company should use, because it reflects the customer opinion

Table 5: Sales area contribution to the scorecard measurement.

	Financial perspective	Customer perspective	Internal perspective	Learning and growth
System module	Product development cost reduction; profit margin growing along product life cycle.	Customer needs; productive chain needs; used products final destination; product quality.	Key product development processes performance; development tools improvement.	Time to develop and to launch; innovation; new development methodologies.
Sales and distribution	New product sales costs and invoicing per period, per area, per sales channel compared with other similar products results.	Identification of the typical customer, the most profitable one, the most reliable one, acquisition period and locals. Knowledge of project scope in terms of geography. Demand forecast estimated to the market.	How product design can aggregate value to sales and distribution tasks. How large the market engagement in the current product family positioning is.	Sales methods analysis and measurement of results variation during its life-cycle.
Customer Care		Customer view about project process. Customer view about how the product must be.		
Marketing database		Specific information about customer view of the project and the product.		

and behavior, and to a customer oriented company – which is today a requirement to success – this must strongly drive the adopted strategy. CRM (customer relationship management) systems that nowadays are included in many ERP solutions can provide more precise information (always considering that the implementation process was well done).

The engineering area is responsible for many steps of the development. From an ERP, the company cannot get design information but many project-related data is represented. Allocated people, time scale, supply costs and many kinds of documentations are stored and available by systems. Table 7 does not show this information since not all ERPs have modules already implemented, but production planning and quality assurance modules are mandatory for any ERP or local applications in the company.

From the manufacture area, important data are obtained about the infrastructure agility for a fast adaptation of the installed capacity to the requirements of the new product.

Table 8 exemplifies control points that support the of the goal questions.

In Tables 9 and 10, respectively of the logistics and of supplies areas, referring data mainly to costs are identified, looking for an optimization of the use of resources to be addressed to the new product.

Controllershship has a very clear concern with costs and with the integrity guarantee of the several processes, not allowing redundant procedures, gaps or out of standard procedures. There is, therefore, a great contribution of this business area in the product development; however, regarding transactional systems data, it is limited to financial aspects as shown in Table 11.

And, finally, regarding the high direction of the company, the area is much more an information consumer than properly an information originator. There is, no doubt, a great amount of normative, documents and policies that are defined by the area; however, this kind of information is often stored out of ERPs, in intranets, in knowledge databases or even in files.

Table 6: Marketing area contribution to the scorecard measurement.

	Financial perspective	Customer perspective	Internal perspective	Learning and growth
System module	Product development cost reduction; profit margin growing along product life cycle.	Customer needs; productive chain needs; used products final destination; product quality.	Key product development processes performance; development tools improvement.	Time to develop and to launch; innovation; new development methodologies.
Sales and distribution	Promotional material cost	Efficiency of the marketing campaigns	Market indicators concerning demand for quality, speed, etc.	Graphics comparing results during life-cycle of the company products.
Customer Care	Customer service and relationship costs.	Customer view about how the new product must be. Correct perception of customer needs.	How service can be directed to obtain more useful information in product development	Seeking interaction with the customers and use of their expectations in order to improve the product.
Marketing database	Cost of customers' data management	Specific information about product customer view; Competitors' comparative data.	Which customers needs are in terms of time and place	Analysis capability and understanding of customer profiles and desires.

Table 7: Engineering area contribution to the scorecard measurement.

	Financial perspective	Customer perspective	Internal perspective	Learning and growth
System module	Product development cost reduction; profit margin growing along product life cycle.	Customer needs; productive chain needs; used products final destination; product quality.	Key product development processes performance; development tools improvement.	Time to develop and to launch; innovation; new development methodologies.
Production Planning	Cost of plant setup project. Optimization of resources consumption.		How to organize production management actions for optimizing new product manufacturing.	Performance evaluation of the plant, maintaining critical points and costs involved.
Quality Assurance	Product quality cost; competitors and mastery knowledge acquisition cost, including technological researches.	Quality level positioning in relation to market request. Quality adequacy with customer desires.	How quality control can be more efficient and rational.	Measurement of quality levels and analysis of critical points and comparison of this data with those of similar products.

Table 8: Manufacture area contribution to the scorecard measurement.

	Financial perspective	Customer perspective	Internal perspective	Learning and growth
System module	Product development cost reduction; profit margin growing along product life cycle.	Customer needs; productive chain needs; used products final destination; product quality.	Key product development processes performance; development tools improvement.	Time to develop and to launch; innovation; new development methodologies.
Production Planning	Cost of raw material and its management; Cost of required plant modification and maintaining.	Market dependant deadlines and timetables definition.	Optimizing resources use; Generating internal reuse.	Evaluation of ways to improve the production response to company and market needs, availing demand dependant production programs instantly.
Quality Assurance	Product quality cost in its production process.	Customer view about how the product production process must be.		Measurement of quality levels and critical points analysis.

Table 9: Logistic area contribution to the scorecard measurement.

	Financial perspective	Customer perspective	Internal perspective	Learning and growth
System module	Product development cost reduction; profit margin growth along product life cycle.	Customer needs; productive chain needs; used products final destination; product quality.	Key product development processes performance; development tools improvement.	Time to develop and to launch; innovation; new development methodologies.
Production Planning	Transport, stock and handling costs of products, raw materials, etc during production, stock and distribution.		Use of low level stocks, innovative and efficient methods; generation of internal reuse.	Optimization of resources use; Evaluation of ways to improve the production response to company and market needs, availing demand dependant production programs instantly.
Quality Assurance		Definition of how the customer expects to access the product	Verify ways to improve quality in logistics processes in order to obtain a higher quality end product.	Measurement of quality levels and critical points analysis.
Customer Care	Customer service cost			Seeking the interaction with the customer and use of their expectations in order to improve the product.

Table 10: Supply area contribution to the scorecard measurement.

	Financial perspective	Customer perspective	Internal perspective	Learning and growth
System module	Product development cost reduction; profit margin growth along product life cycle.	Customer needs; productive chain needs; used products final destination; product quality.	Key product development processes performance; development tools improvement.	Time to develop and to launch; innovation; new development methodologies.
Production Planning	Raw material acquisition and management cost; Cost of demand dependant stock maintenance; Cost of repositioning and plant repair stock maintenance.	Perception of market attention to the raw material use, for instance, whether recycled materials are used, whether they do not harm the environment, etc; Use of existing resources of other processes or resulting of other company products.	Use of low level stocks; innovative and efficient methods.	Optimization of resources use. Generation of internal reuse.
Quality Assurance	Cost of raw material quality assurance.	Perception of market attention to raw material precedence.		Measurement of quality levels and critical points analysis.

Table 11: Controllership area contribution to the scorecard measurement.

	Financial perspective	Customer perspective	Internal perspective	Learning and growth
System module	Product development cost reduction; profit margin growth along product life cycle.	Customer needs; productive chain needs; used products final destination; product quality.	Key product development processes performance; development tools improvement.	Time to develop and to launch; innovation; new development methodologies.
Financial Accounting	Adaptation cost to the new product accounting requirements			
Controllership	New product performance analysis methods definition			

Note that the tables many times show subjective aspects, such as “points of view”, “positioning”, “definitions” and others, which actually are interpretations of the data available in the company databank and not the datum found exactly in the form it is stored.

Although the contributions from the different areas may seem very distant, it is with an effort for aggregating some transactional information to other existing data sources in the company, such as goal plans, action directives, reports provided by third parties, market researches and others. In the product development activity, as innovation is dealt with, sometimes information which seem irrelevant at first becomes fundamental.

There is no intention here of detailing or justifying each information source (deriving from corporate systems), but simply of suggesting a scope for each of them. The method used to elaborate the tables is based only on the perception within the company, many items having been validated by the authors own experience; however, from the point of view of implementing the model, this material is simply a small basis.

There are some market softwares that translate the indicators (measurements) deriving from corporate systems in spreadsheets that may be configurated to generate quick overviews to executives.

This stage also presents challenges, as it very much depends on the degree of familiarity of the information users

with the information systems. There is, therefore, a very defining cultural component, and making information available is not enough; it is paramount to have executives to know how to use it advantageously.

4. Conclusion

The identification of goals and consequently the identification of measures for these goals does not solve all the problems faced on the product development activities. These problems surely include a great number of variables such as creativity, resources and sometimes the identification of opportunities from unexpected circumstances. The idea is to substantially reduce the uncertainty component involved in the product development activities, and this is possible through a correct utilization of the numerous information subsidies already available inside the company.

It is important to point out the use of analysis methods and to try to position the product development area – regarding the level of information offered – on a step equivalent to that offered to the other company strategic areas, and, for sure, with more relevant features than simply give a free access to the company transactional database.

This requirement of breaking inter departmental boundaries – easily feasible today due to the already installed infra-structure of the ERP – is a way to provide a broad vision of the company. Using BSC methodology turns the boundaries more permeable once the interchanging and

sharing of mutual knowledge is a condition to the consensus goals definition.

By using BSC, the product development area can then use a knowledge that was formerly restricted to other business areas, and, at the same time, is exposed to the company, with its real strategic value.

In addition to the transactional systems (ERP) information, all other sources of relevant information must be researched, such as documents, policies, spreadsheets, standards and, even if requiring some extra effort, the so called implicit information: the information retained by people and that has to be turned into explicit or documented information using workshops, discussion groups and any kind of incentive to make people share information and experiences.

This is not something trivial mainly due to the extreme resistance of some company areas to "open their files", requiring managerial actuation with strong leadership and ability.

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Adress for mailing

Paulo Carlos Kaminski – Polytechnic School of University of São Paulo (Mecânica) – Av. Prof. Mello Moraes, 2231 – CEP 05508-900 – São Paulo – SP – e-mail: pckamins@usp.br

Renato Vizioli – Polytechnic School of University of São Paulo (Mecânica) – Av. Prof. Mello Moraes, 2231 – CEP 05508-900 – São Paulo – SP – e-mail: renato.vizioli@bol.com.br

