

## TECHNOLOGY MANAGEMENT AND COMPETITIVENESS - A CASE STUDY IN A BRAZILIAN MOBILE TELECOM COMPANY

Maria Alice Frontini , MsC and PhD candidate

Production Engineering Dept., Polytechnic Engineering School, University of São Paulo  
[frontini@alum.mit.edu](mailto:frontini@alum.mit.edu)

Eduardo Pinheiro Gondim de Vasconcellos, Full Professor

Economics, Administration and Accountancy School, University of São Paulo -  
[epgdvasc@usp.br](mailto:epgdvasc@usp.br)

Fernando José Barbin Laurindo, Associate Professor

Production Engineering Dept., Polytechnic Engineering School, University of São Paulo  
[fjblau@usp.br](mailto:fjblau@usp.br)

### **Abstract:**

Decisions about investments in technology aiming innovation are complex in the digital convergence. There are great uncertainties concerning the benefits and significant competitive pressure to make companies to adopt a technological leadership attitude (Tritle et al., 2000). In this context, it is important that technology should be properly managed, in order to be one source of competitive advantage (Marcovitch, 1991).

This paper aims to evaluate the alignment between business strategy and technological innovation strategy, in order to diagnose gaps in the technological plan that can be relevant for guarantee competitiveness.

For this purpose, the methodological approach adopted for this exploratory study was case study. The criteria for selecting the case were the existence of a strategic planning process and the search for technological innovation as a competitive weapon.

Thus, this paper encompasses the basic concepts of strategic alignment between business and technology, which are adapted and applied in the selected case that is a very representative of the Brazilian mobile telecom market. The analyses were performed by the authors based on information gathered in the studied company

among top executives, which allowed verifying the applicability and coherence of the proposed approach, and the limitations of the performed analysis.

**Keywords:** Technological and Strategic Planning, Technological Innovation Evaluation, Digital Convergence

## 1 Strategy and Competitiveness

In a synthesis, according to Serra; Torres and Torres (2002) that the elaboration of strategic planning is based on the definition of strategic objectives and in the choice of actions that will lead the company to achieve the planned results.

The definition of strategic objectives is a way to materialize company's vision and mission, since is what the company intends to accomplish concretely in the short and long run, satisfying the interests of all the actors that, directly or indirectly, participate in the company, i.e., the stakeholders.

As in any real situation, there are many alternatives to leave one state and get to another. That is the case of the company when it defines a strategic objective, since many alternatives of actions (strategies) exist in order to achieve the objective. However, it is fundamental the comprehension of the competitive context of the company in order to identify the alternatives and make the right choice (Markides, 2004).

The competitive dynamic of an industry can be understood through the analyses proposed by Porter (1991) relative to the five structural forces of the industry, to the evaluation of weak and strong points of the company and also the identification of threats and opportunities derived from possible changes in the competitive conjuncture (a analysis called SWOT, i.e., Strengths , Weakness, Opportunities and Threats).

The company strategic planning involves the definition of its business positioning in order to leverage the characteristics that distinguish the company from its competitors. According to Porter (1991), there are three kind of generic strategies, depending on the type of the desired competitive advantage and the market aimed. A company can compete based on low costs or in the differentiation of what it offers; it also can choose to reach all market or to focus in a specific segment.

A competitive advantage based on cost can be reached through continuous improvements in its processes in search of better efficiency or by innovation of activities in order to get significant reduction in its costs

A competitive advantage oriented to differentiation is based on a superior offer of a product and/or service considering the attributes considered important by the customer.

Finally, the competitive advantage of aiming a specific market niche (focus) is based in the fact that the company must possess the competences and capacities in order to reach successfully this niche.

### **3. Technological Strategy oriented to Innovation and Business Competitiveness**

Technological Strategy plays a relevant role in business competitiveness, specially those related to innovation, that can be disruptive or sustaining. Marcovitch (1991) emphasizes the relationship among innovation, sales growth and market share, concluding that the company profitability is determined by the integration and alignment between business and technological strategies. This author highlights that it is not enough that the company has the conditioning elements to innovation, neither is enough to formulate a strategy and a technological plan. The critical success factor relies on the way that the company applies this plan and exploiting the value of its competitive differential.

Basically, there are three dimensions that make a company adopt and capture concrete benefits from technological competitiveness: the environment, the company and top executives (or top management).

In the environment, macro-economic stability combined with low volatility of country risk induce entrepreneurs to act focusing medium and long term, usually more compatible with decisions oriented to innovation. It can also be considered determinant the existence of governmental foment programs for investments and insertion of mechanisms of technological diffusion, of risk capital, of facilities for creating new companies and the availability of skilled human resources.

Considering top management, it is a critical success factor a culture that top executives insert in the organization through a posture directed to innovation, the use of decision criteria oriented for taking risks, an attitude of permanently prospecting technological alternatives and a vision oriented to business.

At this point it is important to understand that there are two kinds of innovations that companies can face. The first, it is called sustained innovation by Christensen & Overdorf (2000) and is oriented to enhancement of products and services, according to technological performance attributes considered important by the more profitable and exigent customers. The second kind is denominated disruptive innovation, which is oriented to new value attributes, enabling the introduction of new business and markets.

According to the research made by Charitou and Markides (2003), there are basically five strategic movements that the leading companies can adopt to face a disruptive innovation:

- Focus on traditional business and strengthen their competitive advantages;
- Ignore the new competitor, since it is not part of the same business;
- Strikes back, leading to auto-cannibalization;
- Adopt and go along with two "games", managing the risk of playing two games simultaneously and of dealing with conflicting business;
- Embrace the Innovation Completely and disseminate it, dealing with the intrinsic trade-offs.

Finally, similarly to the business strategy formulation, the formulation of technological strategy oriented to innovation encompasses the definition of strategic objectives and the choice of actions that would lead the company to achieve the planned results.

Likewise in business strategies, the choice of the best alternative for the company is based on the evaluation of company status (competences, strengths and weakness, and so on) and on the diagnosis of the environment in the aspects concerning emerging technologies and the evolution the technology currently dominated by the company. The strategy formulated by the company is translated to a technological plan that establishes the objectives and the resources to accomplish them..

#### **4. Approach adopted for Case evaluation**

In order to achieve the aim of this paper, i.e., the diagnosis of the alignment between business and technological strategies oriented to innovation, it will be used an approach adapted from Marcovitch (1991) and Vasconcellos & Andrade (1996).

The central idea is to identify the technological plan oriented to innovation in the evaluated company and analyze its alignment with business strategy. For this purpose, the concepts presented above will be used. Four steps will be executed in order to evaluate the alignment between technological and business strategies, as follows:

- Competitive environment analysis;
- Understanding business strategy;
- Identification of technological innovation strategy;
- Evaluation of the alignment between technological plan and strategic directives.

The methodological approach adopted for this paper was case study (Yin, 1994). Information was gathered through semi-structured interviews and complemented by secondary data about the industry of the studied company.

## **5. Case Study**

Mobile telephony is one industry impacted intensively by digital convergence in Brazil. In this sector, technological innovations are characterized as both sustaining and disruptive. In the first case, the focus of innovation is the enhancement of operations performance in order to deal with mass market and optimize company results. In the second case, the innovation in telephony services ("Value Added Services") has tried to find new value attributes to company's customers, in order to differentiate from the competitors (Stienstra et al. 2004; Lal et al. , 2004). Particularly, these services are enabled by two technological elements: telephony network and information technology (IT).

The operator selected for the case study (here and on called Operator A) is an important player in the Brazilian mobile telephony, presents a formal process for strategic planning and its brand exploit technological innovation as a competitive differential.

## 5.1 Competitive environment in Brazilian Mobile Telephony

The market in Brazilian mobile telephony is characterized by high concentration in 4 to 5 players and fierce competition at national level, presenting nowadays 4 major operators: Vivo, Claro, TIM, Oi. One possible evidence of the high great rivalry in the Brazilian Market is the existence of at least three competitors in the most profitable markets, i.e., approximately 65 million inhabitants and the greatest indicator of consume power (49%). The estimate of penetration was 32,2% in 2004 in the Brazilian Market, and the expected annual growth is over 32% per year. Although the penetration of mobile telephony is inferior in Brazil in comparison to more developed markets (for example, the average penetration in Europe is about 80%), the target classes for innovative offers presents a high penetration in Brazil (92% for A class and 51% for B class).

However, the importance of value added services (VAS) is very low nowadays (about 3% of total revenue), but present an important role for keeping the average revenue per user (ARPU) that tends to decrease along the years. Basically, it is possible to classify VAS in two types: traditional and innovative. Traditional VAS are technological solutions based on text exchange (SMS - Short Message Service); innovative VAS uses the other technological features, like Multimedia Messaging System (MMS), Wireless Application Protocol (WAP), and so on.

The leadership of Brazilian market both in terms of numbers of users and of total revenue belongs to Vivo. With investments and presence in most profitable markets, Vivo competitive positioning is based on differentiation due to wide cover and network quality, strengthen an image of reliability and solidity of its image, charging higher prices in function of this positioning (table 1).

The second position in the market is fiercely disputed by Claro and TIM, which presents quite different positioning. Claro has positioned as low cost, while TIM try also to occupy a position of differentiation strategy based on innovation and on a diverse approach.

The SWOT analysis for the rival companies indicate that the greatest threat to Vivo would rely on the attack of its basis by the competitors, but the growth of its basis announced in July 2004 indicates that this menace is still insignificant.

The major weakness of Claro is the consolidation of its required operations. However, these weaknesses are largely compensated by the experience of its stock holder (Telmex Group) and by the synergy with Embratel. TIM appears in this scenery as the only "pure mobile" operator and its main strength relies in its brand and its major menace is Claro.

The analysis of the industry five structural forces points out that mobile telephony operators presents a relatively comfortable situation, excepting for the rivalry among them.

- Barriers to new entrants: The main barriers to entrance in this market are the high need of capital. For instance, just in 2003 and 2004 the investments made by mobile operators arouse to approximately R\$4 billion (about US\$2 billion). Interconnection practices among operators difficult even more the entrance of new competitors in this market.
- Pressure from substitute products or services: As alternative forms of providing services of local telephony, it can be mentioned fixed telephony specially with the new offer of pre-paid and IP telephony for data transmission and services of long distance and fixed in the medium-long term. Concerning to mobility attribute, a possible substitute is satellite, but high prices of this technology practically discard this alternative as a real substitute to mobile telephony, in the current conditions.
- Buyers Bargain Power: This force is relatively weak. Although there is the possibility of operators, the impossibility of maintaining the same number imposes a barrier for the change by the customer.
- Suppliers Bargain Power: there are few equipment and terminals suppliers (Siemens, Nokia, Motorola, Ericson), the demand is concentrated and long term contracts represent worldwide agreements; these conditions diminish suppliers bargain power.
- Rivalry among competitors: this market is remarkably competitive in the dispute of the second place. The main focus of competition in the telecommunication market is on the corporative clients and consumer heavy user.

According to Porter (1991), in highly competitive markets the profitability tends to be very low. In consequence, the acquisition of high value clients and offer differentiation through innovation are competitive key factors for maintenance of margins and remuneration of invested capital.

## **5.2 Business Strategy for Operator A**

Operator A present a generic strategy oriented to the whole market, emphasizing differentiation and innovation of its offer through VAS. Consequently, technological innovation is one of the central elements of its business strategy.

It has a strong brand and is recognized by technological innovation, solidity and reliability of the company. The present ARPU is superior to its competitors, a direct consequence of the strategy focused in high value customers.

The strategic objectives of Operator A are: differentiation, innovation and the quality of coverage and the services provided to customers. The company aims to acquire the most profitable segments of the market, i.e., corporate and consumer heavy user. Within this context, VAS is important source of revenue and future competitiveness. For these segments, Operator A deliberately defines a differentiate value proposal, enabled by technological innovation, as critical item for its competitiveness.

In synthesis, Operator A directives and competitive objectives are: innovative offer, customer orientation, coverage, national presence, strong brand, ARPU defense, optimization of capital expenditures (CAPEX), operative expenditures (OPEX) and internal process.

## **5.3 Technological Innovation in Operator A**

Among the different strategic movements that leading companies adopt relative to disruptive innovation, Operator A is characterized by embracing and disseminating innovations. Operator A invests on new technological generations and searches for disseminating them worldwide, speeding up its "time-to-market".

In a general view, innovation technological strategy of Operator A can be resumed by:

- Assuring the continuous availability of VAS to customers;
- Using existent solutions inside its group, in order to first delivery them to the market, to guarantee service quality and to reduce investments and necessary operational costs.

Fundamentally, Operator A offers and manages the basic network infra-structure for obtaining leadership in the Brazilian market, working on the technological attributes considered valuable by customers: coverage, quality services, reliability and network availability.

Specifically for IT solutions, the company reuses VAS developed in another firms of the same group, customizing them to the needs of the Brazilian market. Basically the following IT are enablers of the VAS: SMS (Short Messages Service); receiving and sending e-mails, download of data and multimedia files.

Generically, innovation directives in technological services of Operator A address four attributes to high value customers:

- Utility: clients can better communicate, in a simpler and faster way through SMS, etc.
- Emotions: clients share emotions and feelings, through sending photos, videos, etc.
- Being innovative: customers want to experiment the new, to be update to any services.
- Mobile productivity: connectivity and mobility in any place and at any time.

By observing the matching between network and information technology, it is possible to conclude that there is coherence among network directives and IT in the technological infrastructure offered to enable innovation services aimed by the company.

#### **5.4 Consistence among Technological Plan and Strategic Directives**

Based on the approach of Vasconcellos and Andrade (1996) to evaluate the consistence among technological plan and strategic directives of Operator A, it may be assessed the contribution of innovation technological projects and the respective technologies to the strategic objectives.

Fist, projects are classified in high, medium and low in terms of their contributions to the analyzed factors, and grades for 1 to three are attributed (1 = low; 3 = high). After, weights from 1 to 3 are attributed to the elements of the evaluation, normalizing the final score until a maximum of ten. Finally, the ranking of projects indicates their

priorities to Operator A, meanwhile the matching of the competitiveness and value attribute provides a vision of the consistency of the projects to business strategy (Table 1).

Table 1 - Technological Projects priorities in Operator A

Project Code	Technology	competitiveness							Score Competitvity	value attributes							Score value attributes	Max score	10																			
		innovative offer	Customer Orientation	Coverage	Strong Brand	ARPU defense	OPEX Optimization	CAPEX Optimization		Countrywide presence	Internal Processes	utility	emotions	innovative	mobile productivity	quality				coverage	reliability	availability																
B15	WAP	A	A		M		A	M	10		A	A						3	9	9	0	0	2	0	6	2	0	28	0	0	3	9	0	0	0	0	0	12
C29	EDGE		A	M		A			10		B	A						1	9	6	0	6	0	0	6	0	0	27	0	1	3	0	0	0	0	0	0	4
C26	EDGE		A	B	A	A			10			A	A					3	9	3	3	6	0	0	6	0	0	27	0	0	3	0	9	0	0	0	0	12
CB5	MMS/ P2P		A			A		A	9		A							1	9	0	0	6	0	3	6	0	0	24	0	3	0	0	0	0	0	0	0	3
C25	MMS/ A2P		A	A		A			9		A	A						1	9	9	0	6	0	0	0	0	0	24	0	3	3	0	0	0	0	0	0	6
C20	SMS/ A2P		A	M		M			7		M							0	9	6	0	4	0	0	0	0	0	19	0	2	0	0	0	0	0	0	0	2
C18	SMS/ A2P		A	M		M			7		M	A						1	9	6	0	4	0	0	0	0	0	19	0	2	3	0	0	0	0	0	0	5
C28	email		A	M		M			7		A	A	A					4	9	6	0	4	0	0	0	0	0	19	0	3	3	9	0	0	0	0	0	15
C21	SMS/ A2P		A	B		M			6		M							0	9	3	0	4	0	0	0	0	0	16	0	2	0	0	0	0	0	0	0	2
B13	SMS/ P2P		B	A		B		M	6		A		A		B	B		5	3	9	0	2	0	0	0	2	0	16	9	0	0	9	0	0	2	2	0	22
CB4	MMS/ P2P		M	B		M		M	5		A							1	6	3	0	4	0	0	0	2	0	15	0	3	0	0	0	0	0	0	0	3
C19	internet		A			M		M	5		M							1	9	0	0	4	0	0	0	2	0	15	6	0	0	0	0	0	0	0	0	6
C10	SMS/ A2P			M		A		A	5		A			M		B		4	0	6	0	0	3	0	6	0	0	15	9	0	0	0	6	0	2	0	0	17
B4	email			A				A	5			A	A	A	A	A		10	0	9	0	0	0	0	6	0	0	15	0	0	3	9	9	9	6	6	0	42
C1	JAVA			A		M			5			A						1	9	0	0	4	0	0	0	0	0	13	0	0	3	0	0	0	0	0	0	3
C7	SMS/ A2P			M		A			3		A			A				4	0	6	0	0	3	0	0	0	0	9	9	0	0	0	9	0	0	0	0	18
B3	GPRS			A					3			A	A	A	A	A		10	0	9	0	0	0	0	0	0	0	9	0	0	3	9	9	9	6	6	0	42
C9	IN				M	A		A	3					A		A		4	0	0	2	0	3	0	0	3	0	8	0	0	0	0	9	0	0	6	0	15
B6	WAP			B		M			3									1	0	3	0	4	0	0	0	0	0	7	6	0	0	0	0	0	0	0	0	6
CB1	IN					A		M	3		A			A				4	0	0	0	0	3	0	4	0	0	7	9	0	0	0	9	0	0	0	0	18
C15	GPRS				A			A	2				A		A			4	0	0	3	0	0	0	0	3	0	6	0	0	0	0	9	0	6	0	0	15
C3	download					A			1		A							2	0	0	0	0	3	0	0	0	0	3	9	0	0	0	0	0	0	0	0	9

It can be noted that there some discrepancy in some technological projects that do not perform properly customer value attributes (for example C29, CB5, C25.). They use updated technology, require high investments and present the risk of not accomplish their roles in the business strategy. Their scope and approach could be reviewed. Other projects could be incorporated to the priorities, because, even though they not contribute directly for business competitiveness, bring a differentiate innovation perception to the market (for example B3, B4, B13.).

From the projects scores it is possible to identify the alignment of technologies with business strategy. The criterion was the average of technology contribution score to indicate its relevance and place them in the quadrants; the number of projects that uses technology to show the participation of the technology in the technological plan and build the bubbles (Figure 1).

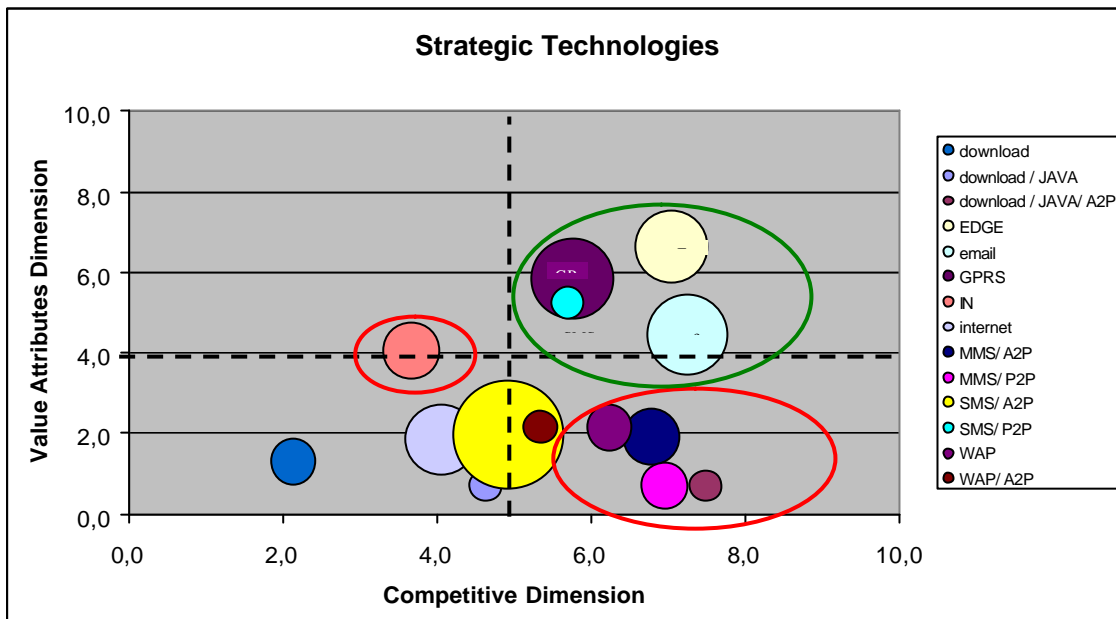


Figure1 - Strategic Technologies in Operator A

Positively, the majority of the strategic technologies of Operator A is aligned to the business strategies. This diagnosis comes from the quantity of technologies in the east quadrants in figure 1.

In one hand, there is a set of top technologies that contribute significantly to company competitiveness and for its perception of innovation face the market (northeast quadrant). These technologies are also those that enable a high quantity of projects of Operator A, showing an alignment among the technologies provided by the company and its strategic objectives.

On the other hand, there is another set of technologies that contribute significantly to the company competitive attributes and not so much to the customer value attribute (Southeast quadrant). They are considered key technologies by Operator A and they

could be better worked in order to effectively extract customer value and achieve the planned competitive strategy.

Finally, it is possible to conclude that there is a high consistency between technological innovation plan of Operator A and its strategic directives, in terms of prior projects and of technologies capable to enable strategic objectives. Operator A presents a innovation oriented technology management aligned with business strategy.

## **6. Conclusions**

This paper evaluates the alignment between business and technological strategies in a mobile telephony operator, in which innovation plays a relevant role face competitiveness and digital convergence context.

The current work shows the high need for understanding the competitive environment, the correct positioning and company strategic objectives in order to evaluate alignment between business and technological strategies.

Finally, from a simple method of weighting competitiveness objectives and technological innovations is possible to evaluate the alignment of technological plan (project and technologies) to business strategy.

However, it is important to highlight that this study presents some limitation. It would be important to evaluating in detail the technological evolution in Operator A in order to support technological plan with competences and necessary capacities. In addition, it could understand the strategic behavior of Operator A face innovation and respective implications in the strategic plan.

These points should be considered in future studies.

## **References**

Charitou, C.D.; Markides, C.C. Responses to Disruptive Strategic Innovation. MIT Sloan Management Review, Vol. Winter, p.55-63, 2003

Christensen, C.M.; Overdorf M. Meeting the challenge of disruptive change. Harvard Business Review, p.66-76, Mar/Apr, 2000

Lal, D.; Pitt, D.; Strachan, P. Strategic Change in UK Telecommunications: Empirical Evidence European Management Journal Vol. 22, No. 1, pp. 99-109, 2004.

Marcovitch J. Tecnologia e competitividade. Revista de Administração, Vol.26, n.2, p 12-21, 1991

Markides, C. What is strategy and how do you know if you have one? Business Strategy Review, V.15,i2,p.5-12,Summer 2004

PORTER, Michael E. Estratégia Competitiva. Rio de Janeiro, Campus. 1991

Serra, F.A.R.; Torres, M.C.S.; Torres, A.P. Administração estratégica: Conceitos Roteiro Prático e Casos. Reichmann & Affonso Editores, cap. 7 p 95-113, 2002

Stienstra, M.; Baaij, M.; Van Den Bosch, F.; Volberda, H. Renewal of Europe's Largest Telecom Operators (1992-2001): From Herd Behaviour Towards Strategic Choice? European Management Journal Vol. 22, No. 3, pp. 273-280, 2004

Tritle, G.L; Scriven, E.F.V.; Fufeld, A.R. Resolving Uncertainty in R&D Portfolios. Industrial Research Institute, nov-dec, p47-55, 2000

Vasconcellos E.; De Andrade V.L Planejamento estratégico da Tecnologia na Companhia Vale do Rio Doce. XIX Simpósio de Gerção da Inovação Tecnológica, São Paulo, 22 -25.out, 1996

Yin, Robert K. "Case study research: design and methods", Applied Social Research Methods Series, Sage, EUA, 1994.