

# Technological Innovation Planning To A Small Agribusiness Company

**Ednilson Santos Bernardes, MSc student**

e-mail: [ednilson.bernardes@embraer.com.br](mailto:ednilson.bernardes@embraer.com.br)

**Doriana Daroit, MSc student**

e-mail: [ddaroit@adm.ufrgs.br](mailto:ddaroit@adm.ufrgs.br)

**José Carlos Lázaro da Silva Filho, MSc student**

e-mail: [jclsilva@bigfoot.com](mailto:jclsilva@bigfoot.com)

**Egídio Luiz Furlanetto, PhD student**

e-mail: [elfurlanetto@adm.ufrgs.br](mailto:elfurlanetto@adm.ufrgs.br)

## Abstract

With growing market competitiveness, technology is becoming a differentiation factor in the search for enterprise survival and to increase firm profitability. Even a technology in a stationary stage needs constant investment in innovation. The coffee grain industrialization technology is an example of such stability (technology is in a mature stage). Innovation management struggle has been responsible for market segmentation and differentiation in Brazil's companies. Companies possessing superior capability in technology innovation increase market participation; in the other hand, companies in which this dimension is ignored fail in continuing activities. The purpose of this article is to discuss technology innovation management in a small company that processes coffee grain in Brazil. The key point is that even small companies belonging to a mature sector can innovate. The company's technology problem is characterized accordingly to its planning action. Its technological capability and the industry technological landscape are analyzed. The interaction between problem definition, company's technological capability and industry technological landscape results in a technological strategy to be followed.

**Keywords:** technological strategic planning, coffee industrialization, technological capability, competitiveness.

## Introduction

Searching for a more competitive position in the market, companies has been given more attention to technology. The use and development of technological innovations start assuming a fundamental role in the survival and increase of profitability (Freeman, 1982). The introduction of technological progresses allows products to correspond in a more suitable way to consumers' needs. Thus, even companies belonging to sectors with steady technology can promote efforts to improve technology in order to obtain advantages over concurrence.

In the last two decades, Brazilian agribusiness sector has been awaking to technological progress, even if in a slow way. While some industries have been adopting technological improvements, coffee industrialization, which is a steady technology, only now begins to look for more competitiveness by the introduction of technological innovations.

The scenery of powdered coffee industry in Brazil demonstrates that the 4 major companies, which make more investments in technology, tend to dominate the market. However, coffee industry is characterized by presenting a great number of small companies which need to find solutions in order to guarantee their permanence in the market.

Incocafé Indústria e Comércio de Café Ltda., the company chosen for this study, is a small company from Rio Grande do Sul, a state in south Brazil. Rio Grande do Sul presents a strong presence in the agribusiness sector, but does not cultivate coffee, which is brought from the north of the country. This company reflects well the reality of most business in the country, which have traditional trade-marks and a reduced staff of employees. Incocafé has two registered trade-marks: Café Marques and Café Economia Doméstica, which supply a market with little qualitative perception of the product. These two marks present differences regarding the grain used as raw material and both are sent to market in cushion shaped packets.

Incocafé company wants to gain market share and it is necessary to expand production capacity in the first place. However, there is a technological restriction in the production process that prevents the completion of this. Hence the importance of accomplishing a technological strategic planning, which is the objective of this work, in order to look for more conditions to compete within the characteristics and tendencies of the coffee industry and the internal resources of the company.

## **Coffee industry in Brazil**

The total amount of internal consumption of coffee reaches 11,9 million bales/year, being 480 thousand bales (4%) of soluble coffee and 11,4 million of roasted ground coffee (powdered coffee). This amount of powdered coffee represents a national average consumption per capita equivalent to 3,45 kg/year. The consumption of coffee in Brazil presents a seasonal characteristic, with higher volume during the winter and lower in the summer, affecting directly the industrialization of the product.

Powdered coffee industry presents an income superior to R\$ 2,5 billion, generating 23,000 direct employment and taxes in the amount of R\$ 300 million. The popularity of the product, the simplicity of the industrial process and the low investment required to establish a coffee company allowed the increase in the number of competitors in this sector.

### *Historical notes about coffee industrialization*

Coffee is consumed since 1550, however the first seeds came to Brazil in 1727, smuggled from French Guyana to a state in the northeast of the country called Maranhão. But, the lack of natural conditions obliged the cultivation to be directed to the southwest regions (INMETRO, 1999). In the

beginning of 20th century, coffee cultivation stopped having a character essentially rural and became a source to urbanization and industrialization. The development of the technology of coffee roasting allowed this industry to be established close to non producers urban centers. This way, it was possible the rising of roasting companies in the south of the country.

Roasting and grinding companies present a high prevalence of small size family organizations, which process a low volume of bales and have a reduced staff of employees. At the end of the 80s, the extinct Brazilian Institute of Coffee registered about 1,200 roasting companies, while in 1998 this number was 1,593 (ABIC,1999). However, the influence of new technological paradigms is changing this direction. In the market share in 1998, a growing concentration expressed by the indexes of Herfindhal and Gini was observed. Gini's index shows a growth of 0,6134 in 1989 to 0,6950 in 1997 (ABIC, 1999).

Differentiated technologies of process or packing allow the supply to overpass regions, and increase the slice of the market of the 4 major companies in the sector. Thus, industries from states or areas of which production exceeds its consumption supply the insufficient production of the others. In south Brazil, where it is located the studied company, industrialization does not supply total consumption (ABIC, 1999). Thus, roasting companies from Rio Grande do Sul find themselves in direct competition against companies from other states which have a higher technological content in their process.

### **Coffee industrialization technology characteristics**

The technology of coffee industrialization consists of transforming coffee grains in roasted ground powdered coffee for consumption. The most used coffee grains in industrialization are the ones belonging to the Arabian variety, which flavor and aroma characterize the drink in the whole world. The quality of grains is classified according to an international scale ranging from 8 (the worst) to 2 (the best). In Brazil, mainly grains from classes 6, 7 and 8 are industrialized, since they have been satisfying the level of quality perception of the local consumer. The technology of coffee industrialization starts from the selected grain and follows according to the flow of process below:

#### **STORAGE - ROASTING - GRINDING - PACKING SYSTEM**

The grains are driven to the roasting machine, where temperature and time of permanence are controlled until they get the optimum point. Right after this, grains are ground until they get the desired size. Next, it is the turn of powder packing. The technology of coffee industrialization can be summarized in 3 technological vectors: roasting, grinding and packing, each one presenting specific sub-vectors. The performance indicators identified in the **roasting vector** were: color, temperature of the process, time of roasting, humidity. In the **grinding vector**: powder ideal size and in the **packing system vector**: weighing, packing and closing.

The variables of the process of industrialization are well-known and great modifications representing revolutions in coffee industrialization have not been observed. Therefore, technology of coffee industrialization is a steady technology. According to Zawislak, Nascimento and Graziadio

(1997), the strategic management of a steady technology involves the reduction of uncertainties and the solution to problems that represent threats to competitiveness. The technological strategic planning tries to guide technology so that it can solve the existent problems.

### **Technological strategic planning**

Technological innovation management rises from the need of managing problems due to the use of a technology. The solution to the problems involves the management of available information and creativity to guarantee the efficiency of the process of searching solutions. As each type of technology corresponds to different strategies, technological capability, available information and creative power, the management of technologies is different for each point of the technology curve where is located the company.

Steady technologies management can be accomplished by a technological strategic plan, which encompasses eight stages defined in Zawislak, Nascimento and Graziadio (1997) paper: problem definition; external environment or technological scenery scanning; technological capability mapping; internal information processing; external information processing; technological strategy definition; project elaboration; and the evaluation of efficiency. This group of activities is the main responsible for the success of technology management.

In order to accomplish the objective of this study, the stages of the technological strategic planning focus the description of technology in the company and definition of the problem; mapping of the technological scenery; mapping of technological capability of the company and definition of the technological strategy based in internal and external information gathered to the company. The remainder stages were elaborated by the company and they will not be described in full detail in this work.

### **The Incocafé case study**

Information gathering to elaborate this study was made through interviews with the owner and employees of Incocafé, as well a visit to the company. By means of this, it was possible to elicit the problems of the company, its expansion project and its technological capability. To outline the technological scenery the following means were used: consultation to sites of several coffee roasting companies, manufacturers of equipment, national and international associations and universities; interviews with commercial representatives, with the Union of Coffee Industry of Rio Grande do Sul, with an expert in the food area of Federal University of Rio Grande do Sul; visit to the major roasting equipment manufacturer in the country (Metalúrgica Leogap) and investigation in catalogs and books. Gathered information and their analysis allowed the definition of the technological strategy for Incocafé through the technological strategic planning.

### *Technology of coffee industrialization at Incocafé*

Coffee industrialization at the studied company follows the technology above described. However, it presents some particularities in its vectors: the classified and selected coffee in grains (in bales containing 60 kg ) is roasted and stored in a silo for about 8 hours in order to loose gases. The roasted grain is ground and stored again by a brief period of time. Right after this, dosage and packing of the coffee powder are made. The weighing of the package is made in an electronic weighing-machine and the package is then closed.

### *Technological problems at Incocafé*

Through a brainstorm made with the manager and the more expert employee of the company, the following technological problems were identified and grouped according to the vectors of technology:

- **roasting:** productivity;
- **grinding:** layout, facilities;
- **packing system:** reliability, packet type, value-added of the product, productivity, packing process.

After identifying this problems and considering the annual planning of the company in producing 216 ton of coffee/year, starting from an average of 12 ton/month to 18 ton/month, with a pick of 25 ton from June to August, which are the months that correspond to the winter, it was verified that the main technological problem of the company was found in the packing vector, since:

- the roasting productivity was below the expected rates, but it does not limit the plans about production;
- grinding presents problems in the settlement of the equipment, but they can be contoured within the plan of production;
- the packing system is the most critical vector, since the problem about low reliability on the weighing equipment brings the need of a new weighing, reducing the capability of production, which is already limited by the obsolescence of the equipment.

The packing system vector presents the following sub-vectors: dosage, packing and weighing, in which basis it will be described the mapping process of the technological scenery.

### **Scenery of the technology of coffee packing in Brazil**

Besides the characterization of the current situation, the mapping of technological scenery should look for an analysis of the emergent tendencies of the industry in order to assure a comprehensive strategic planning. It also have to be in connection with the aspirations of the market and with the trajectories of technology.

Once Incocafé main problem was identified in the packing system vector and its sub-vectors dosage, packing and weighing, internal and external technological alternatives to the company and market tendencies were studied.

The low reliability on the weighing equipment, causing a reduction in the productivity since there is the need of a new weighing, can be internally solved in two ways: by the repair of the scale or by the acquisition of another electronic scale. The first alternative, although possible, it is not suitable since the equipment is very old and its cost of repair is very high. The second alternative requests the hiring of a new employee, elevating the costs of the company. As neither of the options definitively solves the problem, external alternatives were searched, while existent tendencies were verified.

Studying the technological scenery, a growing tendency of vacuum packing system was observed. After sealing the packet, there is a CO<sub>2</sub> production due to the contact of the coffee with the oxygen inside the packet. The release of CO<sub>2</sub> results in the swelling of the packet, which can tear it, besides reducing the quality of the product because of the loss of aroma and flavor. Some holes are made in the traditional cushion shaped packet in order to allow the exit of CO<sub>2</sub>, conserving the coffee for 90 days. The vacuum packing system conserves the coffee for 12 months, since it avoids the production of CO<sub>2</sub>. This facilitates the transport of the roasted ground coffee from the major producer centers to areas where market is deficient. Using the vacuum system, the packet takes the shape of a brick and are packed in paper boxes for sale. In Brazil, vacuum packing is responsible for almost 15% of the market and cushion shaped packing for about 83% (ABIC,1999). In Rio Grande do Sul, according to the experts, the vacuum packing market share is superior to 35%.

As it was mentioned before, there is a strong tendency to concentration of the sector in the coffee industry. Through Internet search, it was observed that the major companies in the sector are the ones which invest more in technology, although none of them presents an innovative process. This happens because coffee industrialization is a steady technology. The big differential among the companies corresponds to the equipment used in the industrialization of the product. More modern equipment with larger technological content provide more quality and income of the final product and elevate productivity. Thus, the following equipment were found as options to solve the problem at Incocafé:

- **scale processed by a computer system**: it can be connected to the equipment of the company, but has no significant effects on the productivity;
- **semiautomatic packing machine**: equipment similar to the one Incocafé possesses, but counts on more reliability;
- **automatic packing machine**: the automatic process is the most advanced concerning cushion shaped packing; it eliminates the need of direct human intervention; it increases productivity and reduces operation and packing costs;
- **manual vacuum packing machine**: it presents a low level of productivity, but it represents a strong tendency of the market, since it conserves the product for more time and it allows its sale in distant markets;
- **automatic vacuum packing machine**: totally commanded by PLC, it presents a good productivity and belongs to a new S curve of packing technology.

Once identified the main available equipment for coffee packing, it was possible to gather information from commercial representatives that allowed the establishment of historical series for these equipment. Table 1 shows the evolution of packing equipment.

### Technological Evolution of Packing Equipments

YEAR	EQUIPMENT	PRODUCTIVITY(pac/min)		COST EQUIPMENT, 1999 (R\$)	
		cushion	vacuum	cushion	vacuum
1950	manual	10			
1972	semiautomatic	25		6000	
1976	automatic	30		30000	
1983	automatic/PLC-vacuum	35	6		25000
1988	vacuum 2 <sup>nd</sup> generation		9		
1992	automatic new generation	50		35000	
1998	vacuum 3 <sup>rd</sup> generation		26		100000

Table 1: Evolution of coffee packing

Manual equipment is no longer used in the roasting process. Semiautomatic equipment presents a productivity similar to the first automatic equipment, also presenting a lower acquisition cost. However, the semiautomatic equipment requests an operator, resulting in higher costs and a productivity restriction. In the same period that automatic machines with PLC allowed an increase in the productivity, vacuum packing presenting low productivity and high costs was introduced in Brazil. But this last one represented the rising of a new technology. The development of automatic machines allowed the production of 50 packets/minute, presenting a better relation between cost and productivity. Productivity in this process remains stable. Vacuum third generation provided more productivity, although the relation cost/productivity is about the same.

With the productivity of the equipment and its correspondent year of insertion in the market it was possible to build the *S curve* for roasted ground coffee packing technology. In Figure 1 it can be verified that vacuum packing is a growing technology and the cushion packing is a mature technology. This last one is a technology that will persist for several years, because it presents a high productivity and a lower cost of equipment when compared to the vacuum system. Besides, the slice of the market for cushion packet is still superior to the one for vacuum package.

## Evolution of technology productivity in coffee packing

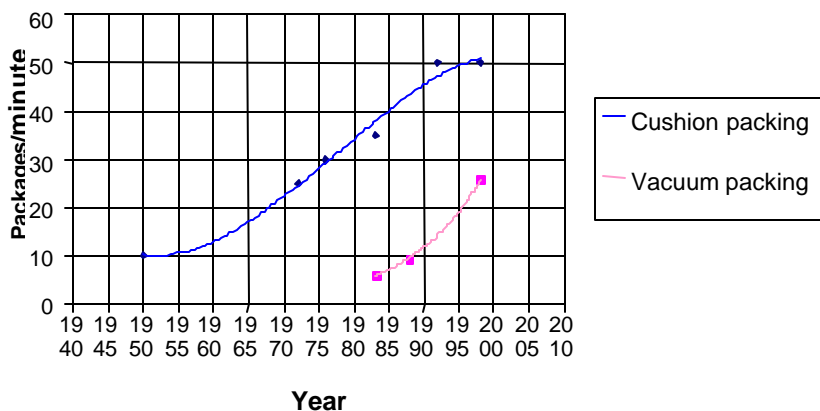


Figure 1: S curve

The process of vacuum packing is characterized by maintaining the quality of powdered coffee. In a research made by ABIC (Brazilian Association of Coffee Industry) in September, 1997, it was verified that quality criteria to consumers are mainly related to flavor (65%), purity (44%) and aroma (29%). While purity is guaranteed by the ABIC's Stamp of Purity, aroma and flavor can be maintained by vacuum packing. Once technological scenery was mapped, it is necessary to identify technological capability of Incocafé in order to choose the best alternative.

### Technological capability of the company

Technological capability of a company means its competence in absorbing, dominating, adapting, improving or innovating a technology. Technological capability is responsible for survival in dynamic atmospheres (Zawislak, Nascimento and Graziadio, 1997). According to Lall (1992), technological capability can present three levels : basic, which guarantees continuity of accomplished activities; intermediate, which allows the company to improve its activities; and advanced, which guarantees the improvement of activities as well as allows the company to accomplish them in a different way.

The visit to the company and the content of the interview showed that a suitable classification of Incocafé relating to technological capability is basic, according to Lall (1992). The following supports the basic capability classification: the company's history performance, characterized by assimilation and use of the acquired technology, with resolution of routine problems; the physical structure found to preventive maintenance, with informal activities of Quality and Programming Control and Production Control; the structure of staff characterized by the existence of a technician and by "learning on the job" process; the level and type of technological domain which correspond to operation and maintenance of

equipment and the null technological independence characterized by technology acquisition with accomplishment of incremental improvements. Although the company presents some characteristics of intermediate technological capability, as the improvement of equipment for its maximum use and the maintenance of an engineer in the company, these characteristics are not enough to classify the technological capability in the intermediate category.

After defining technological capability and analyzing the concerning data, it was observed that internal resources were exploited to the maximum by the company. The available equipment and the impossibility of promoting more improvements put technology in a delayed position in the S curve of coffee packing. It represents a great technological delay, causing problems in productivity, quality and competitiveness.

### Technological strategy for Incocafé

Considering the tendencies and alternatives found in the mapping of technological scenery and the basic technological capability of the company, it is observed that it will be very difficult to Incocafé to develop internally an innovative and suitable solution to its situation. Therefore, searching external solutions is a suitable option.

The problem resulting in low productivity found in the packing system vector can be solved by the acquisition of an automatic packing equipment, which characterizes a imitative strategy. This strategy is more suitable for Incocafé, since Incocafé would reach a point of the S curve of packing technology in which its current problem would be solved with an evolution equivalent to 20 years (Figure 2). Thus, the company would present an up-to-date competitive positioning.

### Technological Strategic Planning for Incocafé

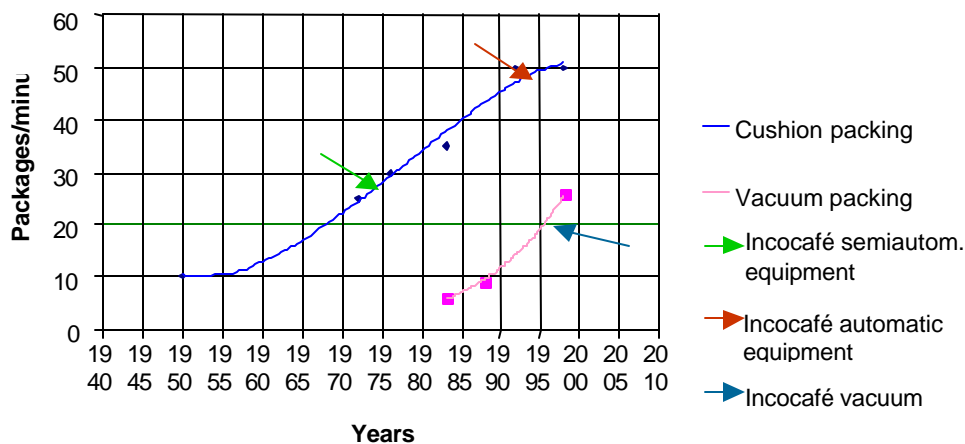


Figure 2: TSP for Incocafé

The acquisition of an automatic equipment can facilitate the future insertion of the company in the new curve of vacuum packing, once equipment available in the market can be coupled to a vacuum closing device. This considers the emergent tendency of vacuum packing in dominating the market.

Although vacuum packing is the most advanced technology found in the technological scenery, it was not the chosen option, since Incocafé does not have technological capability to work with a technology in expansion. Besides, it would be necessary to update the other vectors that compose the technology of coffee industrialization, solving other problems related to productivity and quality of the product in the company.

## **Conclusions**

The application of a technological strategic planning in Incocafé case shows the importance of technology in the competitiveness of a company. Although technology in coffee industrialization is steady, there are companies that adopt technological innovations, standing out from the others. The execution of the technological strategic planning for Incocafé allowed the identification of its technological problems and the relation of these with the other areas in the company. Through the analysis of the powdered coffee industry and the mapping of the technological scenery, it was verified that innovations in coffee industrialization process are due to the introduction of new equipment by the sellers.

The developed technological strategy was adopted by Incocafé, representing a reduction of costs and elevating its productivity allowing the company to accomplish its expansion plans. This demonstrates that technological strategic planning is a valid instrument in the search of competitiveness, even when it is the case of a small company of an industry presenting a steady technology. The process highlighted the importance of a technological strategic planning to identify means of innovation even in a technology steady industry, because to the company in point, to make use of the planning process results was an innovation.

## References

### *Interviews*

Fidelis Marranghello - Marranghello Com. e Rep. Ltda.

Marcos Kepper (Commercial Department) - Metalúrgica Leogap S.A

Sergei Nitzke da Silva - Incocafé Indústria e Comércio Ltda.

### *Internet (http://)*

General Information Sites

[www.inmetro.gov.br/cafe.htm](http://www.inmetro.gov.br/cafe.htm) (01/03/99)

[www.csf.com.br/foodnet/arq10.htm](http://www.csf.com.br/foodnet/arq10.htm) (18/02/99)

[www.cia.usp.br/~ghftagli/café/trabalho.html](http://www.cia.usp.br/~ghftagli/café/trabalho.html) (12/02/99)

[www.gourmet-coffee.com/freshness.html](http://www.gourmet-coffee.com/freshness.html) (19/02/99)

[ecocoffee.com/](http://ecocoffee.com/) (18/02/99)

[www.coffeuniverse.com](http://www.coffeuniverse.com) (19/02/99)

[www.abic.com.br/web/abic.htm](http://www.abic.com.br/web/abic.htm) (19/02/99)

[www.abic.com.br/pesquisa/outubro98/e.htm](http://www.abic.com.br/pesquisa/outubro98/e.htm) (19/02/99)

[www.abic.com.br/encafe/1998/main\\_eventos\\_encafe7\\_dia19d.htm](http://www.abic.com.br/encafe/1998/main_eventos_encafe7_dia19d.htm) (19/02/99)

Equipment's Sites

[www.netuno.com.br/~raumak](http://www.netuno.com.br/~raumak) (02/03/99)

[www.lilla.com.br](http://www.lilla.com.br) (19/02/99)

[www.waig.com.br](http://www.waig.com.br) (18/02/99)

[www.limeira.com.br/matisa/empresa/produtos/index3.htm](http://www.limeira.com.br/matisa/empresa/produtos/index3.htm) (18/02/99)

[www.acheiweb.com.br/medianeira/](http://www.acheiweb.com.br/medianeira/) (18/02/99)

[www.truenet-ce.com.br/orved/produto1.htm](http://www.truenet-ce.com.br/orved/produto1.htm) (18/02/99)

[www.abic.com.br/web/feira\\_moderniza.htm](http://www.abic.com.br/web/feira_moderniza.htm) (19/02/99)

[www.abic.com.br/encafe/1998/sala\\_de\\_negocios.htm](http://www.abic.com.br/encafe/1998/sala_de_negocios.htm) (19/02/99)

[www.leogap.com.br](http://www.leogap.com.br)

Roasting industries Sites

[www.melitta.com.br](http://www.melitta.com.br) (18/02/99)

[www.ciauniao.com.br](http://www.ciauniao.com.br) (18/02/99)

[www.cicara.com.br](http://www.cicara.com.br) (18/02/99)

[www.dialnet.com.br/afa/historic.htm](http://www.dialnet.com.br/afa/historic.htm) (18/02/99)

[www.cafedopont.com.br/empresa.html](http://www.cafedopont.com.br/empresa.html) (18/02/99)

[www.3coracoes.com.br](http://www.3coracoes.com.br) (18/02/99)

[www.bomdia.com.br](http://www.bomdia.com.br) (18/02/99)

### *Catalogs*

Cia. Lilla de Máquina Indústria e Comércio - Guarulhos/SP

COOCACER (Coperativa dos Cafeicultores do Cerrado Patrocínio Ltda.) - Patrocínio/MG

EMBRAPAC – Equipamentos S.A. - São Paulo/SP

Johnis Balança Microprocessada (Silvestre Alvarenga Repres.) - Belo Horizonte/MG  
Metalúrgica Leogap S.A. - Curitiba/PR

Montana Coffe Com. Import Expor. Ltda - São Paulo/SP

SERAM Divisione Packaging di Pasetti s.r.l. - Parma/Itália

### ***Bibliography***

Freeman, C. *The economics of industrial innovation*. . 2<sup>nd</sup> edition. Cambridge: The MIT Press, 1982. 250 p.

Lall, S. Technological capabilities and industrialization. *World Development*, v. 20, n. 2, 1992.

Zawislak, P. A .; Nascimento, L. F.; Graziadio, T. Planejamento estratégico de tecnologia para PMEs: o caso da empresa de autopeças do Rio Grande do Sul. *Revista de Administração Contemporânea*, v. 2, n.3, set/dez, 1998, p. 27-43.

Title: Technological Innovation Planning To A Small Agribusiness Company

Ednilson Santos Bernardes, MSc student  
NITEC / PPGA / UFRGS / Brazil  
Av. Washington Luís, 855 sala 416  
90.010-460 Poa-RS / Brasil  
e-mail: [ednilson.bernardes@embraer.com.br](mailto:ednilson.bernardes@embraer.com.br)

Doriana Daroit, MSc student  
e-mail: [ddaroit@adm.ufrgs.br](mailto:ddaroit@adm.ufrgs.br)

José Carlos Lázaro da Silva Filho, MSc student  
e-mail: [jclsilva@bigfoot.com](mailto:jclsilva@bigfoot.com)

Egídio Luiz Furlanetto, PhD student  
e-mail: [elfurlanetto@adm.ufrgs.br](mailto:elfurlanetto@adm.ufrgs.br)