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Managing Innovation in Small High-technology Firms: A Case Study in Brazil

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Abstract

Evaluating innovation competence and practices is a significant and complex issue for many contemporary organizations and it presents itself as a challenge for forthcoming initiatives. In this article, we present the case study of a small high-technology firm. Cianet Networking is a digital communication solutions manufacturer in Brazil that went through the implementation of an innovation management assessment system. This article reports the challenges the firm faced through the diagnosing/benchmarking and action plan proposal phases as well as the challenges facing the implementation phase. This system helped the firm to understand their strengths and weaknesses as well as to establish action plans in order to achieve higher performance. Since the beginning of the implementation, the results have corroborated the firm´s positive operational outcomes.

Key words: innovation; SME; high technology companies; performance measurement

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Introduction

Innovation initiatives have become extremely important for companies seeking higher competitiveness. In this sense, the first step in order to start Innovation Management initiatives is to diagnose the current company's situation and to benchmark it with best-practice companies in the market. The logical sequence would be to propose action plans in order to achieve higher outcomes, followed by the implementation phase.

This article presents the case study of a small high-technology firm, Cianet Networking, a digital communication solutions manufacturer in Brazil which went through the phases described above, diagnosing/benchmarking, action plan proposal and implementation of an innovation management assessment system and reports how Cianet faced the challenges imposed after the project and the results obtained since then.

We present in the next sections, a brief explanation about Innovation Management; next, the research methodology; followed by the steps needed for each phase: diagnosing/benchmarking, action plan proposal and implementation, that were executed by the company, including the lessons learned by Cianet Networking and detailing the company's experiences during the process; and finally the conclusions and the bibliographical references.

Innovation: Concepts and Context

The study of innovation had two different influences. The first one, the neoclassical approach founded by the Solow proposal on technological change, which explains the residuals in econometric models as the result of the technological changes (Solow, 1994). The second one, the influence founded on the Schumpeter approach, who argued about the effects of innovation in development and growth (Schumpeter, 1983).

For Solow (1994) technological changes were exogenous; for Schumpeter (1983), technological changes were articulated by the dynamics of entrepreneurship. Most of the newest proposals consider Schumpeter theory as the endogenous model for economic growth based on technology development, where companies invest in Research and Development (R&D) in order to innovate.

On the other hand, there has been much arguing related to what means innovation, for the OECD (1997) innovation refers to the introduction of new knowledge or combinations of several existent knowledge.

In present day, academics have given much more importance to the agents that interact in the process of innovation than to other factors, these has led to a convergence of several academic researchers such as Freeman (1987), Nelson and Winter (1982), Rosenberg (1982), and Lundvall (1988), followed by the discussion of the dynamics of innovation at the regional and national level. Companies of all sizes nowadays, seek to innovate in order to gain competitive advantages, which in turn, create economic flows and dynamics that support labor and also the creation of new companies, affecting what has been called the "National Innovation System".

Innovation practices are especially important for companies that are knowledge-intensive and high-tech centered; these are companies that use knowledge as its major asset and resource, in order to produce high-technology goods or services.

Knowledge-intensive companies serve as sources of innovation when they develop processes or deliver services; serve as facilitators when they support other organizations in their innovation processes; and also, serve as carriers of innovation when they participate in technology-transfer activities (OECD, 2006).

In this sense, several governments are working in order to improve innovation levels in its industries. However, quantifying, evaluating and benchmarking innovation competence and practice is a significant and complex issue for many contemporary organizations (Adams et al., 2006) and it presents itself as a challenge for forthcoming initiatives.

Research Methodology

This study was undertaken within a small digital communication solutions manufacturer in Brazil, which was identified by the authors as a benchmark in innovation practices, confirmed by the several awards the company received from state and national science and technology agencies.

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Cianet Networking provides digital communication solutions for several markets around the globe, by developing and incorporating technologies in a convergent and flexible way. It has over 12 years in the market, and its headquarters are located in the city of Florianópolis, State of Santa Catarina, Brazil. Cianet evolved from designing and consulting operations for electronic development projects for other companies in its early years, to solid R&D, NPD, sales and OEM operations with Taiwan in present days, as well as an engineering-to-order partner.

The methodology had two phases, first, deep bibliographical surveys on several Cianet documents, starting in 2006, after the diagnosing/benchmarking phase was completed, and the continuing in 2008, after the implementation phase was started.

The second phase involved several on-site visits to the company since 2006 until 2009. The timing of the visits enabled a greater understanding of the innovation management model developed by Cianet as well as to better contrast with prior documentation and findings that were studied.

Semi-structured interviews were conducted with several employees from Cianet. Interviewees were drawn from different hierarchical levels of the firm, including senior management levels.

The Diagnosing/Benchmarking Phase

The Origins of the Benchmarking Methodology

The Diagnosing/Benchmarking phase was developed in 2006 by the Instituto Euvaldo Lodi in Santa Catarina State (IEL/SC), through the participation of a project financed by the Brazilian Agency for Project Funding (FINEP). The objective of the project was to develop a Brazilian benchmarking methodology for innovation management in small companies, namely the Benchstar Methodology.

The origin of the Benchstar Methodology (BM) was the "Made-in-Europe" program for benchmarking best practices in European companies in the mid 90's. Since 1997 the Instituto Euvaldo Lodi (IEL/SC) in Santa Catarina, Brazil worked in the acquisition and adaptation of this knowledge, finally producing the "Made in Brazil" methodology (Siebel, 2004).

The "Made in Brazil" methodology consists in a rapid and effective diagnose for medium and big-sized enterprises, covering all the key areas in the company, allowing the comparison of its results with the indexes stored in an international database, containing more than a thousand companies from 32 different countries (Gariba, 2005).

The Benchstar methodology then, was adapted from the MIB, for suiting the SME's characteristics and needs, seeking to disseminate modern management techniques, and to communicate what the market leaders, contained in the database, are doing to secure their leadership position (Mazo, 2003).

It is composed of a well defined set of phases, which are shown in Figure 1:

Figure 1. The Benchstar development steps. IEL/SC (2006)

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Practice and Performance Index

The BM uses two concepts for the establishment of comparison parameters, the Practice index and the Performance index. The practice index is related to the management and technological tools and techniques in the productive system. The performance index measures the company's performance through the practices implemented (Mazo, 2003).

It uses two different graphs to present the results, the first one is the Radar Graph, and the second one is the X-Y Plot, called the Practice and Performance Graph.

The radar graph (Figure 2) is composed by five axis, each one with a scale from 0-100%, the position of the company in a specific aspect is represented with a point, linking them with a line, forming a closed polygon of five faces, the corners of the polygon represent the aspects that were measured: Innovation, Innovation Organization, Competitive Intelligence (CI), Monitoring and New Product Development (NPD).

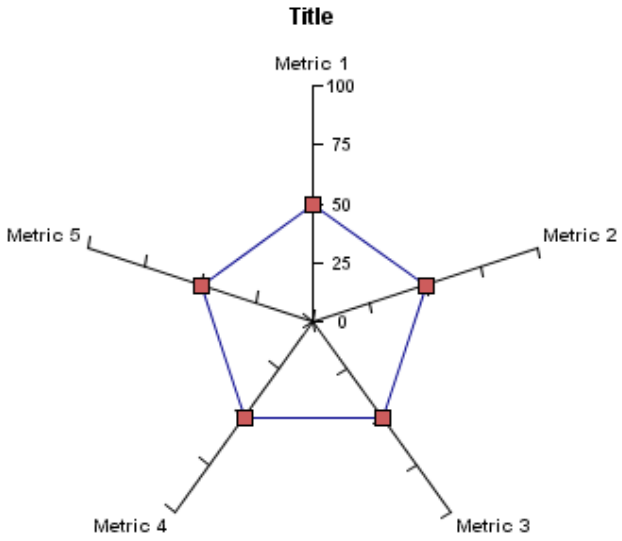

Figure 2. Radar Graph. : Mazo (2003)

The second graph uses a boxing analogy (Hanson & Voos, 1995; Mazo, 2003; IEL/SC, 2006) (See Figure 3). The basic test of validity of the model is to correlate the use of Best Practice versus Performance, the designated areas in the graph are (IEL/SC, 2006):

- *World class*: Those with both practice and performance better than 80%.
- *Innovatives*: Those with practice and performance better than 60%.
- *Contenders*: Those with both practice and performance better than 50%.
- *Promising*: Those with 50% or more of the practice but had yet to enjoy the performance benefits to the same level.
- *Vulnerables*: Those with 50% or more of the performance scores but without having the enduring best practice to the same level.
- *Reactives*: Those with practice and performance below 50%.

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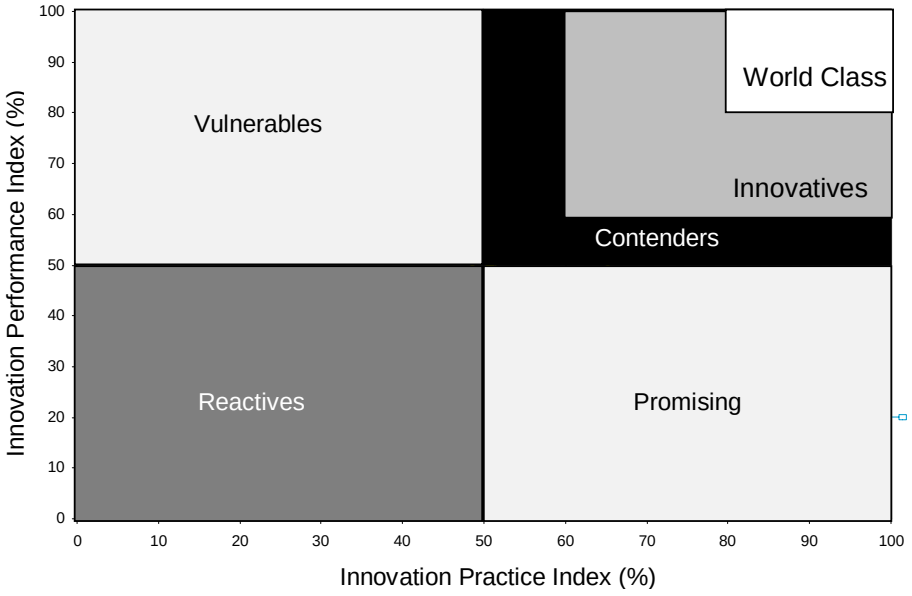

Source: IEL/SC Report (2006)

Figure 3. Practice vs. Performance Graph. IEL/SC (2006)

Practice Variables

The Benchstar measures four key Practice Processes: Organization for Innovation, Competitive Intelligence, Product Development and Monitoring.

Organization for innovation is related with different managerial styles that are used in the company. In Table 1 are shown the main variables analyzed.

Vision, Mission and Goals Sharing
Leadership Style
External Involvement
Working Flexibility
Workers involvement
Human Resource Development
Internal Involvement
Innovative Environment
Relationship with Suppliers

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Client Focus
Relationship with universities and research centers
R&D Infraestructure

Table 1 - *Variables measured in Organization for innovation. Adapted from IEL/SC (2006)*

Competitive Intelligence is related with several technological aspects and its reflection on marketing strategies. In Table 2 are shown the main variables measured.

Product Development measures several aspects related to the product's life-cycle and to the production processes. Table 3 shows the variables analyzed.

Investments in technological upgrading
Product technology strategy
Information Systems
Concept generation for innovative products
New technology apprehension strategies

Table 2 - Variables Measured for Competitive Intelligence. Adapted from IEL/SC (2006)

Product Life-Cycle Planning
Change Control
Engineering Processes
Problem solving tools
Introduction tools for new products
Automation of Project Development

Table 3 - Variables Measured for Product Development. Adapted from IEL/SC (2006)

The Monitoring process is related to measurement activities seeking to give feedback about the other production processes. In Table 4, the main items are shown.

Performance measures
Feedback from the field

Table 4 - Variables Measured for Monitoring. Adapted from IEL/SC (2006)

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Performance Variables

Finally, the variables that measure performance are organized in a separate group, called Innovation Activities. These aspects are related to the overall process of innovation, from the design phase to the market share and client satisfaction. The variables are shown in Table 5.

Cycle Time – From product release to market availability
Cycle Time – From product design to product release
Market share
Quality of new product in relation to specifications
Introduction of new products (last 2 years)
ROI Time
New product/process release time
Innovative Capacity
Workers´ level of satisfaction
Functional product performance
Client Satisfaction

Table 5 - Variables Measured for Innovation Activities. Adapted from IEL/SC (2006)

The Application at Cianet Networking

The BM was applied in Cianet in 2006. Cianet was invited by IEL/SC to participate in the Benchstar pilot project, along with four other companies. The company was invited due to its focus on technology and product development, for having quality and technological programmes implemented, and for winning several Brazilian awards in R&D and innovation, state as well as nationwide.

The BM application helped the company to identify key factors that needed to be strengthen, in Cianet's Innovation Management system. Specifically, the Benchstar helped to identify:

- The relationship between Innovation and the company's strategy
- The main aids and barriers to the innovation process
- The tools and techniques used in the NPD process, and the new perspectives
- The efficiency of the Innovation process
- The actual profile of workers and organizational culture facing Innovation Management

For the process of application a committee was established internally, composed with managers, supervisors, and technical staff, which primary function was to sensitize the company's workers about the importance of the activities being developed, approximately, 90% of the committee was designated from the already existing Quality Committee. The sensitization process was

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smooth due to the committee's past experience in similar activities.

After the first phase, the data collection phase was strongly supported on the documentation related to the company's ISO 9000:2000 system, thus, the staff didn't have major difficulties in collecting the relevant information. This information was then analyzed and compared with the IEL/SC database.

The results obtained are presented in Table 6, containing the areas: Innovation Organization, Competitive Intelligence, Product Development, Monitoring; and the indexes: Innovation Practice and Innovation Performance.

Benchstar Areas	Cianet	Leaders average	Diff. with Leaders average
Innovation Organization %	**68,3**	**88,0**	**- 17,4**
Competitive Intelligence (CI) %	**48,0**	**92,5**	**- 44,9**
Product Development (NPD) %	**57,1**	**88,6**	**- 29,1**
Monitoring %	**60,0**	**86,0**	**- 26,7**
Innovation Practice Index (%)	**60,7**	**88,8**	**-28,0**
Innovation Performance Index (%)	**52,7**	**82,7**	**- 31,1**

Table 6 - Results per area of analysis. IEL/SC (2006)

Both indexes had values lesser than the leaders average. The Innovation Practice Index obtained by Cianet was 60,7%, below 28,0% of the world leaders average considered in the IEL/SC Database. On the other hand, the Innovation Performance Index was 52,7%, below 31,1% of the world leaders average.

In the Practice vs. Performance graph, both indexes gave Cianet Inc. the Contender position (Figure 4), meaning that the company uses some of best practices in Innovation Management and its results on performance are adequate.

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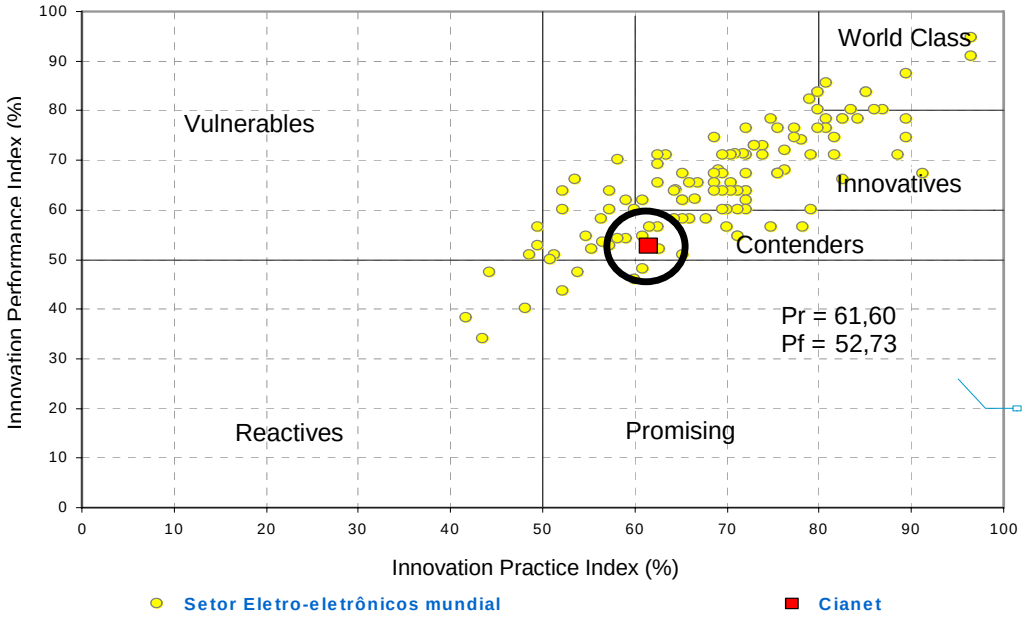

Figure 4. Cianet´s innovation positioning. IEL/SC (2006)

The indicators measured for the Radar graph (Figure 5) showed that Organization for Innovation is the one that gets closer to the Leaders' level, this was sustained by the natural focus on R&D that Cianet has, due to the expertise of its shareholders in this matter.

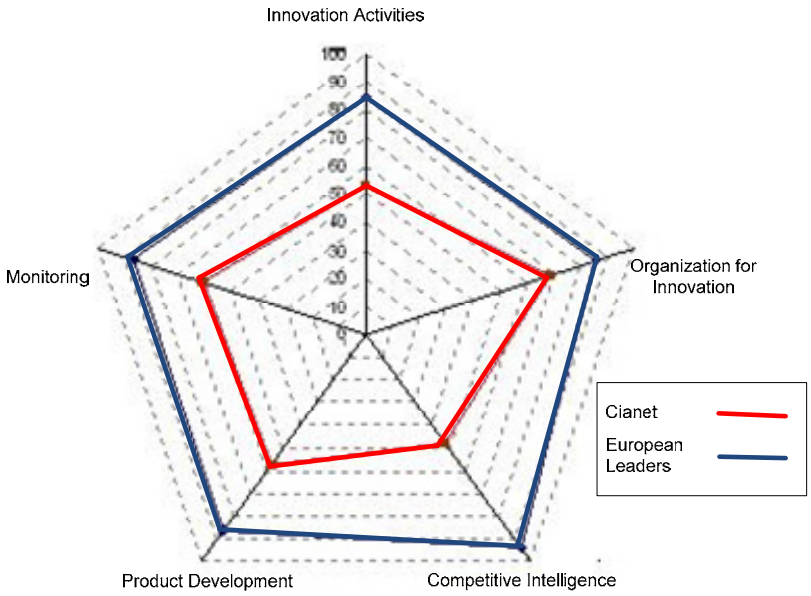

Figure 5. Cianet´s radar analysis. IEL/SC (2006)

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The methodology applied at Cianet Inc., namely Benchstar, brought some interesting results regarding aspects such as Production and Operations Management in general and Innovation Management practices and performance.

After the presentation of the final report by IEL/SC in 2006 to Cianet's managers and a meeting held in August 2007, some aspects were discussed and analyzed, in order to identify some of the causes that contributed to obtain those values in Practice and Performance indexes.

First of all, it was determined that the methodology didn't consider explicitly the situational context of the companies studied, in the sense that some of the weaknesses identified by the BM were known to Cianet's managers, however because of the unavailability of more own financial resources, lack of supporting public policies, etc., these actions (e.g. specialized product testing equipments, ERP system implementation, extra quality management staff, etc.) weren't executed.

These characteristics could inevitably affect the performance and practice indexes, since benchmarking companies of different contexts, like the Latin American SME's and European world class companies, present exogenous variables, that sometimes are determinant factors for producing biased values.

This also means, that unlike when the state-of-the-art practices are unknown to SME's scenario, where mentoring, tutoring and training could help to solve this kind of problems; in some of Cianet's experiences, managers knew the problems, the causes to these problems, and the actions that needed to be taken for improving performance, however with a more complex problem solving process, that is, to surpass the financial obstacle, common to MPE's in Latin America, the lack of Government policies for MPE's development, etc.

Second of all, these measurement system feeding the IEL/SC Database, could present inconsistencies between the companies benchmarked, due to the aspects considered above. Thus, the performance and practice indexes should need to have an additional weighted procedure for insuring that context aspects are also considered.

The Action Plan Proposal Phase

After the presentation of the results by IEL/SC, an improvement plan was designed, facilitating future measurements of Production and Innovation practices and performance; and the inclusion of innovation initiatives in Cianet's Strategic Plan. The shareholders also concluded that through the implementation of Innovation Management tools and techniques like Competitive Intelligence and Business Intelligence software, SWOT strategic analysis, Quality Function Deployment, among others, Cianet's innovative potential could be greatly increased. In 2007, a meeting was held in order to establish the next steps of the project.

The bottom-line was that Cianet proved to be an innovative company yet with current unstructured innovation processes, as well as with inadequate IT tools.

Cianet started the phase were actions needed to be established in order to structure a proper innovation management system. In this phase, IEL/SC helped in training the company´s stakeholders that would be part of the implementation team.

In order to achieve this, Cianet adopted an strategy-driven approach, by focusing on a top-down management, working over Strategic Planning concepts, in order to analyze internal and external aspects of the company (Jeston and Nellis, 2008). Some models were used in order to establish an innovation- driven strategy, among them, SWOT analysis, competitive forces and environmental aspects (Porter, 1980) as well as core competencies (Hamel and Prahalad, 1994).

After the analysis, some strategic choices had to be made, related to the vision, mission, goals, strategic intent and implementation strategies.

The overall results of this process helped to identify the need of three main areas related to Innovation Management: Technologies, Product and Process Engineering and Competitive Intelligence..

The Implementation Phase

Until April, 2009, the implementation process was still in execution. This phase is being sustained through four

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different bases: Diagnosing, Internal Technology Analysis, Project Management and Competitive Intelligence.

Periodically, new diagnosing activities are made internally, which seek to evaluate and identify performance gaps in the innovation process. The internal technology analysis is supported by the SWOT model, aiding to understand the current technological positioning of the company. The activities for project development are supported now in tools and techniques of Project Management. And, finally competitive intelligence systems were implemented.

The results after three years of implementation have shown an improved control over current and new projects, a better alignment with innovation for employees, more qualitative and quantitative information processing improving decision making and a stronger market focus.

The implications of these changes have led to a greater number of projects being developed by Cianet, and also, a greater number of new products going to the market.

Conclusions

Innovation Management measurement has proven to be an effective initiative for improving organizational performance. This paper presented the challenges a small high-technology firm faced when implementing an innovation management and measurement system, through their first three phases: diagnosing/benchmarking, action plan proposal and implementation.

The experiences gained by Cianet Inc. in the process, as showed in this paper, facilitated the identification of the causes that were preventing the company to reach higher performance levels and the establishment of actions aiming to eliminate or at least reduce those causes.

These experiences also showed to be positive for the implementation of a continuous innovation management cycle inside the company, incorporating periodic meetings with the IEL/SC staff in order to measure the changes perceived by Cianet.

Another relevant fact that was learned from the Benchstar application in the case study company was that some of the weaknesses of the methodology were identified, especially regarding to contextual or situational variables, that impact directly on the indicators measurement and analysis, creating a feedback process for the IEL/SC Institute in order to improve the BM.

The results after three years of implementation corroborate the success of the model, when reached a better visualization and control over project development, improved qualitative and quantitative information processing and specially, a greater number of new developed projects and with market insertion. As one of the corporate managers suggested "it has been a positive experience with a clear and visible development of the company with a sharper focus on innovation".

The practical implications of the study for innovative organizations are twofold. First, the need for companies to focus on innovation and to design, implement and manage innovation activities as a core competency inside the firm. Second, the need for a process of organizational change, which enhance drastically the performance of such initiatives.

The next step for Cianet Networking is to continue with the implementation process, and to start a new innovation practice and performance measurement in order to visualize the qualitative and quantitative changes experienced in the process.

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