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The Challenges of Technology and Economic Catching-up in
Emerging Economies



From Imitation to Innovation: Sectoral Patterns of Diffusion of Innovation Management Practices in Brazilian Innovating Companies

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Paper objective

The paper addresses the challenges of the transformation in organization and management practices in emerging country firms in their process of technological catching up. It does so by exploring the diffusion of innovation management practices (IMP) in Brazilian innovating manufacturing companies and the constitution of sectoral patterns of diffusion.

Conceptual assumptions

- In her seminal essay, Lam (2005) binds innovation and organizational change as innovation implies organizational capability for change and adaptation.
- This was largely reinforced in the literature on organizational ambidexterity (O'Reilly and Tushman 2008, 2013)
- Even more so in the growing literature on business model innovation (Teece 2018, Teece and Linden 2017).
- The dynamic capabilities approach (DCV) sees innovation-related organizational and management capabilities as component of dynamic capability micro-foundations (Teece 2007, Eisenhardt and Martin 2000, Janssen, Alexiev, den Hertog and Castaldi 2012).

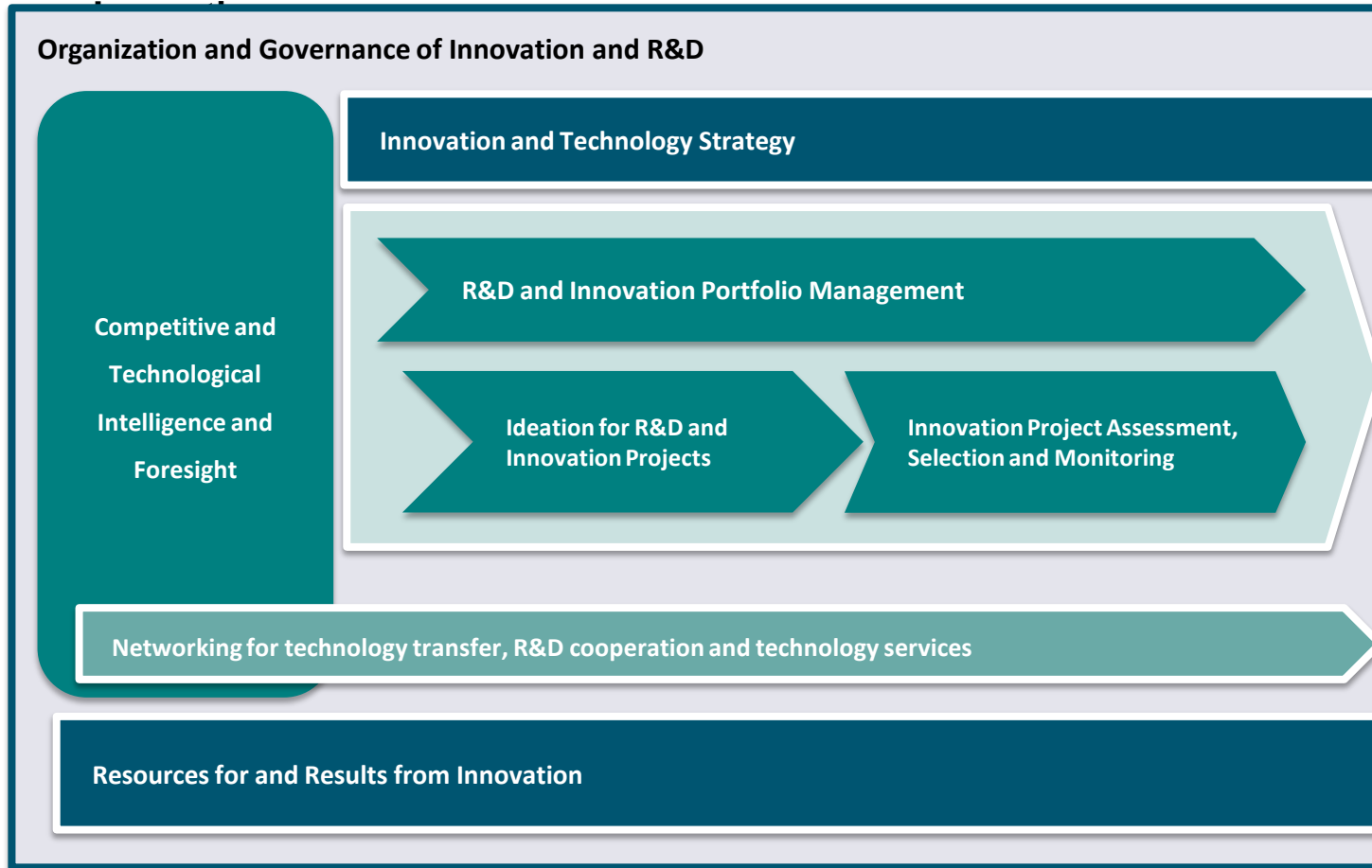
Literature gaps addressed: the need for understanding innovation management capabilities in emerging countries



- Emerging country firms innovate: China, India, Brazil (Ernst 2008, Govindarajan and Trimble 2012, Lema et. Al. 2015) – Reverse innovation
- Innovation Paradox (WB): Important obstacle to developing countries' innovation and technological catching up lies on their lack of managerial capabilities (Cirera and Maloney 2017). WB study based on Bloom and Van Reenen's (2007) survey on management practices diffusion.
- Yet, concern with the challenges emerging country firms face in developing innovation management and related organizational skills has received little attention; few exceptions focused in case studies (Quadros et al. 2013, Nagano et al. 2014 , Zhang 2014).
- This research set out to map the diffusion of IMP in a robust sample of Brazilian innovating manufacturing firms, across a large number of sectors and a wide a wide range of management practices.

How to measure diffusion of Innovation management practices (IMP)

Figure 1 -Reference Model of Strategic Management of Technological



Source: Quadros et al. 2017

Survey objective

The survey intended to identify and measure the level of intensity of diffusion of a diversified set of IMP in Brazilian firms:

- What were the most and the less disseminated processes and tools related to innovation management?
- What was the intensity and diversity of technological cooperation ties of the surveyed firms with suppliers, customers and research institutions?
- What was the organization of innovation activities and management leadership's engagement with innovation strategy decision-making?

Are there sectoral patterns of diffusion of IMP in Brazilian manufacturing? To what extent does the emerging country context affects sectoral diffusion? (using Pavitt's taxonomy)

- Premise: critique of the innovation management literature which pursue universal 'best practices', meaning the adoption of the same tools and recipes in any firm, irrespective of sector or context.
- Tidd and Thuriaux-Aleman (2016) in a pioneering survey of IMP adoption in a sample of 292 firms across 10 groups of industrial sectors in more than 16 countries, they have found significant differences in the adoption of different IMP practices across industry groups
- In this research, we set out to verify whether there is distinctiveness in the intensity and diversity of adoption of IMP between different manufacturing sectors, but we also intended to understand whether patterns of IMP adoption would be related with sectorial innovation dynamics and trajectories. This has led us to adopt Pavitt's taxonomy of innovation trajectories (Pavitt 1984, 1992, Pavitt et al. 1989).

Survey strategy and methods



1. Empirical investigation is based on a survey conducted by the author and colleagues and commissioned by a federal think-tank (CGEE) which produced **indicators of IMP diffusion and capabilities** in Brazil. Context: **New Indicators Focusing the Black Box**
2. Survey of an intentional sample (panel) of 65 Brazilian firms, mostly in manufacturing, carried out in 2015/2016.
3. The survey was based on a structured questionnaire comprising the 6 dimensions of IMP. Even though the questionnaire was electronically available to interviewees in advance, finalization of it was based on visits and live interviews carried out by a couple of experienced interviewers. Interviews were meant to discuss and explain doubts to gather empirical evidence of adopted IMP in order to support responses.
4. Senior managers in R&D and innovation areas of firms were in charge of filling in questionnaire and participating in interviews and revision of filled questionnaire.
5. Sample major inclusion criterion was that firm be substantially experienced in innovation and has a record of adoption of IMP. Most firms with such profile are also amongst the top R&D and innovation activity performers. Thus **the sample comprises a robust parcel of top Brazilian manufacturing firms, either foreign or local.**



Research strategy and methods



6. Sample was segmented as to include distinctive technological trajectories, according to Pavitt's taxonomy (Pavitt 1984), as well as different capital ownership nationality (national x foreign). Most firms are in the manufacturing industry, but a few local suppliers of customized software have been included as part of the specialized suppliers sub-sample .
7. Measurement: An important contribution of the survey has been the design of a system of simple and composite indicators of IMP adoption as means to quantify and normalize to a common scoring scale from 1 to 10 all questionnaire variables, including categorical ones.
8. Indicators have been calculated considering simple and weighted arithmetic averages for both sets of attributes: technological trajectories and nationality of capital ownership (foreign x national).
9. Averages have been submitted to nonparametric variance tests (Anova).

Table 1 – Sample composition

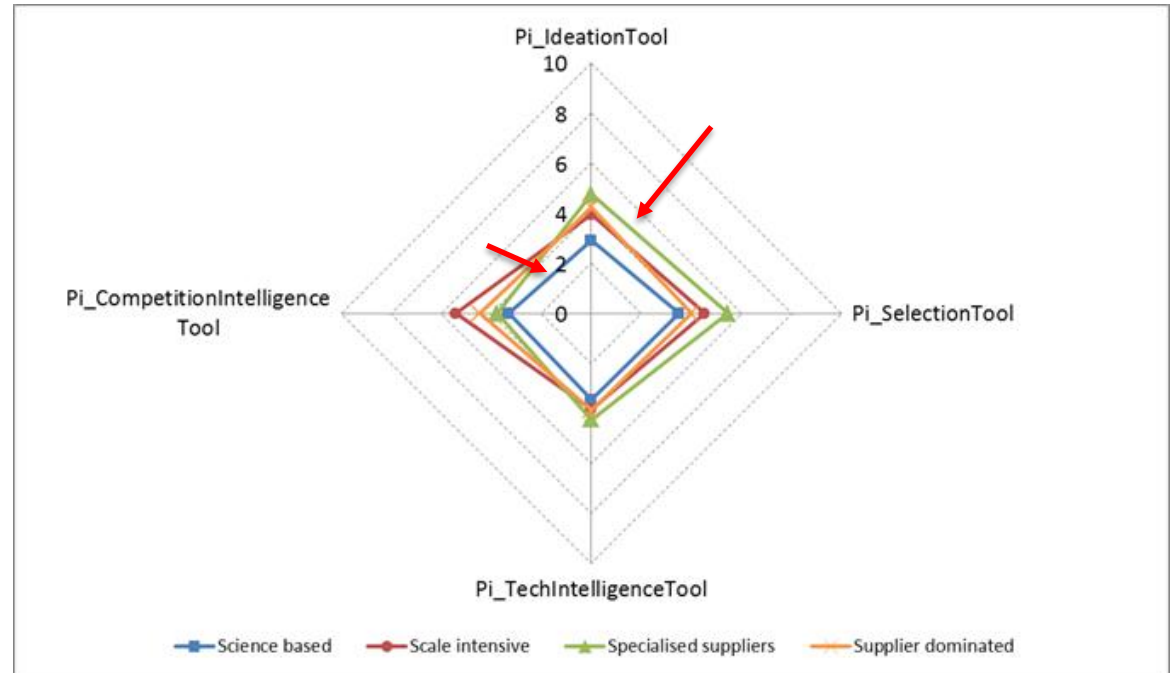
Technological Trajectory	National Firms	Multinational Subsidiaries	Total
Science-based firms	10	5	15
Scale-intensive firms	12	13	25
Specialised Suppliers	10	3	13
Supplier-dominated firms	7	5	12
Total	39	26	65

Findings: Diffusion of Innovation Management Processes and Tools

Figure 2 Component Indicators of the Composite Indicator of Intensity and Diversity in the Use of Tools in Innovation Management Processes (ip-IntTool) by Technological Trajectory

Specialised Suppliers present the highest rate of adoption of IMP, in 3 out of 4 processes, whereas Science-based firms are at the bottom of all groups of firms in all 4 processes.

Science-based firms (pharma, fine chemicals and telco equipment) present the highest R&D/sales ratio.



	Science based	Scale intensive	Specialised suppliers	Supplier dominated
Pi_IdeationTool	2,9	3,9	4,8	4,2
Pi_SelectionTool	3,5	4,5	5,4	4,0
Pi_TechIntelligenceTool	3,5	3,8	4,3	3,9
Pi_CompetitionIntelligenceTool	3,3	5,4	3,8	4,4

Source: CGEE

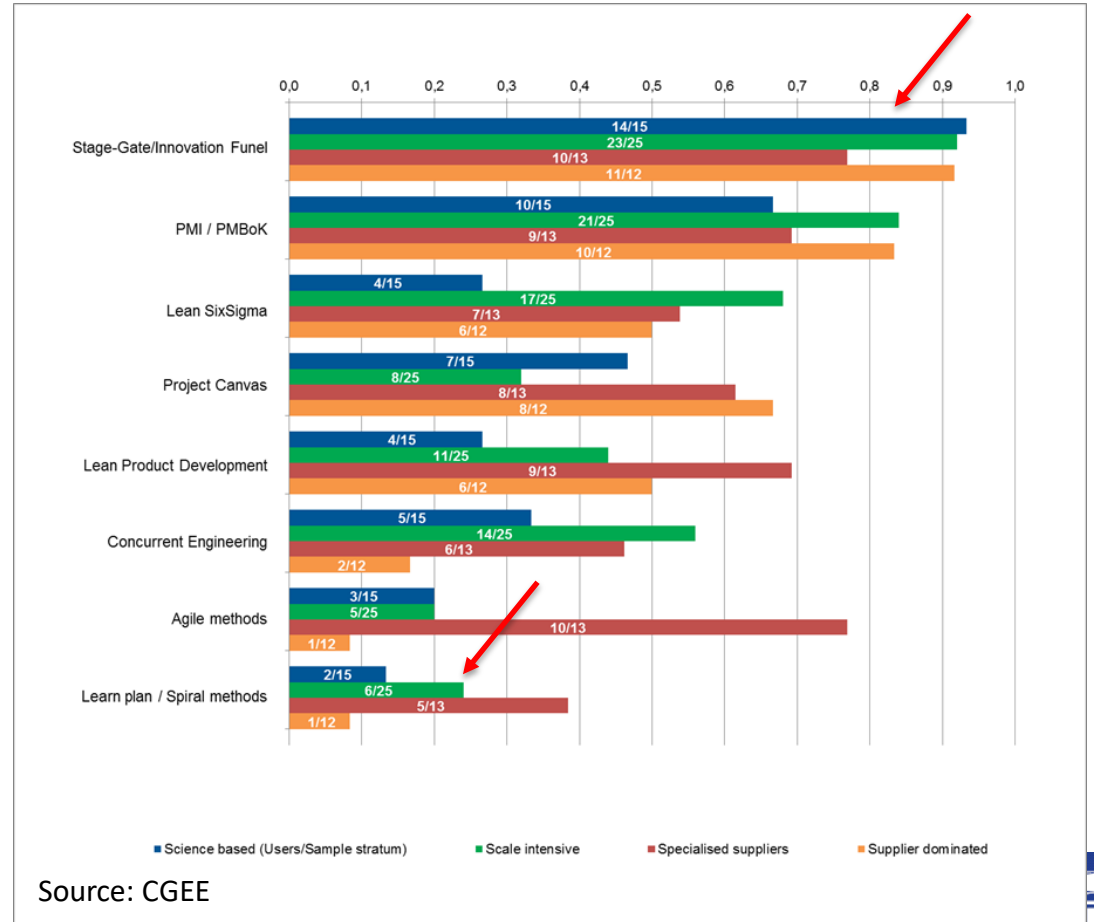
Findings: Diffusion of Innovation Management Processes and Tools



Figure 3 - Relative frequency of users of tools and techniques for evaluation, selection and management of R & D and innovation projects by Technological Trajectory

The indicator of frequency of users of evaluation and project selection tools presents the highest value in the survey.

Within this group of tools, Stage-gate and Innovation Funnel techniques rank first in terms of number of users in the sample stratum for all trajectory strata, followed not far by PMI techniques.



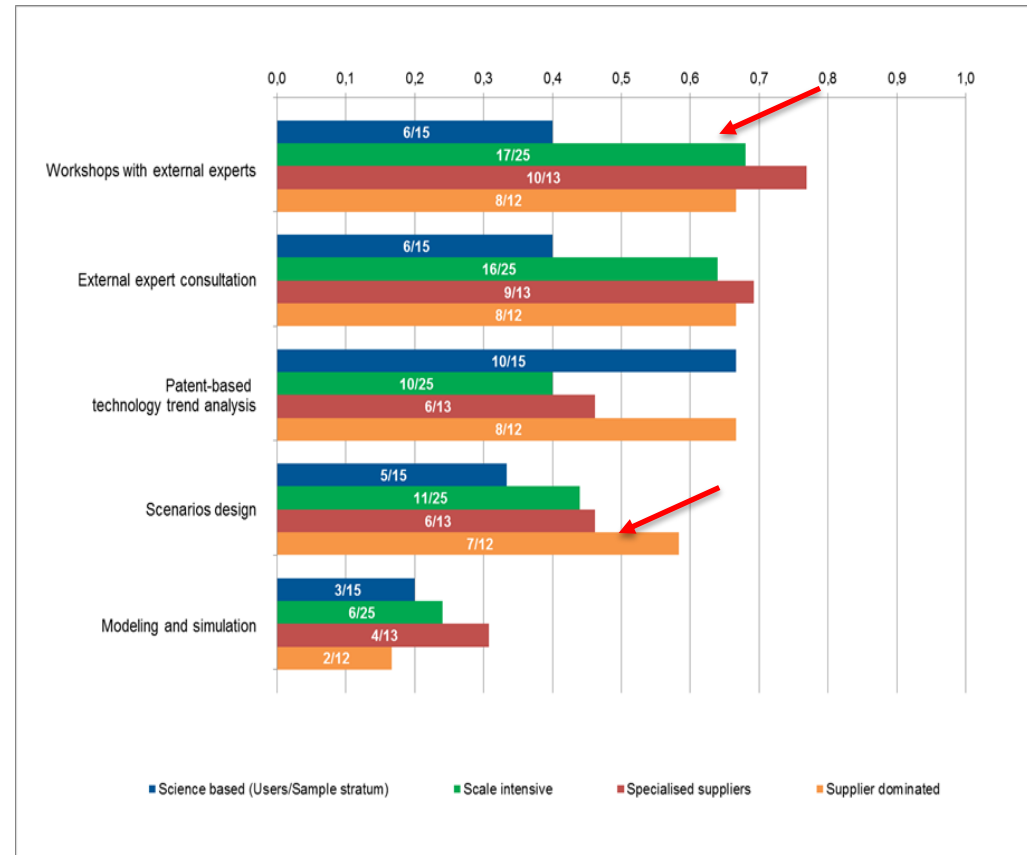
Findings: Diffusion of Innovation Management Processes and Tools



Figure 4 - Relative frequency of users of tools and techniques of technology intelligence by Technological Trajectory

Whereas the indicator of frequency of users of technology intelligence and prospection tools presents the lowest value in the survey.

More elaborated and/or long-term oriented practices, such as scenarios design are considerably less diffused than simpler practices aiming at raising awareness and understanding of emerging issues, such ad-hoc expert workshops.



Source: CGEE

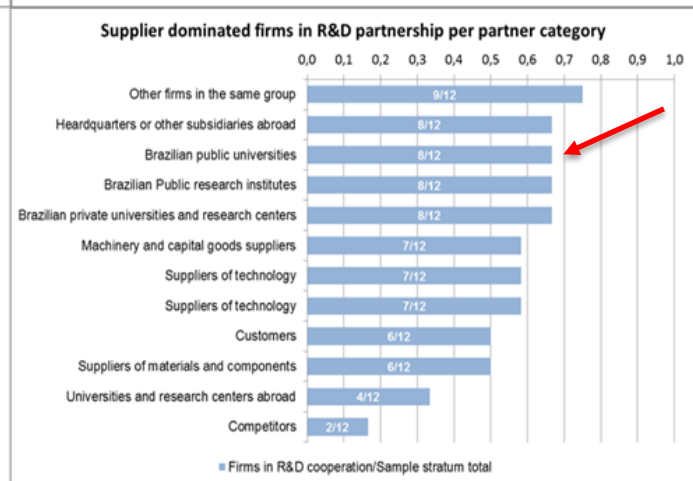
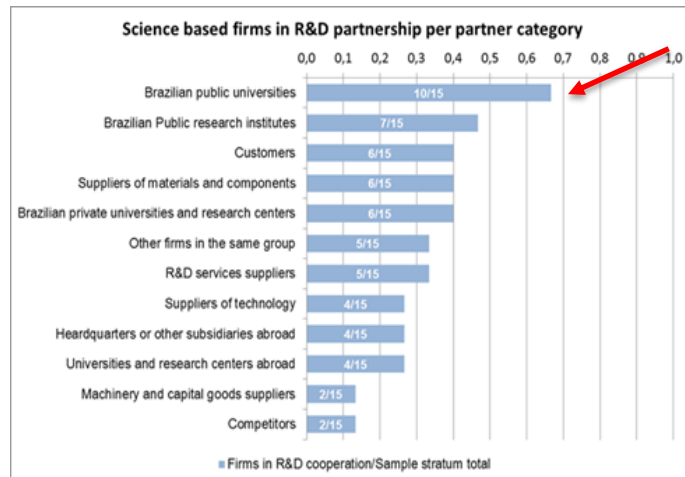
The prominence in the use of tools which are meant to the management of incremental product and process innovation or adaptation suggests that market pulled, incremental innovation is the major focus of most Brazilian innovating companies adopters of IMP. While the diffusion of tools related to advanced engineering and technology development is confined to a small group of firms.

Findings: Networking Practices for Access to Technology and R&D Cooperation



Figure 5- Relative frequency of firms in R&D partnership agreements per partner category by technological trajectory

The most important finding is the very high profile attributed to Brazilian public universities as partners for R&D cooperation by sample firms in all groups. 63% of responding firms declared they have established R&D partnership agreements with such institutions.

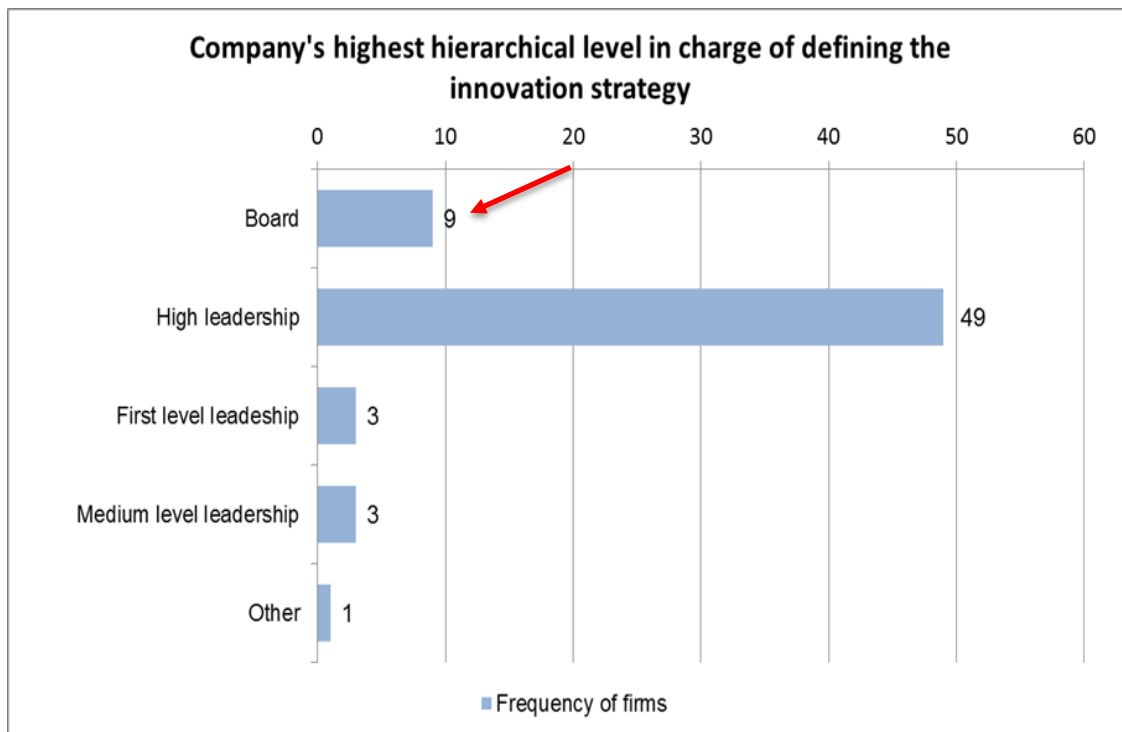


Brazilian innovation literature has pointed out the relevance of academic research in the context of business innovation in the country. There are a number of determinants contributing to this phenomenon. Overall, most Brazilian innovating firms (either controlled by nationals or by foreign MNC) have accumulated neither culture, nor capabilities, nor technological infrastructure enough for technological research.

R&D and innovation activities comprise rather the use of available knowledge for new product and process development and experimentation (NPD) than creation of technological knowledge or new combinations of knowledge. Therefore, in search for solutions to technological problems emerging in NPD projects, it is not uncommon that firms turn to university labs and research groups as a second best for the missing applied research internal unit.

Figure 7 - Frequency of firms per hierarchical level of decision-making on innovation strategy

58 out of 65 surveyed innovating companies have their innovation strategy defined at the highest decision-making levels. No distinctive sectoral pattern. In 9 national companies the board of directors engages with innovation-related decision making (recent trend).



Source: Primar CGEE

Intriguing issue is that such wide engagement of high leadership with innovation decisions has not entailed significant change in companies' directions towards more ambitious innovation strategies.

Plausible hypothesis for further research to explain why Brazilian managers in innovating firms are relatively timid or conservative in innovation strategies is to look into corporate governance: the nature and dynamics of decision-making within the board and amongst corporate owners.

A board of directors, usually controlled by family groups, which is focused on maximizing short term performance and value, and is little familiar with innovation capabilities and requirements may constitute various sorts of restraints, by means or decision rules and parameters, to changes in innovation strategy.

Table 3 - Composite Indicator of Intensity and Diversity in the use of Tools in Innovation Management Processes (ip-IntTool) and its components indicators by sample stratum

The group of board-engaged-with-innovation companies presents substantially higher scores in indicators of intensity and diversity of diffusion of tools of IMP, particularly as regards tools employed in technological intelligence and foresight and compared with the entire group of national companies.

Sample Stratum	Ip_Intensity tool	ip_Idea tion tool	ip_Selection tool	ip_Tech Intelog. tool	ip_Com Intelig tool
Firms with inovation-engaged board	4,9	4,4	5,1	7,0	4,7
National firms	3,7	3,3	3,9	3,8	3,6
MNC subsidiaries	4,9	4,8	5	3,9	5,6
Total	4,1	3,9	4,4	3,8	4,2

Source: CGEE

Findings: Governance and organization practices in connection with innovation strategy



There has been a recent movement in local innovating companies, in which the board establishes a permanent innovation advisory committee, in order to organize and submit to the board strategic decisions regarding innovation.

Cases comprise companies like Aché, Natura, Fibria/Suzano, Ourofino and others, which seem to have set out to put innovation at the centre of their growth strategy.

In such companies, board's decisions regarding innovation comprise approving innovation and R&D budget, approving alliances with third parties regarding strategic technologies and assessing diversification opportunities based on new technologies.



Conclusions:



1. Research on innovation management capabilities and the diffusion of IMP in emerging countries is still in its early stages. However, the knowledge produced by the Brazilian IMP survey suggests that this is a promising way to deepen the understanding of limitations of emerging country firms' catching up in innovation.
2. Sectoral patterns of diffusion of IMP in Brazilian innovating firms surely are influenced by firms' technological trajectories, but in a manner which is substantially influenced by the country context.
3. Technological innovation capabilities, IMP diffusion and innovation management capabilities follow the same pace and interact. Particular limitations in management's vision, targets and aims of Brazilian firms' innovation processes need to be taken into account: overall, a short-term vision, geared to adapting and innovating to keep business as it is, prevails.
4. Better understanding of the role of high leadership and of corporate governance in regard to innovation strategies could be an important subsidy for policy-makers and business leaders to promote the transformation in Brazilian business firms into more ambitious, effectively innovating corporations.



Thank you!
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