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Methods and tools for innovation management and entrepreneurship: Designing self-facilitation templates in the context of a technology park

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Abstract

In the innovation dynamics within organizations, Management Methods and Tools (MaTs) are commonly adopted to aid in mapping uncertainties, understanding problems, decision-making, and adapting to market demands across various dimensions. However, the diversity and complexity of MaTs can hinder their proper selection and adoption by managers, often requiring specific expertise for proper implementation and achieving results. In this context, *self-facilitating templates* are defined as visual artifacts designed to support the learning and initial implementation of MaTs, reducing learning time and the need for specialist guidance. This study aims to identify key elements for designing self-facilitating templates. Based on literature and empirical insights from a research network working with innovation management, we propose a framework that identifies key design elements for these templates. The findings contribute theoretically by integrating perspectives on MaTs, productization, and visual management, offering a structured approach for their design. Practically, this research provides guidelines for developing intuitive, visually guided MaTs, facilitating their adoption in organizations and innovation-promoting environments.

Keywords: methods and tools, innovation management, self-facilitating templates, visual management.

1. Introduction

Implementing innovation practices in organizations brings with it a set of significant challenges. Allocating resources to innovation-related activities alone is insufficient, and many companies that do so without properly addressing the weaknesses in their innovation processes fail to innovate successfully (Hansen & Birkinshaw, 2007). In this context, Management Methods and Tools (MaTs) are commonly adopted to assist in mapping uncertainties, understanding problems, decision-making, and adapting to market demands across various dimensions.

However, managers' difficulties in selecting and applying MaTs involve several challenges, such as uncertainty about their compatibility with the company's workflow dynamics or the lack of intuitive application. In response to this scenario, the productization of MaTs emerges as a process that analyzes a need and defines and combines suitable elements into a product-like object that is replicable and comprehensible (Harkonen et al., 2017). Furthermore, within the scope of productization and the intuitive diffusion and adoption of MaTs, a promising approach involves using visual methodologies through self-facilitating templates. Phaal et al. (2016) employ these methodologies to transfer much of the facilitator's autonomy (a specialist in the MaT) to the tool itself and the participants.

Although the value of adopting MaTs to support activities associated with innovation processes and management in companies is widely recognized, and visual and self-facilitated approaches show promise in integrating MaTs into organizational workflows, research efforts and practical intervention case studies in these areas remain nascent. They lack integrative and prescriptive perspectives.

From this standpoint, this study aims to undertake an exploratory and critical analysis of self-facilitating templates based on the experiences of a research network focused on management technologies for innovation-promoting environments—LabMIn. Following an initial literature review, templates developed by the LabMIn team are analyzed for the following MaTs: Roadmapping, Strategic Choice Approach (SCA), Innovation Diffusion Radar (IDR), and PaD-Projects (a hybrid approach for managing Innovation and Digital Transformation Projects). Finally, a framework is proposed as a preliminary guide with guidelines for designing self-facilitating templates.

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2. Literature review

2.1. Methods and tools in the context of innovation management

According to Birkinshaw et al. (2008), innovation management is implementing and conducting a new practice, process, or structure that significantly alters how work is carried out and how the organization's innovation-related goals progress. This definition encompasses four critical points: (i) Implementation, with the primary focus on generating economic value; (ii) The introduction of something new to be adopted by the organization; (iii) Emphasis on the implementation of a new practice, process, or management structure (Alänge et al., 1998); (iv) Advancing organizational goals.

Innovation management is a complex activity requiring planning and leadership coordination (Stefanovitz & Nagano, 2014). Efficient management, as defined by Cormican & O'Sullivan (2000), occurs when companies explore and evaluate a wide range of factors, such as leadership, culture, planning, communication, and functional integration, ensuring high performance. Furthermore, Birkinshaw et al. (2008) argue that innovation management must also involve the invention and implementation of practices, processes, structures, and techniques to promote the integration of these factors.

To map uncertainties that arise during innovation processes or projects, Management Methods and Tools (MaTs) serve as mechanisms to support problem identification and decision-making, primarily helping managers address complex issues (Wright et al., 2013). Brady et al. (1997) highlight several factors to consider when selecting the best tools: the degree of formality, the tool's objective, its "hardness" level, task specificity, source, and intensity of use.

Regardless of the system used to categorize MaTs, some considerations should be made regarding their use. First, the chosen approach must be appropriate for the problem. Second, the individual selecting the tool must know which are the most suitable options. Third, the person using the tool must understand how to apply it and its limitations concerning the problem (Brady et al., 1997).

However, the large number of available MaTs makes it challenging for managers to select and adopt the most suitable ones. Phaal et al. (2006) point out that one of the main challenges for managers is determining how to find appropriate MaTs, evaluate their quality and usage, and apply them in a practical environment or process. For companies, accessing the right MaTs to support their innovation efforts and understanding how to apply them is essential (Demaria & Mendonça, 2024; Bagno, 2024). Additionally, the needs and specificities of each organization can vary significantly, requiring a thorough analysis to determine which tool best aligns with the company's objectives, structure, and culture.

2.2. Productization of management methods and tools

The term "productization" can be understood as a process that analyzes a need and defines and combines elements with the goal of producing something replicable and comprehensible (Harkonen et al., 2017). However, it is important to note that even with productization, the appropriate selection of MaTs for application in business innovation still requires a clear understanding of the company's specific needs and careful evaluation of how these tools align with those needs. Nevertheless, productization can provide a promising starting point.

According to Rodrigues et al. (2024), MaTs for innovation and entrepreneurship are management technologies that share several characteristics with services. This is because they inherently consist of condensed knowledge elements used in organizational practices to support decision-making and the disciplined management of various processes. A productization perspective can significantly enhance the design and adaptation of MaTs to facilitate their diffusion and ensure proper organizational applications (Rodrigues et al., 2024).

Thus, translating technical information into formats accessible to the business community becomes crucial (Silva Júnior et al., 2024). Given the complexity of the business environment, tools with meaningful and accessible forms of visual representation provide a powerful means to help share and disseminate knowledge and understanding among managers (Platts & Tan, 2004). Self-facilitating templates emerge as artifacts that support the productization of MaTs by leveraging visual strategies to make them more tangible and replicable, aligning with certain characteristics of a product.

2.3. Visual management and self-facilitating templates

Knowledge visualization encompasses all graphical means that can be used to convey insights, experiences, methods, or skills (Eppler & Burkhard, 2007). Using a design thinking approach as an example, the benefits of visualization are numerous (Eppler & Kernbach, 2016; Suwa & Tversky, 1997), whether by improving idea generation and creativity (Atilola et al., 2016; Lugt, 2005), increasing problem-solving capacity (Goldschmidt & Smolkov, 2006; Larkin & Simon, 1987; Tversky & Suwa, 2009), among other benefits.

In this field, self-facilitating templates are mechanisms that use visual elements as potential solutions to support the productization process, creating artifacts to aid in learning and applying MaTs during their initial implementation stage. In their study on self-facilitating templates for technology and innovation workshops,

Phaal et al. (2016) discuss this visual tool. The idea is that it incorporates a guidance process typically provided by a facilitator to reduce the number of necessary interventions and empower participants to organize their own strategic discussions.

Phaal et al. (2016) conducted experiments using traditional roadmapping processes and a self-facilitating template. For example, the traditional roadmap template can be seen in Figure 1, while the self-facilitating template is shown in Figure 2.

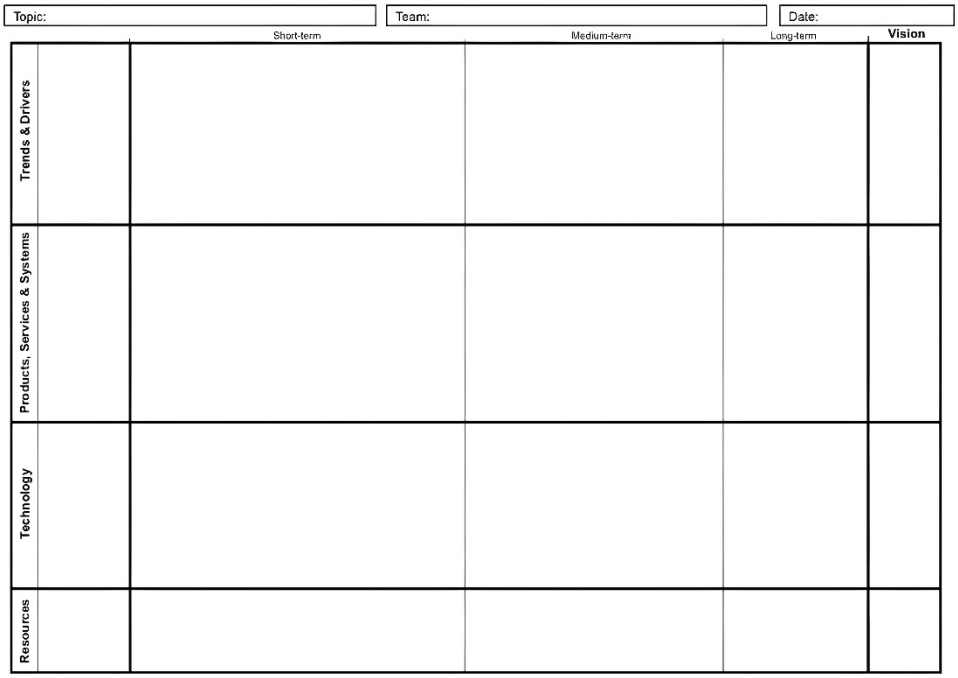

Figure 1. Classic roadmap template model used in workshops (Phaal et al., 2007).

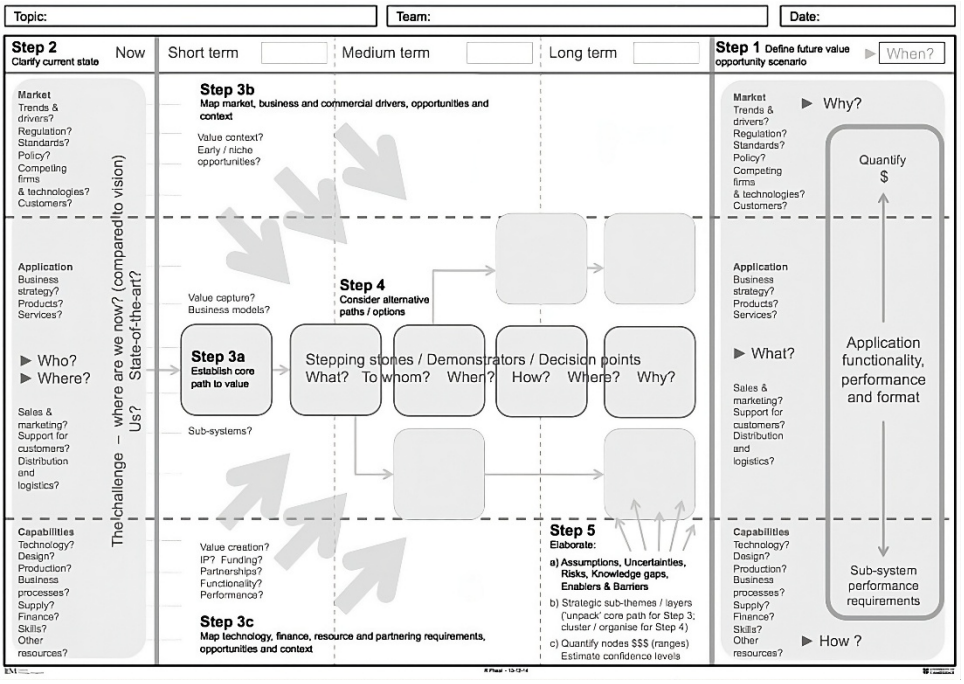

Figure 2. Example of a self-facilitating roadmap template model (Phaal et al., 2016).

Self-facilitating templates leverage visualization and imagery to effectively promote relevant and creative discussions. In this context, visualization should be understood as a process of encoding information into various

images that stimulate imagination and creative thinking, discovering optimal solutions to existing problems (Manole & Grabara, 2016).

Phaal et al. (2016) explored several benefits of using the self-facilitating template in the experiment. Among these was the generation of more ideas by the end of the workshop compared to the group that conducted the Roadmap using the traditional method. Additionally, the new template was considered more comprehensive and produced higher-quality results.

A significant aspect of this new tool is its reduced need for interventions by a specialist facilitator, as also noted in the workshop reported by Phaal et al. (2016). Using the self-facilitating template made the roadmapping process significantly faster for the group. Therefore, we conducted a review of visual representations and other aspects (such as cognition and structure) to identify elements that characterize an effective self-facilitating template. Table 1 summarizes the elements identified from this review.

Table 1. Preliminary Elements for the Characterization of Self-Facilitating Templates. Source: the authors (based on literature review).

#	Guideline	Explanation	Author(s)
1.	Structure	It is important to have a structure that encourages users to visually link their ideas	Jaco et al. (2013)
2.	Visual guidance	The visual representation must serve a dual purpose: to capture and structure contributions, while also providing a sequence of actions	Eppler et al. (2011)
3.	Clear and well-distributed	The tool should be self-explanatory and easily understandable with minimal cognitive effort	Few (2006) Tufte (2007) Eppler et al. (2011)
4.	Visual appeal	It is important that the tool is attractive in order to promote productive collaboration	Eden & Ackermann (2006) Eppler et al. (2011)
5.	Elements that foster dialogue	The interface should have elements that promote dialogue and give the impression that the content needs to be developed	Eppler & Bresciani (2013) Norman (1988)
6.	Collaboration	The interface should include interrogative phrases and/or provocations that enable interaction and collaborative dialogue (to develop each other's ideas)	Hausmann et. al (2005) Sweller (1988) Casto et al. (2016)

3. Methodology

3.1. Methodological strategy

This study critically analyzed the characteristics of the templates used in the MaTs developed by LabMIn. To understand the user experience with these templates, data were collected through interviews with participants from workshops where these MaTs were presented. According to Gil (2002), such data collection involves gathering information from a group of individuals about a studied problem, followed by qualitative analysis to draw conclusions based on the collected data.

The collected data were used to refine the framework developed during the literature review and to propose improvements for the templates designed by LabMIn.

3.2. Research process

Initially, a preliminary framework was developed, summarizing key guidelines for designing self-facilitating templates for management and innovation tools (Table 1). Subsequently, specific MaTs were selected for further analysis based on their usage in LabMIn workshops conducted in 2023. These tools include the Strategic Choice Approach (SCA), Innovation Diffusion Radar (IDR), PaD Projects, and Roadmapping. These MaTs were chosen because they utilize templates with visual and cognitive features designed to facilitate their initial implementation in companies.

A preliminary study of each MaT was conducted, analyzing their assumptions, core characteristics, and contexts of application. This included reviewing existing frameworks, such as SCA (developed by John Friend) and Roadmapping (as studied by Garcia & Bray, 1997, and Phaal et al., 2004). The primary data collection method involved interviews with workshop participants. These individuals were selected based on their roles: some were responsible for designing the templates, others actively participated in the workshops, and some attended as

observers. Interviewees included multiple participants, with some providing input across several workshops. Additionally, a key person from LabMIn offered broader insights into the developed templates.

The interviews were semi-structured, combining open-ended and focused questions to gather in-depth perspectives. The questions were designed based on dimensions outlined in the framework, such as structure, visual guidance, clarity of information, visual appeal, and elements that foster dialogue and collaboration. The interviews were conducted virtually by the authors, each session lasting between 30 and 45 minutes, allowing enough time to explore the participants' experiences in depth. Table 2 provides an overview of the interviewees, their roles, and the workshops they attended.

Table 2. List of Interviewees and their respective roles.

Identification	Workshop participated in	Occupation
Interviewee A	RDI	Researcher with a scholarship at UFMG
Interviewee B	RDI, PAD Projects	Project manager
Interviewee C	Roadmapping	Undergraduate student in Production Engineering
Interviewee D	Roadmapping	Executive Director of a startup
Interviewee E	SCA	Undergraduate student in Production Engineering
Interviewee F	SCA, RDI, PAD Projects	Professor of Administrative Sciences at UFMG

Source: the authors.

The interview questions are presented in Table 3, outlining the key topics explored during the sessions. This structure helped focus the discussions while allowing room for participants to share additional insights. The guide also included a section for comments and additional feedback to capture aspects not covered in the predefined dimensions, enabling a more comprehensive understanding of the participants' experiences.

Table 3. Interview questions.

Guideline	Questions
Structure	Is the structure for using the tool clear? In other words, is the way the template is built familiar enough that users can easily identify where the instructions are, where to input information, where the tips are, etc.?
	Does the structure provided by the template allow ideas and definitions from each step to be linked together? For example, are the insights from Step 1 logically connected to those from Step 2?
Visual Guidance	Are the visual guidance structures (e.g., arrows and indicators) sufficient?
	Does the guidance restrict users in any way, such as limiting observations or initiating certain discussions?
	Is the next action or reflection within the tool intuitive?
Clear and Well-Distributed Information	Is it possible to distinguish the different parts of the template, such as tips, legends, questions, etc.?
	Does the template require a high cognitive load? In other words, is there a logical flow and fluid design to what is presented?
Visual Appeal	Is the template aesthetically appealing?
	Does it make use of visual metaphors? For instance, does it use visual elements such as images, shapes, colors, or compositions to convey meanings or concepts beyond their literal sense (e.g., an image of a bridge connecting two opposite shores could represent collaboration and communication between departments)?
	Does it associate with any familiar topics for the participants (e.g., definitions, words, or logic previously used), or is it entirely new?
Elements That Foster Dialogue	Are there spaces that encourage participants to add information?
	Are these spaces inviting, or are they merely blank spaces (with no words or indications suggesting the need to fill them)?
Collaboration	Are there aspects of the template that stimulate information sharing among participants? For example, questions, prompts, or encouragement to verbalize ideas?

The findings from the interviews, combined with the critical analysis of the templates, led to the development of recommendations for improving the LabMIn templates. These recommendations aimed to enhance the usability, visual appeal, and collaborative aspects of the templates. Furthermore, insights from the interviews informed refinements to the framework, resulting in a more comprehensive guide for designing self-facilitating templates.

4. Discussion and Analysis

4.1. Brief description of the productized MaTs in the study context

4.1.1. Strategic Choice Approach (SCA)

The **Strategic Choice Approach (SCA)**, proposed by Friend & Hickling (2005), is a structured model that supports decision-making involving multiple interdependent and, therefore, complex choices. The SCA provides a strategic way to mitigate key uncertainties that prevent decision-makers from committing resources to a particular course of action in a given context. This MaT facilitates stakeholder communication, enhances engagement, and enables agile uncertainty management (LabMIN, 2023).

Flexible and interactive, the methodology can be applied to various situations, guiding the decision-making process in an integrated manner. Its structure is divided into four phases:

I. **Model**: Identify and list viable strategic courses of action for each decision area.
II. **Design**: Define the current problem and weigh strategic objectives, establishing variables for the problem situation and interrelations between decision areas.
III. **Compare**: Evaluate and compare strategic courses of action following the initial analysis.
IV. **Choose**: Refine decision options, excluding less relevant items, which may require additional rounds of analysis.

The SCA maps actions from a temporal perspective, identifies uncertainties, engages with stakeholders, and provides a strategic vision for the business's forward path.

4.1.2. Innovation Diffusion Radar (IDR)

The **Innovation Diffusion Radar (IDR)** was developed under the context of a master's thesis at a local university (UFMG) in collaboration with LabMIn (Brasil, 2023). This tool was designed to analyze the attributes of an innovation in relation to its potential for adoption by prospective customers. It consists of questions based on best practices in the literature for a self-assessment of the innovation's diffusion capacity. As a result, it is possible to identify opportunities to improve innovation and increase its adoption rate (LabMIN, 2023).

Based on Rogers' (1995) innovation diffusion model, the IDR focuses on the effects of innovation attributes on the adoption rate. The main attributes considered are (i) relative advantage, (ii) compatibility, and (iii) ease of use. These attributes are measured through a Likert scale using forms and radar charts. The application can be carried out by sending forms to customers and compiling the results for internal discussion or through self-assessment by entrepreneurs based on experiences with potential adopters.

4.1.3. [a]PD-Projects

The **[a]PD-Projects** is an innovation project management approach that combines processes marked by phases and decision points with elements of agile management. The model makes intensive use of visual artifacts and prototyping methods. It is modular and better suited for short/medium-term projects culminating in proof of concepts involving small, multidisciplinary teams (LabMIN, 2023). The MaT operates at three proficiency levels:

I. **Phase System**: This system defines detailed deliverables from a phase backlog, with an emphasis on prototyping and validating the innovation.
II. **Sprint Dynamics**: Break down backlog deliverables into activities assigned to individuals, organized on a Kanban board.
III. **Work Routine and Alignments**: Defines smaller tasks over short periods, adjusting time and number of sprints.

4.1.4. Roadmapping

Roadmapping is a method for identifying, defining, and mapping the strategies, objectives, and actions associated with innovation within an organization. The approach integrates two main components: the Roadmap, which is a map presenting an innovation route, and its collaborative construction process, known as roadmapping. In this way, the method seeks to answer the questions: “Where are we?”, “Where do we want to go?” and “How will we get there?” (LabMIN, 2023). The main types of roadmapping are:

I. **Innovation Roadmap**: focused on the planning of products and technologies.
II. **Strategic Roadmap**: focused on business and organizational strategies.

4.2. Self-facilitating templates: Critical analysis and interviews

4.2.1. SCA

The analyzed template (Figure 3) separates the four phases of the SCA methodology and presents various fields within each phase for the template user to fill in. The order of completion does not matter, given that the methodology is flexible and interactive. The template's purpose is to guide the decision-making process by determining areas of uncertainty and the decisions to be made (present and future).

The template provided relatively little information to encourage visual connections with the ideas of the method. The phases are well-defined, but the transition between them is unclear. Interviewee F suggests greater flexibility in filling it out, while Interviewee E believes the numbering of the phases limits this flexibility. The design is not very fluid and lacks logical clarity, which could be improved with arrows or indications for the next steps. The template is predominantly textual, with limited visual appeal. Visual metaphors and figures could strengthen the material, in addition to some definitions that are not trivial.

The numbering of the spaces guides the completion, but the column size limits the text, which can be restrictive. The lack of questions and provocations makes it difficult to foster dialogue among participants. Although the SCA template extracts important information, the way this information is conveyed needs to be improved. It has elements of self-facilitation with colors and blank spaces, but there is still room for visual improvement and for encouraging discussions.

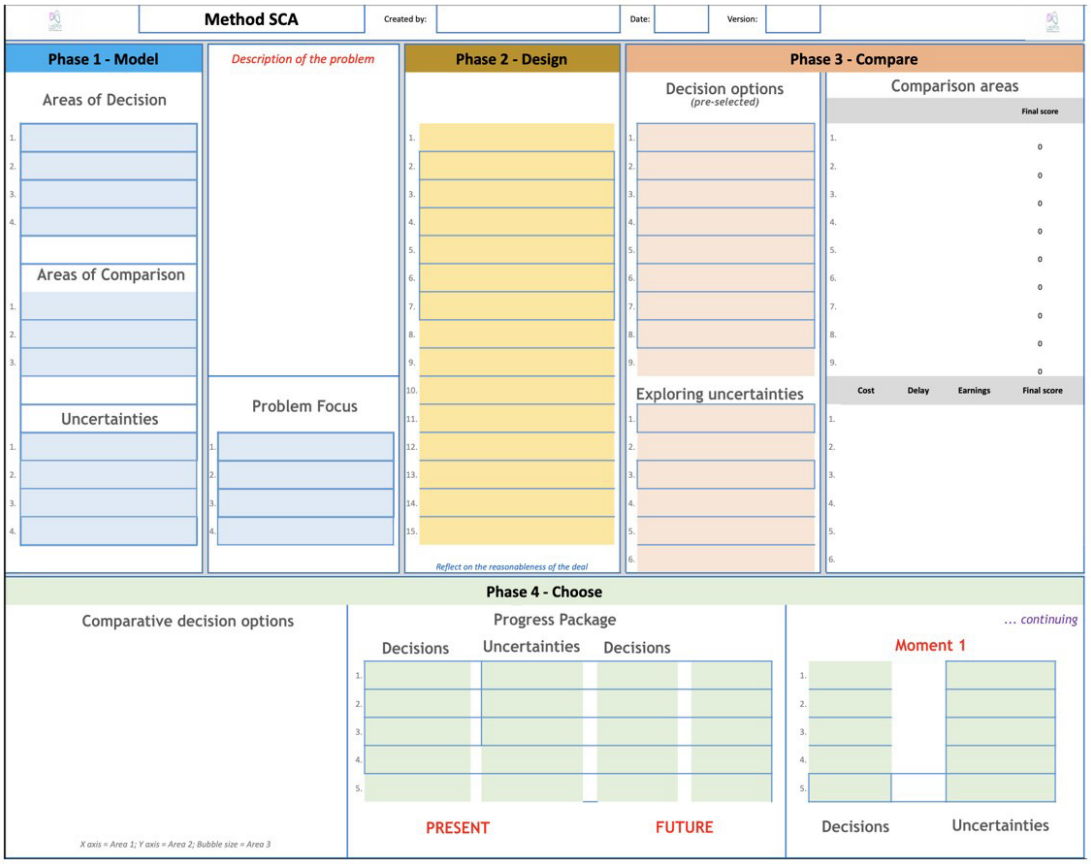

Figure 3. SCA Template.

4.2.2. IDR

The IDR template (Figure 4) is well-defined and practical. The user assigns values to statements, guided by pink tips that automatically feed the attributes of the radar. The goal is to indicate which attributes can be improved through innovation practices. This may cause some initial confusion, as no visual guidance distinguishes inputs from outputs. The information is concise, but its non-strategic placement may affect usability. The visual appeal is minimal, with text predominating, which increases cognitive load and may suggest that the template is complete, discouraging further interaction. The arrangement of the statements without distinguishing innovation attributes could confuse and limit discussions.

For clients, the template tends to be filled out in a non-collaborative way, requiring subsequent discussion within the company. In self-assessments, discussion is necessary during the filling process. Interviewee A highlights the practicality and straightforward structure of the template, suitable for quick responses without the need to share information. Interviewees B and F emphasize autonomous interactivity, where the participant can fill out the template alone without the need for discussion.

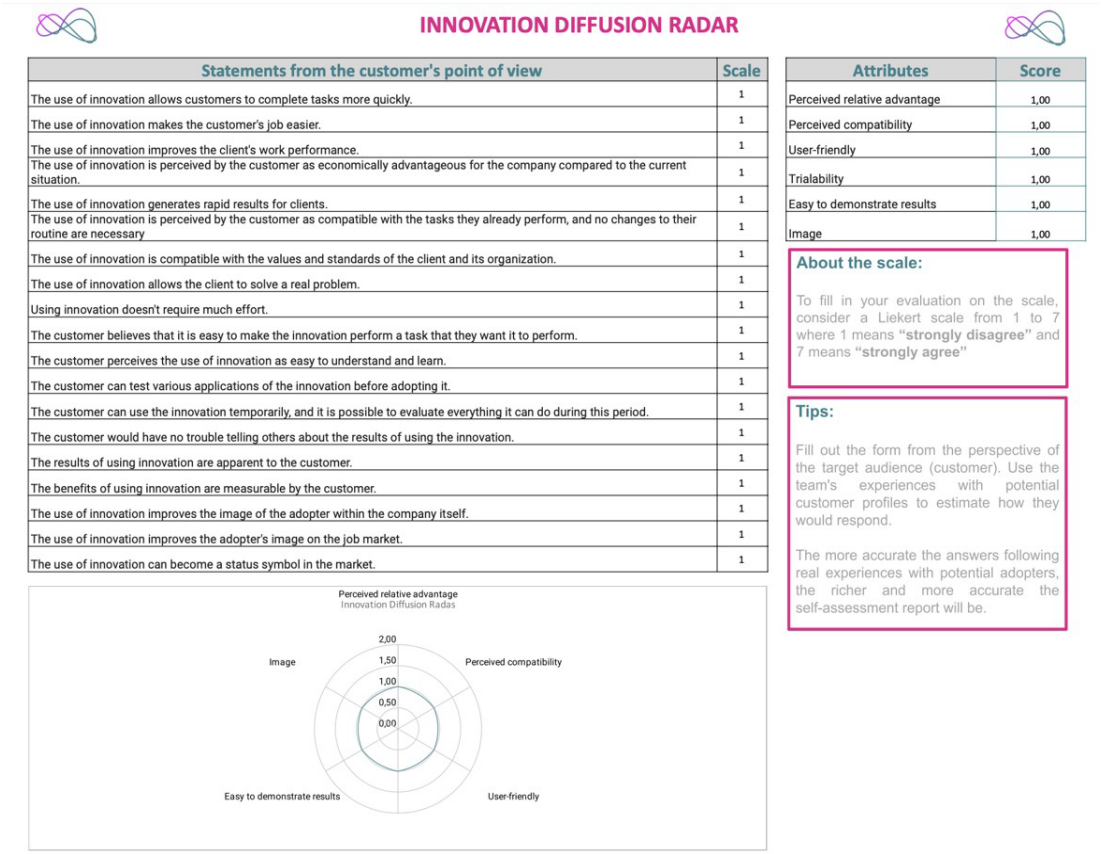

Figure 4. IDR Template.

4.2.3. ªPD Projects

The template (Figure 5) consists of stages representing the development process of innovation projects. Each stage's main focus and various questions that must be answered by the template users using post-its can be observed, with examples of requirements and tips provided as support.

The template is clear and facilitates use with focus points, tips, and examples. Highlighted colors help, but intuitive elements, such as arrows to indicate the logical sequence, are missing. Tips and examples could come before the filling process to better guide the participant. The template is predominantly textual, which can limit creativity.

The questions in the template stimulate discussion and active participation. Examples help with verbalization, creating analogies with reality. However, the ªPD Projects approach is complex and requires discussion to be effective. Interviewee F sees the ªPD as complex and not intuitive, requiring prior knowledge. Interviewee B agrees, emphasizing the need for preparation to use the template effectively.

Visually functional, the template may appear rigid and unappealing. Its complexity limits its attempt at attractiveness with colors and icons. The ªPD encourages dialogue due to its robustness, but not because of the template's attributes. Interviewee B notes that the workshop encourages more dialogue than the template itself. All MaTs require collaboration and dialogue, but some more than others.

4.2.4. Roadmapping

The template (Figure 6) should be filled out based on the topics in the vertical axis, which represent the different types of information addressed in the map, guided by the questions provided, following the flow of arrows, and considering the timeline on the horizontal axis. As a result of its completion, which can be done using Post-its and placing them on the map, it is expected that a list of actions related to the elements of the map will be generated.

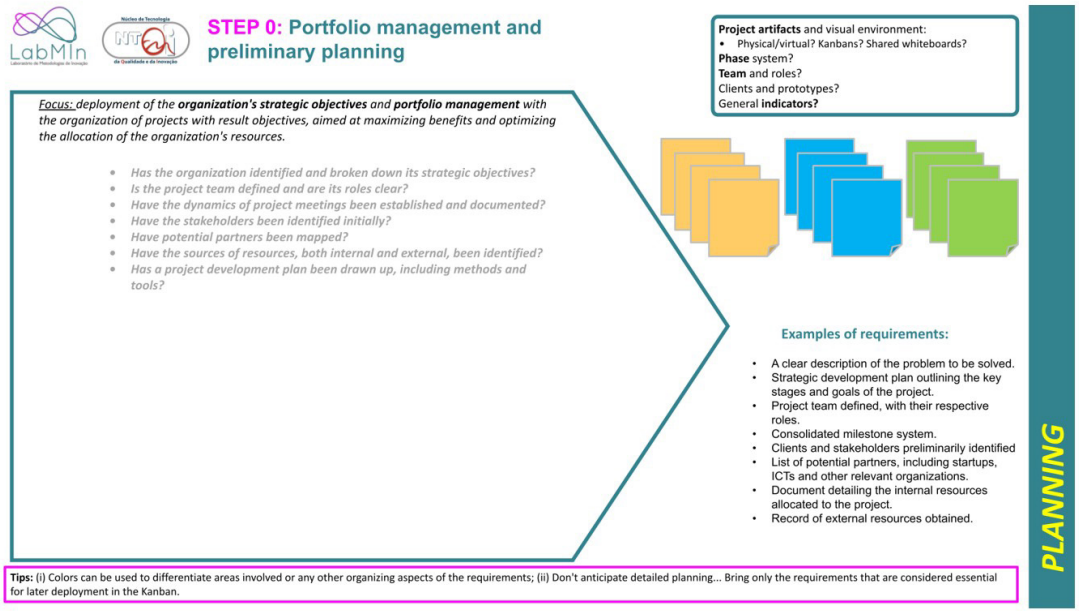

Figure 5. [a]PD Projects Template – Example of Step 0.

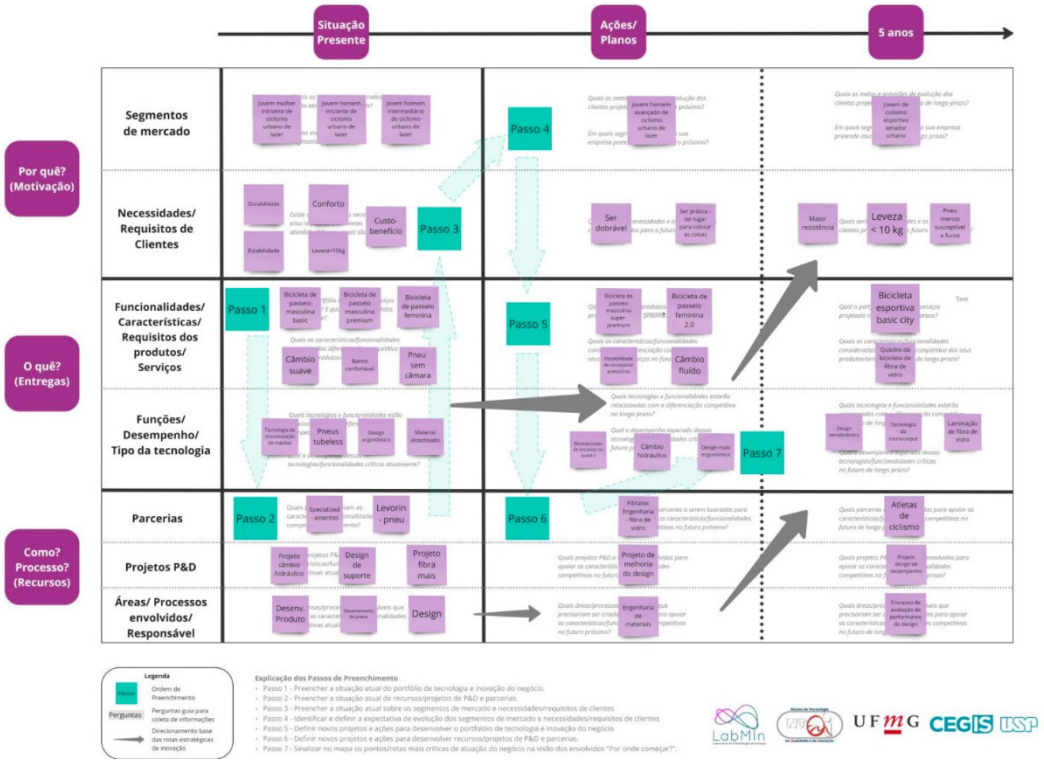

Figure 6. Roadmapping Template.

The template (Figure 6) follows a visual and intuitive structure, guiding participants with arrows, tips, and predefined titles. It uses colors such as purple for the horizontal and vertical axes and green for steps to follow. The information is clear and organized, with a logical sequence facilitating completion, as interviewee C noted. The horizontal axis represents a temporal sequence, and the vertical axis addresses resources, deliverables, and motivation. Colors highlight important information, and a legend helps with understanding.

Although textual information predominates, many of the text excerpts are questions, encouraging verbalization and discussion ("How?", "What?", "Why?"). Interviewee C highlighted that the questions were not trivial, making it difficult for companies without a clear strategic structure to complete the template. Interviewee D mentioned the need to consult workshop notes to answer the questions, suggesting the inclusion of sample answers for different contexts (startups, companies...) to clarify the objectives of each question and the expected outcomes.

4.3. Final discussions

During the development of this work, it became clear that the initial framework of elements for auto-facilitator templates, based solely on literature, were complemented, resulting in a framework that serves as a guide for the design and proposition of auto-facilitator templates for MaTs, identifying central elements for their design (Figure 7). Critical analysis and interviews with experts revealed three additional important points:

Figure 7. Guidelines Framework.

- **Target audience**: The template should reflect the target audience's reality to generate engagement, as with the IDR, which needs to be practical and dynamic for innovative companies.

- **Examples of contexts**: The template's questions should be clear. In the SCA workshop, presenting a case with possible answers before using the template helped participants understand what was expected in each field.

- **Synergy for guideline selection**: Different guidelines have different impacts. The roadmapping template needs clear visual directions and an organized structure, while the IDR values practicality and aesthetics, such as a spider chart.

Our findings reinforce the role of self-facilitating templates as a means of enhancing the usability and accessibility of Management Methods and Tools (MaTs) in innovation management. This aligns with prior discussions on visual management (Eppler & Burkhard, 2007; Platts & Tan, 2004) and the service productization (Harkonen et al., 2017), which emphasize how structured and/or visual artifacts contribute to knowledge dissemination, customer/adopter perceptions and structured decision-making processes. More recent studies further support this perspective by addressing different aspects of MaTs adoption. For example, Bagno et al. (2024) propose a readiness scale for organizations to evaluate their capability to implement MaTs, highlighting the need for structured frameworks that facilitate adoption. Similarly, Silva et al. (2024) introduce a meta-visualization approach to enhance visual management in innovation projects, reinforcing the idea that structured visual elements can improve engagement and decision-making. Additionally, Ramos & Bagno (2024) present a toolkit for applying MaTs in technology parks, aligning with our study's objective of making MaTs more accessible and practical for real-world application. By integrating these perspectives, our research contributes to both theoretical and practical advancements in the field, offering a structured framework for designing self-facilitating templates that enhance the adoption of MaTs through intuitive and visually guided mechanisms.

5. Conclusion

This work investigated ways to develop templates for MaTs (Management Methods and Tools) in innovation environments, reducing the need for an expert. Based on literature and interviews, a framework of elements was offered to design self-facilitating templates, making them more intuitive and accessible.

Among the main limitations of the research, a notable challenge is the scarce literature available on self-explanatory templates and their characteristics, which hindered the theoretical foundation and the development of the initial framework. Moreover, the methodology employed had specific characteristics that did not fit into any existing method, resulting in the need for adaptations and the creation of new methodological approaches.

For future studies, it is expected to enhance the studied templates based on the guidelines of the framework and test them in innovation environments. This will allow for the identification of improvements and the acquisition of new perspectives on the studied MaTs, significantly contributing to the evolution and effectiveness of management MaTs in innovative contexts.

6. Acknowledgements

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7. References

Alänge, S., Jacobsson, S., & Jarnehammar, A. (1998). Some aspects of an analytical framework for studying the diffusion of organizational innovations. *Technology Analysis and Strategic Management*, *10*(1), 3-22.

Atilola, O., Tomko, M., & Linsey, J. S. (2016). The effects of representation on idea generation and design fixation: A study comparing sketches and function trees. *Design Studies*, *42*, 110-136.

Birkinshaw, J., Hamel, G., & Mol, M. J. (2008). Management innovation. *Academy of Management Review*, *33*(4), 825-845.

Brady, T., Rush, H., Hobday, M., Davies, A., Probert, D., & Banerjee, S. (1997). Tools for technology management: an academic perspective. *Technovation*, *17*(8), 417-426.

Brasil, L. M. I. (2023). O desafio da adoção de uma inovação tecnológica de uma startup no mercado: uma abordagem baseada na teoria da difusão da inovação [Dissertação de Mestrado]. Universidade Federal de Minas Gerais, Belo Horizonte.

Casto, H., McGrath, B., Sipple, J. W., & Todd, L. (2016). "Community Aware" education policy: enhancing individual and community vitality. *Education Policy Analysis Archives*, *24*, 50.

Cormican, K., & O'Sullivan, D. (2000). Developing a self-assessment audit to support product innovation management. In *Proceedings of the Information and Communication Technology (ICT) in Logistics and Production Management Conference.* University of Galway.

Bagno, R. B., Demaria, A. L. P. D., & Mendonça, B. S. D. (2024). Escala de prontidão para Métodos e Ferramentas Gerenciais em empreendedorismo e inovação: proposta de processo e aplicações. In *Proceedings of XIII Workshop do IGDP.* Even3. Retrieved in 2024, January 31, from https://www.even3.com.br/anais/13-workshop-igdp-450079/

Eden, C., & Ackermann, F. (2006). Where next for problem structuring methods. *Journal of The Operational Research Society*, *57*, 766-768. http://dx.doi.org/10.1057/palgrave.jors.2602090.

Eppler, M. J., Hoffmann, F., & Bresciani, S. (2011). New business models through collaborative idea generation. *International Journal of Innovation Management*, *15*(6), 1323-1341. http://dx.doi.org/10.1142/S1363919611003751.

Eppler, M., & Bresciani, S. (2013). Visualization in management: from communication to collaboration. A response to Zhang. *Journal of Visual Languages & Computing*, *24*(2), 146–149. http://dx.doi.org/10.1016/j.jvlc.2012.11.003.

Eppler, M. J., & Burkhard, R. A. (2007). Visual representations in knowledge management: framework and cases. *Journal of Knowledge Management*, *11*(4), 112-122.

Eppler, M. J., & Kernbach, S. (2016). Dynagrams: enhancing design thinking through dynamic diagrams. *Design Studies*, *47*, 91-117.

Few, S. (2006). *Information dashboard design: the effective visual communication of data*. Newton, MA: O'Reilly Media, Inc.

Friend, J., & Hickling, A. (2005). *Planning under pressure: The strategic choice approach* (3rd ed.). Oxford: Pergamon.

Garcia, M. L., & Bray, O. H. (1997). *Fundamentals of technology roadmapping*. Albuquerque: Sandia National Laboratories. https://doi.org/10.2172/471364.

Gil, A. C. (2002). *Como elaborar projetos de pesquisa*. São Paulo: Editora Atlas.

Goldschmidt, G., & Smolkov, M. (2006). Variances in the impact of visual stimuli on design problem-solving performance. *Design Studies*, *27*(5), 549-569.

Hansen, M. T., & Birkinshaw, J. (2007). The innovation value chain. *Harvard Business Review*, *85*(6), 121-130.

Harkonen, J., Tolonen, A., & Haapasalo, H. (2017). Service productisation: systematising and defining an offering. *Journal of Service Management*, *28*(5), 936-971.

Hausmann, R., Pritchett, L., & Rodrik, D. (2005). Growth Accelerations. *Journal of Economic Growth*, *10*(4), 303-329.

Jaco, A. A., Buisine, S., Barré, J., Aoussat, A., & Vernier, F. (2013). Trains of thought on the tabletop: visualizing association of ideas improves creativity. *Personal and Ubiquitous Computing*, *18*, 1159-1167. http://dx.doi.org/10.1007/s00779-013-0726-3.

LabMIN. (2023). Laboratório de Metodologias de Inovação. Belo Horizonte: LabMIN. Documentação interna do projeto.

Larkin, J. H., & Simon, H. A. (1987). Why a diagram is (sometimes) worth ten thousand words. *Cognitive Science*, *11*(1), 65-100. http://dx.doi.org/10.1207/s15516709cog1101_3.

Lugt, R. V. (2005). How sketching can affect the idea generation process in design group meetings. *Design Studies*, *26*(2), 101-122.

Manole, A. L., & Grabara, I. (2016). Methodologies and visualization tools of effective project management. *Polish Journal of Management Studies*, *14*(2), 137-149.

Norman, D. (1988). Incorporating operational experience and design changes in availability forecasts. *Reliability Engineering & System Safety*, *20*, 245-261.

Phaal, R., Farrukh, C. J., & Probert, D. R. (2006). Technology management tools: Concept, development, and application. *Technovation*, *26*(3), 336-344.

Phaal, R., Farrukh, C. J., & Probert, D. R. (2004). Technology roadmapping: a planning framework for evolution and revolution. *Technological Forecasting and Social Change*, *71*(1-2), 5-26. http://dx.doi.org/10.1016/S0040-1625(03)00072-6.

Phaal, R., Farrukh, C. J., & Probert, D. R. (2007). Strategic roadmapping: A workshop-based approach for identifying and exploring strategic issues and opportunities. *Engineering Management Journal*, *19*(1), 3-12.

Phaal, R., Kerr, C., Ilevbare, I., Farrukh, C., Routley, M., & Athanassopoulou, N. (2016). *On self-facilitating templates for technology and innovation strategy workshops* (Centre for Technology Management working paper series, No. 8). Cambridge: University of Cambridge.

Platts, K., & Tan, K. H. (2004). Strategy visualization: Knowing, understanding, and formulating. *Management Decision*, *42*(5), 667-676.

Ramos, M. V., & Bagno, R. B. (2024). Métodos e ferramentas gerenciais voltados para inovação em um parque tecnológico: Proposição de um toolkit e ferramenta auxiliar para gestão do portfólio. In *Proceedings of XIII Workshop do IGDP*. Even3. Retrieved in 2024, January 30, from https://www.even3.com.br/anais/13-workshop-igdp-450079/

Rodrigues, R. N., Silva Júnior, A. R. P., Barroso, M. B. C., & Bagno, R. B. (2024). Productizing methods and tools for innovation management and entrepreneurship: A process proposal. *Product: Management & Development*, *21*(1)

Rogers, E. M. (1995). Diffusion of innovations: Modifications of a model for telecommunications. In Stoetzer, M. W., & Mahler, A. (Eds.), *Die Diffusion von Innovationen in der Telekommunikation* (Schriftenreihe des Wissenschaftlichen Instituts für Kommunikationsdienste, Vol. 17, pp. 25-38). Berlin: Springer.

Silva Júnior, A. R. P., Barroso, M. B. C., Rodrigues, R. N., & Bagno, R. B. (2024). Proposta de um descritivo para métodos e ferramentas gerenciais em inovação e empreendedorismo. *Produto & Produção*, *25*(2), 40-61.

Silva, C. M., Ruffo, L., Pereira, A., & Bagno, R. B. (2024). Gestão visual em projetos de inovação e empreendedorismo: proposta de uma ferramenta de meta-visualização como alavanca de comunicação e colaboração. In *Proceedings of XIII Workshop do IGDP*. Even3. Retrieved in 2024, January 30, from https://www.even3.com.br/anais/13-workshop-igdp-450079/

Stefanovitz, J. P., & Nagano, M. S. (2014). Product innovation management: proposition of an integrated model. *Production*, *24*, 462-476.

Suwa, M., & Tversky, B. (1997). What do architects and students perceive in their design sketches? A protocol analysis. *Design Studies*, *18*(4), 385-403.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, *12*, 257-285. http://dx.doi.org/10.1207/s15516709cog1202_4

Tufte, E. R. (2007). *Beautiful Evidence*. Cheshire, Connecticut: Graphic Press.

Tversky, B., & Suwa, M. (2009). *Thinking with sketches.* Oxford: Oxford University Press.

Wright, R. P., Paroutis, S. E., & Blettner, D. P. (2013). How useful are the strategic tools we teach in business schools? *Journal of Management Studies*, *50*(1), 92-125.