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Key principles for developing industrially relevant strategic technology management toolkits

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ABSTRACT

When considering the potential uptake and utilization of technology management tools by industry, it must be recognized that companies face the difficult challenges of selecting, adopting and integrating individual tools into a toolkit that must be implemented within their current organizational processes and systems. This situation is compounded by the lack of sound advice on integrating well-founded individual tools into a robust toolkit that has the necessary degree of flexibility such that they can be tailored for application to specific problems faced by individual organizations. As an initial stepping stone to offering a toolkit with empirically proven utility, this paper provides a conceptual foundation to the development of toolkits by outlining an underlying philosophical position based on observations from multiple research and commercial collaborations with industry. This stance is underpinned by a set of operationalized principles that can offer guidance to organizations when deciding upon the appropriate form, functions and features that should be embodied by any potential tool/toolkit. For example, a key objective of any tool is to aid decision-making and a core set of powerful, flexible, scaleable and modular tools should be sufficient to allow users to generate, explore, shape and implement possible solutions across a wide array of strategic issues. From our philosophical stance, the preferred mode of engagement is facilitated workshops with a participatory process that enables multiple perspectives and structures the conversation through visual representations in order to manage the cognitive load in the collaborative environment. The generic form of the tools should be configurable for the given context and utilized in a lightweight manner based on the premise of 'start small and iterate fast'.

1. Introduction

Within the business strategy research community, there has been a call to refocus the emphasis toward the human activity [1]; that is, to concentrate more upon the "micro aspects of how managers think, act and interpret strategic decisions" [2]. This is known as the strategy-as-practice perspective, where the "thrust is to dig into what managers actually do when they strategize" [3]. Strategy is therefore now seen as something individuals do as opposed to something that an organization has [1]. "Thus the practice perspective is concerned with managerial activity, i.e. how managers do strategy" [2]. For such a perspective, Whittington [4] proposed three elements for a theory of practice, namely: praxis, practices and practitioners. Praxis refers to the situated and socially accomplished flows of activities that are strategically "consequential for the direction and survival of the group, organization or industry" [5]. Whereas practice refers to the tools and models for enabling action [6] along with their associated organizational specific embedded routines [4]. This strategy-as-practice view has been adopted as an interpretative lens for the study of strategic technology management (STM) with an initial focus of inquiry on the tools/toolkits adopted and used by practitioners for supporting

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their decision-making. Such STM tools take many forms; for example: charts, checklists, diagrams, graphs, grids, maps, matrices and tables. Additionally, different combinations of these forms are also readily found [7]. The study of tool development and application has been selected for investigation because "effective management of technology requires practical management tools to support decision-making and action" [8]. Taking the practice perspective, McGahan's [9] paper on 'academic research that matters to managers' states that "managers don't care about disciplinary boundaries. They want to know how to solve specific problems quickly". Thus it can be said that in the practical setting, managers are problem-driven and application-oriented [10]. This requires both an integrative approach to toolkit development and the acceptance of the transdisciplinary nature of tool utilization in industrial engagements. Additionally in the real-world context for tool adoption and application, managers "are usually more concerned about finding good, politically feasible solutions, instead of optimal ones" [11]. Therefore the aim of any tool should be to satisfy the user in finding a set of 'good' options that have the potential to provide clear improvements in their organization and which are deemed implementable at the same time [11–13]. In using tools to support decision-making, the belief is that "although we are not perfect decision makers, we can do better through more structure and guidance" [14]. Such guidance should give a consistent recommendation on tools to adopt and apply across the range of problems typically encountered in technology management. However as noted by Whitney [15] on assembling a technology development toolkit, they usually consist of a 'favorite collection of tools' that is built over time through discovery and experience. The problem is clearly articulated by Phaal et al. [16] who state that "the effectiveness of these tools is limited by a lack of fundamental understanding of the structure and application of management tools, together with generally poor levels of awareness of what tools are available". Additionally, one of the key concerns in technology management is that the tools are often presented, treated and used in isolation along with insufficient integration with other tools [17]. This situation is exasperated by the proliferation of tools and associated approaches developed by academics and consultants. For instance, a study by Phaal et al. [7] identified over 850 tools based on the simple 2×2 matrix. This can lead to potential confusion in the choice of which tools to use and how to deploy them most appropriately [8]. It has also been noted that the proliferation of tools carries with it "little consistency in terminology or theoretical foundation, and a lack of understanding of how such tools can be linked together to tackle management challenges in an integrated way" [8]. To address the degree of rigor that must be applied to the challenge of providing tools that are 'practically relevant and academically sound', a number of issues posed by Phaal et al. [16] need to be addressed:

- How to find the appropriate tools?
- How to assess the quality and utility of the available tools?
- How to apply the tools in a practical setting or process?
- How to integrate tools with other tools, and with business processes and systems?

This list was later extended by Phaal et al. [8] to include two other important issues:

- What is the minimum set of tools that can be used to build the toolkit?
- What are the rules for generalizing, integrating and configuring these tools?

Phaal et al. [8] put forward the vision of a "universal toolkit that can be configured to support a wide range of technology management decisions and processes" whereby the toolkit would "comprise the minimum set of generic tools required to solve the class of problem for which they are designed, together with guidance on how to integrate, configure and deploy them". To make a start on the journey of attempting to realize such a vision, this paper proposes seven guiding principles that provide an initial conceptual foundation for STM toolkits and which should be operationalized during their development. The principles emerged from an inductive reflection of multiple (>200) research and commercial engagements with industry. Their description is substantiated by the pertinent literature. Essentially, these principles embody our underlying philosophy for developing and deploying industrially relevant strategic technology management toolkits.

2. Strategic technology management

In order to outline a number of principles for operationalizing a set of tools into a STM toolkit, it is first necessary to consider the essence of technology management and the meaning assigned to the terms 'strategic' and 'tool'. The key reference point in arriving at a conceptualization of technology management that mutually spanned both the academic and industrial spheres was the ISAEP process framework put forward by Gregory [18] as depicted in Fig. 1. According to Gregory [18], technology management "addresses the effective identification, selection, acquisition, development, exploitation and protection of technologies needed to maintain a stream of products and services to the market". The specific elements embodied in this definition are further articulated in Table 1. Additionally, Phaal et al. [19] state that technology management is concerned with "establishing and maintaining the linkages between technological resources and company objectives". Thus, technology management is a "multifunctional and multidisciplinary field" as it "deals with all aspects of integrating technological issues into business decision-making and is directly relevant to a number of core business processes including strategy, innovation, new product development and operations management" [19].

Although Gregory's [18] original process framework is an excellent foundation for defining technology management, there is the possibility of updating it in a number of ways to allow for a further degree of explanatory power. Fig. 2 shows the next iteration in design where the following modifications are proposed:

1. Technology (technological resources) has been put in the center of the framework.
2. The protection process is shown as surrounding the technology base.