

1.3 The TM framework to set the context

The TM discipline has a history of over 50 years (Kocaoglu, 1994; Roberts, 2004; Larson, 2007). The discipline has evolved from a stable and predictable situation within an R&D department to a discontinuous and unpredictable situation taking place at the strategic level (Drejer, 1996). However,

TM studies offer few universally accepted conceptual models or frameworks to understand and communicate structures and relationships within a TM system (Phaal et al., 2004). This book integrates the theory of dynamic capabilities into a TM framework developed by Phaal et al. (2004) and offers a comprehensive framework in understanding TM (Cetindamar et al., 2009).

TM activities are based on technological capabilities. Due to the complex nature of firms and industries, it is difficult to describe where exactly firms exercise these activities. In the

TM framework presented in Figure 1.1, the TM activities – acquisition, exploitation, identification, learning, protection and selection – are typically linked to or embedded within three core business processes: strategy, innovation and operations (Phaal et al., 2004). For example, technology selection decisions are made during business strategy and new product/service development.

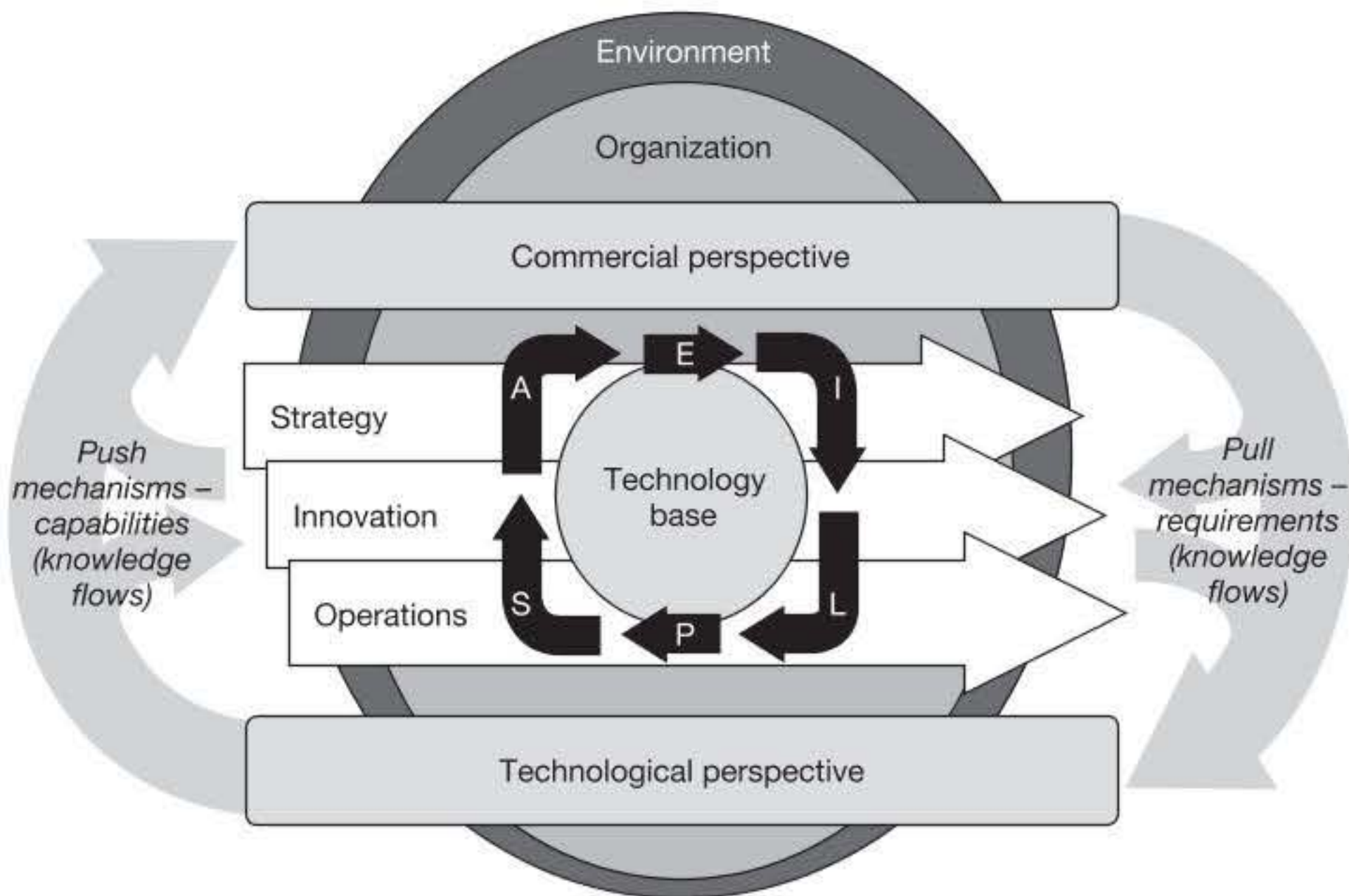


Figure 1.1 TM framework

Source: Based on Phaal et al. (2004).

Key aspects of the framework include:

- The linkage between technological and commercial perspectives in the firm.
- The knowledge flows (and other mechanisms) that support this linkage.
- The core business processes of strategy, innovation (including new product development) and operations.
- The TM processes: identification, selection, acquisition, exploitation, protection and learning.
- The organizational and environmental context in which the firm operates (the 'system'), which includes additional internal elements of the system, such as staff and other business processes and sub-systems, together with external elements such as customers, competitors, partners, government, etc.
- Time (change, trends, evolution and synchronization).

Time is implicitly included in the business and TM processes, together with the trends that are associated with the business environment.

At the heart of the framework are three core business processes – *strategy, innovation and operations*, operating at different business system 'levels' in the firm. The link to core business processes is important, as these are the focus of management and action in the business, and the means for ensuring sustainable productive output of the firm. One of the challenges of TM is that associated activities are distributed and embedded in these core

business processes. The aim of effective TM is to ensure that technological issues are incorporated appropriately in these processes, to form a system that is coherent and integrated across and beyond specific business processes and activities.

The proposed TM framework offers many advantages. It allows us to conceive that TM activities might operate in any business process, department or business system level, for example project, corporate and strategic business units, in the firm. The framework does not differentiate with respect to the sector in which firms operate. It is valid for service firms as much as it is valid for firms in manufacturing sectors that are extensively discussed in Chapter 14.

The framework also indicates that the specific TM issues faced by firms depend on the context (internal and external), in terms of organizational structure, systems, infrastructure, culture and structure, and the particular business environment and challenges confronting the firm, which change over time. The time dimension concerns synchronizing technological developments and capabilities with business requirements, in the context of evolving markets, products and technology. Thus, the TM framework is in line with the dynamic-capabilities framework. While the former focuses on managing technological capabilities, the latter covers all capability types.

An advantage of the TM framework is its applicability to all firms regardless of their size, in contrast to the frameworks/models that implicitly assume firms with leadership status. Most are oriented towards large firms with R&D departments and elaborate organizational divisions of labour rather than small or medium-sized enterprises (SMEs) that might operate with more informal processes with perhaps no official R&D or engineering department. Many SMEs lack R&D departments and they are followers, but the TM framework can still apply in these firms.

Further, the framework considers technology as a resource. This is why the technology base of a company represents the technological knowledge that needs to be turned into products, processes and services through the technological capabilities developed by TM.

The framework emphasizes the dynamic nature of the knowledge flows that must occur between the commercial and technological functions in the firm, linking to the strategy, innovation and operational processes (Phaal et al., 2004). An appropriate balance must be struck between market 'pull' (requirements) and technology 'push' (capabilities). Regardless of the driver of technological change, managers need to link markets and technology through various mechanisms, including traditional communication channels, cross-functional teams or meetings, management tools, business processes, staff transfers and training.

Firms vary widely in size and scope, ranging from a one-person firm to a company with multi-department/multi-country operations. In each case, this basic TM framework can be applied, adapted appropriately for the particular organizational context. After identifying the business processes behind strategy, innovation and operations, managers could integrate TM processes into them. The next section focuses on the generic TM processes that can be observed within firms.

