Classifying organisational capabilities by their nature and role for technological capability

Based on critical literature review this research highlights a number of gaps in the existing treatment of technological and organisational capabilities. It has been recognised that organisational capabilities have an important role to play in development of technological capabilities both in latecomer and advanced companies. However, different studies focus on different organisational capabilities and prescribe them different importance. Further, despite the extensive research on organisational capabilities and a number of taxonomies of organisational capabilities, the literature review in this paper reveals that a classification highlighting different types of organisational capabilities by their nature and their role in development of technological capability is still absent. Further, studies often conflate technological and organisational capabilities, and adopt different units and levels of analysis and disaggregation. This study examines the above issues and develops a classification of organisational capabilities by their nature and their role in development of technological capability. In refining the interface between technological and organisational capabilities, this research disentangles the notion of organisational capabilities and introduces the notion of organisational capacity.

Keywords: organisational capabilities; technological capabilities

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1. Introduction

Organisational capability is a long investigated concept in organisation science (Penrose 1959; Rumelt 1984; Wernerfelt 1984; Barney 1991; Mahoney and Pandian 1992; Stalk, Evans et al. 1992; Collis 1994; Pisano 1994; Teece and Pisano 1994; Pisano 1996; Galunic and Simon 1998; Barney 2001; Zahra and Nielsen 2002; Marsh and Stock 2003; Verona and Ravasi 2003; Teece 2007) and a number of topologies of organisational capability have been developed (Henderson and Cockburn 1994; Grant 1996; Verona 1999; Sorensen and Stuart 2000; Teece 2007). Despite the extensive research on organisational capabilities and a number of taxonomies of organisational capabilities, the literature review in this paper reveals that a classification highlighting different types of organisational capabilities by their nature and their role in development of technological capability is still absent.

Organisation studies have also recognised that it is of critical importance for companies to develop technological capabilities (Tushman and Anderson 1986; Henderson and Clark 1990; Teece and Pisano 1994; Leonard 1995; Patel and Pavitt 1996; Patel and Pavitt 1997; Teece, Pisano et al. 1997; Tidd 2001). The organisation science literature has been predominantly focused on companies that are embedded in an advanced context and therefore have already developed technological and organisational capabilities and possess advanced capability base (Penrose 1959; Rumelt 1984; Wernerfelt 1984; Tushman and Anderson 1986; Henderson and Clark 1990; Barney 1991; Mahoney and Pandian 1992; Stalk, Evans et al. 1992; Collis 1994; Henderson and Cockburn 1994; Pisano 1994; Teece and Pisano 1994; Leonard 1995; Patel and Pavitt 1996; Pisano 1996; Patel and Pavitt 1997; Teece, Pisano et al. 1997; Galunic and Simon 1998; Barney 2001; Tidd 2001; Zahra and Nielsen 2002; Marsh and Stock 2003; Verona and Ravasi 2003; Teece 2007). Further, organisation studies have investigated extensively the impact of age on capability development and innovation activities and have highlighted differences between young and old firms (Tushman and Anderson 1986; Henderson and Clark 1990; Sorensen and Stuart 2000) or how firms develop capabilities (Eisenhardt and Martin 2000). However, they have explored young firms that are advanced companies and therefore possess advanced capability base despite being new entrants in a particular industry advanced firms. Organisation studies give relatively little attention to latecomer companies (i.e. companies that originate and are embedded in a context that is not advanced) that are in a process of capability building and are likely to possess lower levels of technological and organisational capability.

This paper distinguishes between companies embedded in advanced context (referred to as advanced companies) and companies embedded in latecomer context (referred to as latecomer companies). This distinction is particularly important in investigating the technological and organisational capabilities in companies due to the significant differences in the capability base of advanced and latecomer companies, as research has shown (Lall 1992; Bell and Pavitt 1993; Hobday 1995c; Kim 1997b; Kim 1997a; Ernst, Ganiatsos et al. 1998; Kim 1998; Dutrenit 2000; Kim and Nelson 2000; Figueiredo 2001; Figueiredo 2002; Figueiredo 2003; Marcelle 2004; Tsekouras 2006; Rousseva 2008).

Organisation studies have revealed that the organisational capabilities are responsible for the deployment and further development of technological capabilities (Tushman and Anderson 1986; Henderson and Clark 1990; Henderson and Cockburn 1994; Leonard 1995; Pisano 1996; Sorensen and Stuart 2000; Tidd 2001). However,

discussion about the phase of accumulation of technological capabilities in latecomer companies and the role of organisational capabilities in development of technological capability, and developing a taxonomy of different types of organisational capabilities reflecting differences in their nature and their interfaces with technological capabilities are absent in that body of literature.

Such an enquiry is particularly important for companies that are in a phase of building technological capabilities. There is a rich body of literature investigating the development of technological capabilities in the development studies literature (Lall 1992; Bell and Pavitt 1993; Hobday 1995c; Kim 1997b; Ernst, Ganiatsos et al. 1998; Dutrenit 2000; Kim and Nelson 2000; Figueiredo 2001; Marcelle 2004). It has scrutinised the complexity in the process of accumulation of technological capabilities and recent studies have recognised that the organisational capabilities have an important role to play in that process (Kim 1997b; Kim 1997a; Kim 1998; Dutrenit 2000; Figueiredo 2001; Figueiredo 2002; Figueiredo 2003; Marcelle 2004; Tsekouras 2006). The recognition of the influence of organisational capabilities in development of technological capabilities however is recent and the literature has not produced a detailed and uniform list of organisational capabilities that influence the development of technological capabilities. Different studies focus on different organisational capabilities and prescribe them different importance, and there is no uniform list of the array of organisational capabilities the latecomer companies need to muster. The latecomer companies begin with a lower capability base and it might be expected that they have lower capability base not only in the technological but also in the organisational capability base, and it is possible that they may not be aware of the array of organisational capabilities they need to develop. Further, the literature on technological capabilities in latecomer companies adopts a uniform treatment of organisational capabilities with respect to their nature. However, the organisational capabilities differ in their nature, as this paper suggests, and this might have implications for development of technological capabilities, which that body of literature need to take into account.

The recent emphasis on learning in latecomer companies (Kim 1997b; Kim 1997a; Dutrenit 2000; Marcelle 2004) also makes this enquiry important. To be able to explore the learning effort in latecomer companies studies need to agree on the array of capabilities the companies have to muster. Latecomer companies may not possess an in-depth expertise and even understanding about the capabilities they need to develop. Further, latecomer companies may lack even basic organisational capabilities. Therefore, the framework for capability building should outline the array of organisational capabilities that the latecomer companies need to muster in order to deliver more practical value than situated studies or ‘explorations’ that may be suggestive but that are difficult to absorb or evaluate.

For all these reasons it is worthwhile developing a classification of organisational capabilities with respect to their nature and their role in development of technological capabilities. The aim of this paper is to improve the coherence of the existing lists by synthesising them and building on their common features and extending them as a foundation for future comparative research (comparing countries and sectors).

The paper is structured as follows: the following section 2 makes a critical assessment of the existing treatment of organisational capabilities. Section 3 develops a classification of organisational capabilities. The final section 4 draws conclusions and outlines directions for further research.

2. Critical assessment of the existing treatment of the organisational capabilities in the technological capability building literature

The review of the literature on accumulation of technological capabilities in the latecomer companies shows that studies have gradually come to recognise the impact of the organisational capabilities. While in the seminal studies (Dahlman 1985; Lall 1992; Bell and Pavitt 1993; Ernst, Ganiatsos et al. 1998) this recognition was somewhat abstract and thus not so clear, it became more explicit in more recent analyses (Kim 1997b; Kim 1997a; Kim 1998; Dutrenit 2000; Figueiredo 2001; Figueiredo 2002; Figueiredo 2003; Marcelle 2004; Tsekouras 2006). This emphasis on organisational issues distinguishes the more recent studies above from earlier studies, where learning and the accumulation of technological capabilities were portrayed predominantly in terms of acquisition of technical expertise. It is important for the latecomers to develop organisational capabilities; acquisition of technological knowledge necessitates employment of organisational capabilities. In fact, development of the latter can influence the advancement of the former. This was perhaps the motivation for early analyses to incorporate the organisational capabilities as integral elements in the technological capability.

Notwithstanding the recognition of the critical importance of organisational capabilities, their treatment in the technological capability literature needs further elaboration to make the framework more precise and operational and with much practical value. Different studies focus on different component elements [2] of the organisational capabilities and prescribe them different importance.

The latecomer companies begin with a lower capability base and it might be expected that they have lower capability base not only in the technological but also in the organisational capability base, and it is possible that they may not be aware of the array of organisational capabilities they need to develop. Further, the organisational capabilities are different in their nature, as this paper highlights, and this may have implications for capability accumulation in the latecomer companies. Neither the literature on technological capabilities in advanced companies and nor in latecomer companies investigate different types of organisational capabilities by their nature and their role for development of technological capability. The organisational capabilities differ in their nature, as this research suggests, and this might have implications for development of technological capabilities.

Recent studies have highlighted the critical importance of learning in latecomer companies (Kim 1997b; Kim 1997a; Dutrenit 2000; Marcelle 2004). However, to develop more systematic evidence on the learning efforts of latecomer companies, it would be useful if studies provided a more unified agreement on the array of relevant capabilities, both technological and organisational, that companies have to master. Latecomer companies may not possess an in-depth expertise and even understanding about the capabilities they need to develop and latecomer companies may lack even basic organisational capabilities. Therefore, the framework for capability building should outline the array of organisational capabilities that the latecomer companies need to muster in order to deliver more practical value than situated studies or ‘explorations’

[2] This research adopts the functional definition of organisational capabilities, which defines the organisational capabilities as the capacity of the company in dealing with different business processes. Hence, the study analyses an array of component elements of the organisational capacity (i.e. organisational capabilities) that represent the capacity of the company in dealing with different business processes.

that may be suggestive but that are difficult to absorb or evaluate.

The capability accumulation in the latecomer companies is qualitatively different from capability development in advanced companies, as the latecomer companies begin with lower capability base and have to engage first in capability accumulation in order to develop an advanced capability base similar to the advanced companies (Lall 1992; Bell and Pavitt 1993; Hobday 1995c; Kim 1997b; Ernst, Ganiatsos et al. 1998; Dutrenit 2000; Kim and Nelson 2000; Figueiredo 2001; Marcelle 2004). For this reason studies of capabilities development in advanced economies are of limited value for the latecomer companies. On the other hand, studies in capability building have been focussed predominantly on the accumulation of technological capability the organisational capabilities remain underexplored.

Developing a single uniform list of component elements of the organisational capabilities influencing the development of technological capabilities is difficult and probably not possible as capabilities reflect certain sector-specific characteristics. For example, an uniform list would outline the capabilities for client and supplier relationships but their importance and the specifics of these relationships could be expected to vary across sectors – some sectors are supplier-dominated (e.g. automobiles, machine tools, etc.), while others are user-centred (e.g. software, creative industries, etc), as highlighted by Pavitt's taxonomy (Pavitt 1984). Similarly, the importance of marketing capabilities is an uniform capability for all sectors and yet it varies across sectors – in some sectors it is B2B (i.e. business to business), while in others it is B2C (i.e. business to client). Despite these difficulties, it is appropriate to examine the existing literature with a few in order to create greater coherence and integration and a synthetic analysis of existing ideas about these capabilities.

In order to produce a more coherent framework for identifying the variety and nature of organisational capabilities and also to evaluate their role in the development of technological capabilities the following aspects need consideration:

1. *the relation between the organisational capabilities and technological capabilities*: the classic studies and some of more recent studies both in latecomer and advanced companies represent organisational aspects as integral part of technological capability, which obscures the role of organisational issues. In refining the interface between technological and organisational capabilities, the research in this paper disentangles the notion of organisational capabilities and introduces the notion of organisational capacity

2. *the unit of analysis*: the more appropriate unit of analysis are the capabilities alone or capabilities in combination with skills or activities, rather than skills or activities alone

3. *level of analysis (disaggregation)*: basic capabilities should be included in the analyses and the studies should span from basic to 'higher level' capabilities

4. an *identification of differences in organisational capabilities* and their respective roles in development of technological capability is needed

Each of these aspects is discussed below in the following four sub-sections.

The relation between the organisational capabilities and technological capabilities

There is a need to elaborate further the notion of organisational capabilities and the link between the organisational and technological capabilities. There are different definitions of organisational capabilities and the major distinction between these different definitions lies in the span of organisational capability they describe (Collis 1994); the organisational studies have investigated organisational capabilities either as functional areas (e.g. business processes) (Amit and Shoemaker 1993) or as a broader capacity (e.g. dynamic capability (Teece and Pisano 1994). On the one hand there is a general capacity of the company to integrate, reconfigure and renew its expertise over time and on the other hand exist firms have abilities to execute, coordinate and systematise different business processes (e.g. human resource, marketing, sales, management, etc.). Acknowledging two different levels and spans of organisational capability makes it worthwhile to distinguish between them further. This research will refer to the latter broader definition as 'organisational capacity', while the former, narrower, definitions will be considered as 'organisational capabilities.' Organisational capacity comprises by a wide range of organisational capabilities. It will be further discussed below how this treatment of organisational capability relates to the existing treatment of organisational capabilities.

Within the narrow definition of organisational capabilities adopted in this paper are all the capabilities involved in dealing with business processes (e.g. production, research and development (R&D), alliancing, etc.). However, some of these capabilities concern business processes that are predominantly organisational in nature, like management, strategy, linkages, etc., while others like production, R&D, etc. involve a significant technological component and represent technological capabilities, and it is meaningful to distinguish technological and organisational capabilities. The technological capabilities represent the company's capacities to manage new technologies, while organisational capabilities represent the capacities of the company to dealing with different business processes. There is a rich body of literature exploring the technological and organisational capabilities both in advanced and latecomer companies but the studies have often conflated the technological and organisational aspects, as it will be discussed below.

In some cases, the technological and organisational capabilities can be interdependent to such a high degree that it might be difficult to analyse them separately. For example the organisation of agile team for software development relies upon each team member being able to take on the responsibilities of any other team member; hence to have the organisational capability of 'being able to use frontier techniques for organising software development' requires a common (and high) level of technological capability in which every member of the team has the same software development skills and capabilities. Nevertheless, in the predominant number of organisational contexts the organisational capabilities can be treated as arrangements that underlie the development of technological capability.

In essence, the technological and organisational knowledge and capabilities are separable and yet interlinked: there are certain characteristics that allow us to classify certain knowledge or capability as technological or organisational; but although technological and organisational capabilities are separable, they are also interlinked, as

discussed below.

To develop technical capabilities companies need to develop mastery in employing and modifying new technologies. The development and deployment of this mastery is often associated with execution of different projects. As the technical expertise involves understanding of technical aspects of new technologies and the latter are changing rapidly, companies have to constantly acquire, absorb and recombine technical information and knowledge. This involves activities of acquisition, re-combination, renovation, renewal, in-sourcing, injection, project spanning, etc. In this sense the accumulation, absorption and the exchange of the technical expertise and respectively capabilities is specific in nature. Notwithstanding their technical nature, the execution of these technological activities also involves some organisational expertise.

The extent of organisational expertise required by particular technical activities varies. Some technical activities involve relatively little organisational expertise, for example design, in which the underlying organisational aspect relates to effective/efficient organising of the technical activities in terms of organisational procedures and techniques. Other technological activities, like for example research and development activities, production, project execution, capacity stretching and process re-engineering, etc. are likely to engage a greater organisational component, and this is a question for investigation in specific industrial and firm contexts. Developing the necessary technical expertise and coupling it with the organisational aspects required for development and deployment is the essence of technological capability.

Alongside the technological expertise, there is a wide spectrum of expertise, which is responsible for the execution of the organisational functions and processes, and is therefore purely organisational in nature. It involves management expertise in its whole spectrum (human resource management, organising, coordination, communication, etc.), contract negotiation, linkage, marketing, vision and strategy setting, etc. We refer to this range of expertise as 'organisational' to denote its organisational character. The capabilities with which this expertise is associated include the establishment and maintenance of procedures for the functioning of the organisation and organisational processes. Some segments of organisational expertise or capabilities (e.g. human resource management, client/supplier relationships; sales and marketing; etc.) are organised as separate departments in the company, while some others (e.g. coordination, communication, general management issues, etc) span departments of the organisation. The development of organisational expertise and capabilities respectively requires systematic process of fine-tuning and is associated with establishing common procedures and protocol across the company.

The capability approach involves analysing both technological and organisational capability bases in the companies and there is a rich body of literature exploring the technological (Tushman and Anderson 1986; Henderson and Clark 1990; Henderson and Cockburn 1994; Leonard 1995; Patel and Pavitt 1996; Patel and Pavitt 1997; Tidd 2001) and organisational capabilities (Penrose 1959; Rumelt 1984; Wernerfelt 1984; Barney 1991; Mahoney and Pandian 1992; Stalk, Evans et al. 1992; Collis 1994; Henderson and Cockburn 1994; Pisano 1994; Teece and Pisano 1994; Pisano 1996; Teece, Pisano et al. 1997; Galunic and Simon 1998; Barney 2001; Zahra and Nielsen 2002; Marsh and Stock 2003; Verona and Ravasi 2003; Teece 2007) in the advanced companies. Studies in advanced companies have revealed that the organisational capabilities are responsible for the deployment and further development of technological capabilities (Henderson and Cockburn 1994; Leonard 1995; Pisano 1996; Sorensen and Stuart 2000; Tidd 2001).

As has been suggested earlier, studies on technological capabilities have tended to conflate technological and organisational capabilities. This holds both for literature on latecomer and advanced companies. The literature review in this sub-section reveals further that the studies in advanced companies have adopted various definitions and treatment of technological and organisational capabilities.

The pioneering studies and some of more recent studies on technological capabilities building in latecomer companies portray the organisational elements as integral parts of the technological capability. In the early studies the organisational element was not explicitly recognised but some elements like negotiation of contracts, recruitment and training, and linkages were included in the framework of technological capability (Lall, 1992; Dahlman and Westphal, 1987). As development of the organisational capabilities can influence the advancement of the technological capabilities, this was perhaps the motivation for early analyses to incorporate the organisational capabilities as integral elements in the technological capability. More recent studies Ernst et al (1998) have included some organisational elements, like linkage capabilities and capabilities for strategic thinking. Overall, the recognition of the organisational capabilities was coupled with their representation as integral parts of technological capability. More recent studies (Kim 1997b; Kim 1997a; Dutrenit 2000; Figueiredo 2001; Marcelle 2004; Tsekouras 2006) have started treating the organisational arrangements as underpinnings of technological capability, but there is still a need to emphasise the distinction between technological and organisational capabilities.

Extensive research has been exploring technological and organisational capabilities in advanced companies and studies have adopted different terminology, and sometimes different definitions. For example, technological capabilities have been defined as 'resources' (Amit and Shoemaker 1993), 'knowledge and skills' or 'technical systems' (Leonard 1992a; Teece and Pisano 1994; Leonard 1995), 'component competence' (Henderson and Cockburn 1994), functional capabilities (Verona 1999), sensing capacity (Teece 2007). Organisational capabilities have been referred to as 'capabilities' (Amit and Shoemaker 1993), 'integrative capabilities' (Lawrence and Lorsch 1967), 'combinative capabilities' (Kogut and Zander 1992), 'dynamic capabilities' (Teece and Pisano 1994), 'integrative capabilities' (Verona 1999), 'capacity to seize and to manage threats and transforming' (Teece 2007), 'managerial systems and 'values and norms' (Leonard 1992a; Leonard 1995), 'architectural competence' (Henderson and Cockburn 1994).

Studies investigating the technological capabilities in advanced companies have similarly highlighted the importance of the organisational arrangements (Leonard 1995; Pisano 1996; Tidd 2001) but there is still a need to emphasise that organisational capabilities are not integral part of technological capabilities but rather underlie their development. Leonard-Barton (1995) emphasised that technological capability has a systemic nature and has outlined the following dimensions of technological capability: activities, physical systems, skills and knowledge bases, managerial systems of education and reward, and values and norms that create a special advantage for a company or a line of business (Leonard, 1995, p. 18). The physical technical systems include machinery, hardware and software; the skills and knowledge bases encompass the pool of employees' knowledge and skills; the managerial systems refer to company's system of education, reward and incentives; values and norms determine what knowledge is sought and nurtured, what kind of knowledge activities are tolerated and encouraged (Leonard, 1995, p. 18-19). While Leonard-Barton (1995) has conflated

the technological and organisational aspects, Henderson and Cockburn (1994), Pisano (1996) and Tidd (2001) have distinguished them.

By shaping the organisational settings in the firm the organisational capabilities also influence the development of the technological capability, as studies both in latecomer (Kim 1997b; Kim 1997a; Kim 1998; Dutrenit 2000; Figueiredo 2001; Marcelle 2004; Tsekouras 2006) and advanced companies have revealed (Handerson and Cockburn 1994; Leonard 1995; Pisano 1996; Sorensen and Stuart 2000; Tidd 2001). However, including the organisational capabilities as part of technological capability obscures their role and diminishes their potential importance as factors influencing the development of technological capability. One may re-assert their significance by maintaining that technological capabilities represent the company's capacities to manage new technologies, while organisational capabilities represent the capacities of the company to dealing with different business processes.

Research in advanced companies have adopted different treatment of organisational capabilities (Collis 1994) - the organisational studies have investigated organisational capabilities either as functional areas (e.g. business processes) or as a broader capacity (e.g. dynamic capability). The former perspective has explored a number of organisational capabilities, like marketing, production, logistics, management, etc. (Collis 1994), while the latter investigates the more encompassing capacities of 'adapting, integrating, and reconfiguring internal and external organisational skills, resources, and functional competences to match the requirements of a changing environment' (Teece and Pisano 1994; Teece, Pisano et al. 1997).

The above literature review reveals that the technological and organisational capabilities have attracted particular interest but the extensive research has lead to proliferation and sometimes misalignment of terminology, which prevents developing consistent concepts around these core elements of organisation theory. Therefore, there is still need for further research and refinement of the treatment of technological and organisational capabilities.

This paper suggests that technological and organisational capabilities can be treated as abilities in functional areas and an additional category can be introduced, the organisational capacity, to reflect the broader capacity of an organisation to renew its capabilities. The organisational capacity consists of a wide array of abilities in functional areas – some of which are organisational and some are technological capabilities. The distinction between organisational and technological capabilities and organisational capacity adopted in this paper has similarities and differences to the earlier distinction between 'component competences' and 'architectural competences' developed by Henderson and Cockburn (1994). Both models make an explicit distinction between technological and organisational capabilities, and between narrow and more general abilities in the firm. But the definitions of these categories in both models differ. Henderson and Cockburn (1994) suggest that the organisational capabilities, or the architectural competence in their terminology, represent the more general ability of the organisation to integrate the technical capabilities and to recombine firm's expertise (Henderson and Cockburn, 1994, p. 65) and equate them as integrative capabilities (Lawrence and Lorsch 1967), combinative capabilities (Kogut and Zander 1992), and dynamic capabilities (Teece and Pisano 1994). This paper suggests that it is meaningful to refer to this more general capacity of firms as 'organisational capacity'. A recent elaborate study has explicated the component elements of dynamic capabilities (e.g. sensing, seizing, and managing

threats/transformation) and the microfoundations underpinning those component elements (Teece 2007). Almost all of the microfoundations of sensing are in essence technological capabilities (e.g. directing internal R&D, selecting new technologies; tapping suppliers and complementor innovations; tapping exogenous scientific and technological developments; identifying customer innovation (Teece, 2007, p. 1326), while the rest of the component elements represent organisational capabilities. The study does not distinguish explicitly between technological and organisational capabilities but implicitly the model outlines that the dynamic capabilities/organisational capacity comprises of technological capabilities and organisational capabilities.

The unit of analysis: capabilities not skills or activities alone

Apart from conflating the technological and organisational capabilities, the existing research on technological capability building so far has directed attention to different organisational elements (e.g. units of analysis) and have also considered different levels of disaggregation (e.g. levels of analysis).

Studies have investigated different organisational elements and thus had different units of analysis. Some studies have investigated capabilities (e.g. management capabilities (Marcelle 2004), while others have focussed on activities (e.g. crisis construction (Kim 1997b), active search, absorption, exchange and recombination of knowledge (Bell and Pavitt 1993; Kim 1997b; Kim and Nelson 2000). Investigation of activities is more practical when they are linked to particular capabilities and the analysis is further coupled with a study of the underlying routines. Similarly, employees' skills are building blocks of organisational capabilities and therefore they need to be analysed in relation to the organisational capabilities (Dosi 2000). There is an important point about the link between employees' skills and organisational capabilities. Although individuals' skills are building blocks of organisational capabilities, skills socialisation might be costly and not all employees' skills are integrated into organisational capabilities. This paper will not differentiate between socialised and not socialised individual skills. This research considers both activities and skills in reference to organisational capabilities.

The level of analysis (disaggregation): from basic to 'higher level' capabilities; basic capabilities must be included

Previous studies of capability and capacity have stressed the existence of different capabilities not only in terms of their variety but also in terms of their 'level'. Some analyses have highlighted 'higher level' organisational capabilities (e.g. capabilities for strategic thinking (Ernst, Ganiatsos et al. 1998), expeditious learning (Kim, 1997), some have also included basic organisational arrangements (e.g. management (Marcelle 2004), organisational systems and leadership (Figueirdo, 2001), managerial systems of education and reward, and values and norms (Leonard, 1995). As the latecomers begin with low capability base and they may not be aware of the range of capabilities they need to build, a framework relevant for latecomer companies has to include more basic capabilities, which are often assumed to exist in an advanced-context company, alongside 'higher' level capabilities.

Identification of differences in organisational capabilities and their respective roles in development of technological capability

The definitions and treatment of *organisational* capabilities in the literature on advanced companies differ considerably (Collis 1994). The organisational studies have investigated organisational capabilities either as functional areas (e.g. business processes) or as a broader capacity (e.g. dynamic capability), as already mentioned. The general perspective on dynamic capabilities has been narrowed down to specific organisational capabilities like sensing, seizing and managing threats/transforming (Teece 2007) or product development, strategic decisionmaking and alliancing (Eisenhardt 2000). Another study (Grant 1996) has highlighted that organisational capability comprises of different types of capabilities, which in essence represent different levels of aggregation of organisational functions, like: single-task capabilities (e.g. manual insertion of components), specialised capabilities (e.g. printed circuit-board assembly), activity-related capabilities (e.g. manufacturing capability), broad functional capabilities (e.g. operational capability, R&D capability, marketing capability, human resource capability, etc.), cross-functional capability (e.g. new product development capability, customer support capability, quality management capability, etc.) (Grant, 1996, p. 378). A recent model (Verona 1999) has referred to organisational capabilities as 'integrative capabilities' and has distinguished between external integrative capabilities (with outside sources) and internal ones (within the organisation) to reflect the locus of the integration processes. The model analyses the integrative capabilities with respect to the locus of integration process, but the issues about the differences in the nature of organisational capabilities beyond the external vs. internal dichotomy remain open.

Research has highlighted further that depending on the age of the companies the organisational capabilities differ in nature and this has implications for technological development and innovation activities in firms (Tushman and Anderson 1986; Henderson and Clark 1990; Sorensen and Stuart 2000). Organisation studies have established two opposing propositions about that link. One proposition suggests that due to cumulative nature of technological knowledge and capability development and increasing efficiency over time older organisations have a better capacity to recognise and absorb new ideas and introduce innovations (Tushman and Anderson 1986). The opposing proposition argues that younger organisations have a better potential to introduce innovations, as aging leads to decreasing efficiency and increasing rigidity in companies (Henderson and Clark 1990). A recent study (Sorensen and Stuart 2000) has reconciled these two opposing views. It has revealed that older organisations tend to introduce more innovations compared to younger organisations. Yet, younger companies seem to introduce innovations that are more suited to the latest technological demands, while the innovations by older firms tend to become less adequate over time.

The results of that latest study (Sorensen and Stuart 2000) also highlight that the organisational capabilities shape the development of technological capabilities: over time firms increase their efficiency and old organisations tend to have stronger technological capabilities in already established fields of innovation which allow them to introduce more innovations, yet their technological and organisational capabilities tend to become more rigid and the companies appear to be less capable in monitoring technological development and in particular detecting shifts in the environmental demands. While younger firms seem to have more dynamic organisational and

technological capabilities enabling them to detect quickly changes in the environmental demand and to respond to it swiftly. In this sense, younger firms seem to have more agile organisational and technological capabilities as compared to older firms.

The above results provide insightful and detailed analysis of the impact of age on innovation activities in firms and the impact of the organisational capabilities on technological development. However the analysis explores young firms that are advanced companies and therefore possess advanced capability base despite being new entrants in a particular industry. These results may hold also for latecomers but this is yet to be tested. Studies in latecomer companies have highlighted also that organisational capabilities shape the development of technological capability (Kim 1997b; Kim 1997a; Kim 1998; Dutrenit 2000; Figueiredo 2001; Figueiredo 2002; Figueiredo 2003; Marcelle 2004; Tsekouras 2006) but there is a need for further research in that direction.

The above literature review reveals that organisation studies in advanced companies have explored differences in the nature and the span of organisational capabilities and have classified organisational capabilities in terms of major functions they serve and the underlying microfoundations (Teece 2007), functional characteristics and their complexity (Grant 1996), locus of knowledge integration (Verona 1999), differences depending on the age of the companies (Sorensen and Stuart 2000), or has identified some important capabilities (Eisenhardt and Martin 2000). Studies so far have not investigated the different types of organisational capabilities by their nature and their role in development of technological capability. Similarly, the research in latecomer companies has focussed on the impact of different organisational capabilities in the technological capability building but has also adopted a uniform treatment of the organisational capabilities with respect to the nature of the organisational capabilities and the eventual implications which the differences in the nature of organisational capabilities might have for the development of technological capability. This paper unpacks the box of organisational capabilities and develops a classification of the organisational capabilities with respect to their nature and their role in development of technological capabilities, which is done in the following section.

Following the findings of the recent studies (Kim 1997b; Kim 1997a; Ernst, Ganiatsos et al. 1998; Kim 1998; Kim and Nelson 2000; Figueiredo 2001; Marcelle 2004; Li, Chen et al. 2006; Tsekouras 2006; Scott-Kemmis and Chitravas 2007) the proposed framework outlines a set of organisational capabilities that have been repeatedly cited as underpinning the development of technological capability and are therefore candidates for those needing to be developed by the latecomer companies. This approach, while using ideas from management and capability literature, has some idiosyncratic elements, some of which are the consequences of the context of latecomer companies. It aims to disentangle the organisational capabilities by reaching a greater level of disaggregation. Further, this approach places also emphasis on the most *basic* of organisational capabilities, like capabilities for general management, as the latecomer companies may lack or possess limited capacity even in such basic management capabilities. It produces a list of organisational capabilities that in some cases may seem simple or obvious from a standpoint of an advanced-context company but for a latecomer company they not be seen as needed or, even if perceived as important, may be difficult to develop, as studies have repeatedly revealed. As the major difference between of latecomer vs. the advanced companies is the lower capability base in the former, in a classification of the organisational capabilities with respect to their nature and their role in development of technological capabilities in the advanced companies,

the groupings of organisational capabilities will remain the same but there might be some differences in the component elements. For example, capabilities for expeditious learning and capabilities for integrative learning are capabilities facilitating the upgrade in the latecomer companies. In contrast, the advanced companies need to develop capabilities for continuous learning. In addition, there might be capabilities that are important for the advanced companies but not relevant for the latecomers, due to the lower capability base of the latter. For example, capabilities for IPR protection and licensing might be an important capability for the advanced companies, while it is not applicable for companies that are in the phase of capability accumulation.

3. Classification of organisational capabilities with respect to their nature and also their role in development of technological capability

This section presents the classification of organisational capabilities with respect to their nature and their role in development of technological capability. This section first outlines the main categories or classes of capabilities, then it identifies component elements within these categories and finally it presents a more detailed description of each of the component elements. The technological capability is the capability to acquire, use, adapt, modify, develop and make ready for commercialisation new technologies (Lall 1992; Bell and Pavitt 1993; Kim 1997b; Kim 1997a; Ernst, Ganiatsos et al. 1998; Kim 1998), and as it is sector-specific the analysis has to unpack its component elements separately. This paper investigates only the component elements of the organisational capabilities.

Organisational capabilities are not uniform; they differ in nature and their role in development of technological capabilities. Therefore it is worthwhile developing a classification that outlines different types of organisational capabilities by their nature and their role in development of technological capability, and to identify the component elements in each category, which is the aim of this research. The classification aims to be as detailed as possible to capture the variety of aspects of organisational capabilities and a detailed list of organisational capabilities explicates the component elements within each category.

Four broad categories of capabilities can be identified - some are background capabilities, some capabilities directly underpin the development of technological capability, other capabilities are boundary, outward facing, others are overarching, as described below (Figure 1).

The first category of organisational capabilities embodies background organisational arrangements that affect the functioning of the organisation as a whole and respectively shape the technological learning and its dynamics. These involve capabilities for effective general management.

The second category of organisational capabilities includes the capabilities that directly underpin the development of technological capability. These include capabilities for human resource development, capabilities for project management, capabilities for client (and supplier) relationships, capabilities for expeditious learning (Kim 1997b), integrative learning (Marcelle 2004), and capability for financing technology upgrade.

The third category of organisational capabilities is associated with activities that establish the link between the external environment and the internal processes in the company and respectively affect the technological learning, and these are referred to as outward facing organisational capabilities. These include the company's strategy, linkage capabilities, capabilities for negotiating contracts and marketing capabilities, etc.

The last fourth category of organisational capabilities (portrayed to the left side of the Figure 1) includes overarching organisational factors like establishment of organisational culture facilitating learning, agility, and entrepreneurial alertness that set the general direction and dynamics of technological and organisational learning.

The idea behind this categorisation is to depict differences in the nature of organisational capabilities. Differences in the nature of capabilities do not suggest that the organisations may have only some types of capabilities developed. Every organisation needs all these types of capabilities developed. It might appear that these differences in the nature of organisational capabilities have implications for the ease with which the companies develop different capabilities and differences in their deployment, and these are open questions for further research.

It should be further noted that organisational processes like learning, integration and recombination, routinisation, reconfiguration and recombination (Teece and Pisano 1994; Teece, Pisano et al. 1997) and also organisational microfoundations (Teece 2007) shape the development of organisational capabilities. In this sense, it would be reductionist to perceive the classification of organisational capabilities as a model of organisational capabilities without investigating the underlying organisational processes, which shape the development of organisational capabilities.

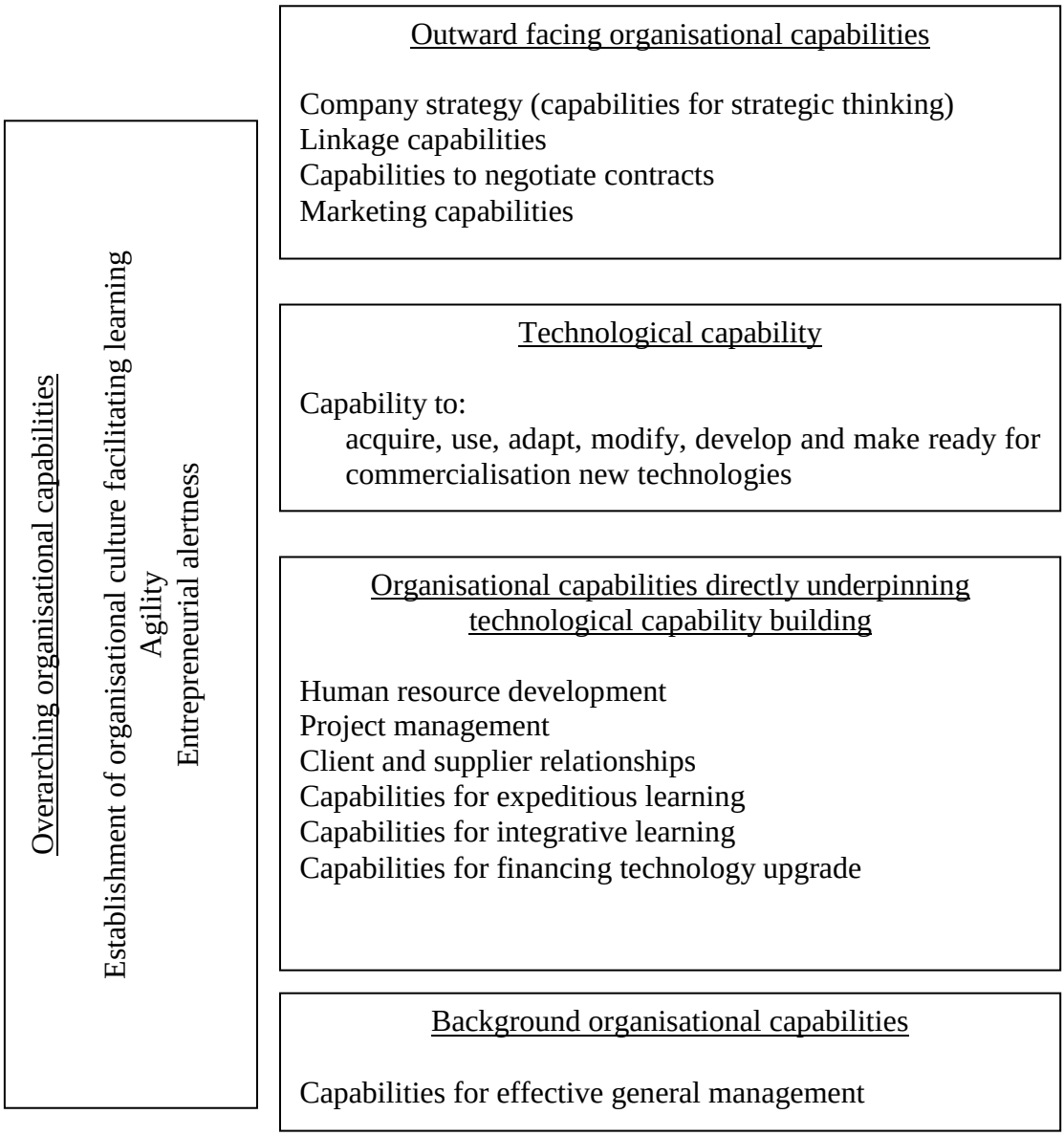

Figure 1. Classification of organisational capabilities with respect to their nature and their role in development of technological capability

Organisational capabilities directly underpinning the development of technological capability

In developing technological capabilities it is obvious that skilled individuals are an asset. Ingenuity and creativity are often able to compensate for shortages of other capabilities or inputs. Human resource development is, however, an area of specialisation in management that is often subordinated to other issues such as employee relations and welfare. The nature of technology-intensive development, however, is that it requires people with strong technological capabilities who are able to adapt and advance their capabilities in parallel with and as a consequence of their specific tasks of the moment. This implies that people must be aware of their current limitations and how these might be overcome through further study and training, and also reflection on how what they are doing is related to skills and knowledge that they or others might use in a different context. Development of such awareness and drive to learn and upgrade might be important for the latecomer companies, as they are facing the challenge of closing the capability gap. Such awareness should be developed by the managers and employees altogether to create a learning environment. In this sense, the latecomer companies need to establish an environment enabling active learning and skills upgrade by the employees to facilitate technological and organisational learning. Therefore, human resource development can be an important driver for upgrade. Human resource development involves an entire spectrum of activities, like recruitment, training and retention, reward and motivation, evaluation and assessment, etc., and these are discussed in detail in human resource management literature. The quality of the human capital might be an issue confronting the latecomer companies and the companies need to develop effective mechanisms for human resource development (Bell and Pavitt 1995; Marcelle 2004). The latecomer companies have to place deliberate effort to develop effective mechanisms for attracting highly qualified professionals and retaining them, to create an environment for learning and further training (Bell and Pavitt 1993; Kim 1997b; Kim 1999; Marcelle 2004). The existence of effective schemes for reward and motivation that provide incentives to the employees to develop their skills and expertise further and to actively apply them in the organisational context creates an additional value. Successful technological upgrade in the latecomers has been underpinned by active human resource development (Bell and Pavitt 1993; Kim 1997b; Kim 1997a; Kim 1998; Kim 1999; Marcelle 2004). The latecomer companies should not confine their human resource development efforts only towards enhancing the technical expertise of their employees but also (and more so) towards development of non-engineering and other change-generating abilities that are crucial for upgrade and yet underdeveloped in the latecomer companies (Bell and Pavitt, 1995, p. 99). Research on advanced companies has highlighted the complementary nature of the company's technological competence and its human resource development strategy (Dodgson 1991).

Capabilities for project management are essential management capabilities (Lewis 2002; Aguanno 2005; Berkun 2005), as the capacity of the firms to effectively manage projects affects positively its management and corporate performance (Aguanno 2005; Berkun 2005), and underpin the development of technological capabilities. Project management involves the structured management of project tasks involving delineating activities, identifying their interdependencies, scheduling them and monitoring the timeliness and quality of carrying out these activities (Lewis 2002; Berkun 2005). The management of small projects differs from the management of large projects due to the differences in scale and complexity (ibid.). Development of project management capabilities may not be straightforward for the latecomer companies, as

they may possess not only limited project management expertise but also limited resources. The large-scale projects may require resources well beyond those under the company's control. Since latecomer firms are often small, undertaking larger projects involves a higher degree of risk for the company. Larger projects require higher levels of such skills and, in a latecomer context, will often involve co-operation with other firms or individuals to fill in gaps in knowledge or skills. If a latecomer company faces the opportunity of executing a large-scale project, it has to be able to mobilise the necessary human resources and the additional expertise it may need. It also has to be able to coordinate the multiple tasks that large-scale projects involve and this is a process that is different in degree if not in nature from the process of managing small-scale projects. Being capable of managing large projects the latecomers are able to mobilise a large pool of resources. When these are coupled with relevant technical expertise and other organisational skills, the latecomer software companies will be in a better competitive position.

Capabilities for client and supplier relationships are another element underlying development of technological capabilities. In particular, the interactions with clients and users have been outlined as an important channel for exchange of information and knowledge and accumulation of new ideas (von Hippel 2000). Clients and users possess an in-depth understanding about the work processes, the performance of the existing technologies and potential niches for further developments, and for these reasons they have been identified as one of the major drivers for generating innovation (von Hippel 1988). Active relationships with clients provide a valuable ground for identifying problems in the existing products, and generation and exchange of tacit knowledge for areas for modification and improvement in the existing products and services, and identifying potential niches for further developments. For every company it is essential to establish good relationships with clients and suppliers but for latecomers this is of particular importance, as being embedded in a latecomer context and away from lead users, the latecomer companies have limited opportunities to obtain tacit technological knowledge (Hobday, 1995, p. 43). Therefore, establishing and maintaining links and relationships with clients, foreign ones in particular, are important channels for obtaining information about new technological developments, feedback and identifying potential niches for further developments. Several studies (Bell and Pavitt 1993; Hobday 1995a; Kim 1997b; Ernst, Ganiatsos et al. 1998) have revealed that establishing and maintaining active contacts and cooperation with clients and suppliers, foreign ones in particular, have contributed significantly to the successful technological development in East Asia. Relationships with suppliers also provide an important base for generation of valuable information and knowledge for latecomers. Suppliers provide information about the latest technological developments and thus facilitate the latecomer accumulation of information and knowledge. Capabilities for client and supplier relationships involve linkage capabilities (which are discussed in the following sub-section) but the former are included separately in this section due to their critical importance in technological learning and capability building.

In addition to the above capabilities another category of capabilities appears to be important and it is the learning ability of the company. In addition to establishing an organisational culture facilitating learning, it also appears to be important to foster particular types of learning capability in the organisation. In particular, latecomer companies need to develop capabilities for expeditious (Kim 1997b) and integrative learning (Marcelle 2004). Learning is the major driving force in the process of upgrade but the appropriate learning effort does not emerge automatically, as studies have repeatedly shown (Bell and Pavitt 1993; Hobday 1995a; Hobday 1995b; Kim 1997b;

Kim 1997a; Ernst, Ganiatsos et al. 1998; Kim 1998; Kim 1999; Dutrenit 2000; Lall 2000; Figueiredo 2002; Kim and Lee 2002; Figueiredo 2003; Marcelle 2004; Tsekouras 2006). Studies have emphasised that in order to enhance the accumulation of technological capability the learning effort should be expeditious and integrative rather than isolated and passive (Bell and Pavitt 1993; Kim 1997b; Marcelle 2004). The latecomers should develop capabilities to learn in an expeditious manner, which may involve crisis construction to rapidly acquire and absorb and re-combine new knowledge and to unlearn deficient elements. Only focussed, purposeful and expeditious learning effort can generate the required dynamics for swift and successful technological upgrade. In addition to this, to successfully upgrade the latecomer companies need to tap a variety of sources of information and knowledge. Information and knowledge from the global innovation system as well as information from suppliers and/or users should be closely integrated with the internal learning effort (Zahra and Nielsen 2002; Marcelle 2004). Furthermore, to achieve utmost results of these integrative learning efforts the latecomer companies need to create a right balance between the different learning sources (Marcelle 2004). In this sense, the ability for expeditious and integrative learning is a fundamental organisational capability, as it induces and shapes the dynamics underlying the development of technological capability. Learning concerns both technical and organisational aspects of upgrade. It involves a search, acquisition, absorption, re-combination and application of technical knowledge. Active acquisition of the latest technological information and knowledge and its rapid diffusion and re-combination has been the driving force of the successful technological development in East Asia (Bell and Pavitt 1993; Kim 1997b; Ernst, Ganiatsos et al. 1998; Hobday 2000; Kim and Nelson 2000; Ernst and Kim 2002). Alongside acquisition of technical knowledge the learning efforts should also involve understanding and development of organisational arrangements to support the technological upgrade. For example, crisis construction is a technique for expeditious learning, which involves creating crises in the company to rapidly attain technological knowledge and also to re-engineer the existing business processes and develop new organisational arrangements and unlearn inadequate practices, and has underpinned the successful technological upgrade in the Korean firms (Kim 1997b). This comes to reveal the critical importance of the expeditious and integrative learning effort for inducing the necessary dynamism for technological upgrade.

Last but not least are the capabilities for financing technology upgrade. Latecomer companies often face serious financial constraints and it might be difficult to allocate resources for technological upgrade (Marcelle 2004). Apart from the financial constraints, however, a more general problem exist, as latecomer companies often do not recognise clearly the need to place deliberate efforts toward technological upgrade and in result do not allocate resources in this direction (Ernst, Ganiatsos et al. 1998; Marcelle 2004).

Background organisational capabilities

The background organisational capabilities are represented by the capabilities for effective general management. Every single aspect of the organisational functioning is affected and indeed shaped by the company's management, which makes company's management a critical factor. The company should be managed in a consistent way to achieve effective results. Alongside effective management, i.e. to do the right things, it is also important to manage things efficiently, i.e. to do the things right, and the latter is particularly important for the latecomers, as it allows achieving cost advantages over established competitors. Organisational processes, like communication, decision-

making, coordination, control, and so forth, and reflect the capability base in the company but also its organisational culture and strategy and reflect the effective management (Robbins and De Cenzo 2004; Lussier 2009).

Abilities for prompt delivery are also elements in effective management capabilities. Meeting deadlines is important, as failing to deliver in time leads to increasing project costs and customer dissatisfaction. In latecomer countries, where the market power of suppliers may be high or where there are high transactions costs of changing suppliers, clients might be more lenient toward delays and this creates a challenge for latecomer companies to learn to execute projects meeting strictly the deadlines. To be able to do that, they need to develop abilities and skills for project management, tracking the work progress throughout the project, clarifying project requirements at the very beginning, effective communication between parties throughout the project, and so forth, as outlined in the project management literature (for example, (Lewis 2002; Berkun 2005).

All above illustrates the complexity, which the latecomers face in developing effective management abilities, enabling them to master the organisational and technological dynamics underpinning the development of new technologies.

Outward facing organisational capabilities

Company's strategy and the capabilities for strategic thinking are other drivers for upgrade. It has been widely recognised that strategic intent (Hamel and Prahalad 1989; Hamel and Prahalad 1993) is critical for establishing and sustaining competitive positions. For the latecomer companies strategic intent appears to be crucial, as it shapes the learning dynamics and in result affect the accumulation of technological capabilities (Ernst, Ganiatsos et al. 1998; Hobday, Rush et al. 2004; Xie and White 2004; Scott-Kemmis and Chitravas 2007; Jiatao and Rajiv Krishnan 2008). Studies (Ernst, Ganiatsos et al. 1998; Hobday, Rush et al. 2004; Xie and White 2004; Scott-Kemmis and Chitravas 2007; Jiatao and Rajiv Krishnan 2008) have revealed that successful technological upgrade has been underpinned by proactive and dynamic strategy making by the latecomers. The managers need to have a clear vision what the company is aiming to accomplish in the future so they are able to prepare and undertake the intermediate steps towards the final goal. In setting their goals the latecomer companies are to take into account their standing with respect to the development of the world industry. Questions like 'where do the products and services offered by the company position with respect to development of the world industry', 'in what direction and how the company can upgrade', and so forth, must be addressed, if latecomers aim to achieve a sustainable position in the international (and also domestic) market.

Mobilisation of organisational capacity and channelling the company effort towards purposeful upgrade in a strategic manner requires vision and leadership. All organisational capabilities may be in place but through vision and leadership and strategic thinking the latecomer companies can harness them and channel them towards purposeful upgrade, and in this sense they serve as organisational glue. The extent to which the vision and strategy will materialise depends pretty much on the leadership in place. The upgrade process is cumbersome and challenges are inevitable part of it. The presence of committed leadership in the latecomer company has a potential to serve as a driver and catalyse change, as studies in latecomer (Kim 1997b; Kim 1997a; Kim 1998;

Kim 1999; Figueiredo 2001; Kim and Lee 2002; Marcelle 2004) and advanced (Selznick 1957; Pettigrew and Whipp 1991; Schein 1992; Wheelwright 1992; Tushman and Nadler 1996; Tidd 2001) companies have highlighted. Capabilities for vision and leadership are perhaps the most difficult to evaluate, as they involve high tacit component and usually are assessed post-factum by evaluating the outcomes.

In order to learn and upgrade the latecomer companies need to acquire valuable information and knowledge. The acquisition of valuable knowledge is not a straightforward task. The modern technologies are increasingly complex and to develop mastery over them and to commercialise the accumulated expertise successfully the latecomers need to accumulate various types of technological and organisational expertise. Due to their complexity these various types of technological and organisational expertise cannot be acquired by a single source and for this reason companies need to establish contacts with a wide variety of sources. A number of studies have revealed that establishing and maintaining active links with various parties (e.g. clients, suppliers, other companies, universities, research institutes, associations, etc.), and foreign ones in particular, have been a major driver for successful technological upgrade in the latecomers, as these links provide channels for obtaining valuable codified and tacit information and feedback on technological dynamism (Bell 1984; Abegglen and Stalk 1985; Amsden 1989; Bell and Pavitt 1993; Abegglen 1994; Hobday 1995c; Hobday 1995b; Hobday 1995a; Kim 1997b; Kim 1997a; Ernst, Ganiatsos et al. 1998; Ernst, Mytelka et al. 1998; Wong 1999; Dutrenit 2000; Hobday 2000; Kim and Nelson 2000; Amsden 2001a; Amsden 2001b; Figueiredo 2001; Lee, Lee et al. 2001; Bell 2003; Figueiredo 2003; Marcelle 2004; Xie and White 2004; Elango and Chinmay 2007; Hobday and Rush 2007; Scott-Kemmis and Chitravas 2007). These studies have repeatedly revealed that the linkage capabilities exercise significant impact on technological upgrade in the latecomer companies and are therefore important to develop.

Other outward-facing organisational capabilities are in marketing [3]. The marketing capabilities include the abilities for identifying potential clients, approaching them, promoting their in-house capabilities, and maintaining relationships upon completion of the project for further developments, and so forth, as detailed in marketing literature. The ability to market the in-house skills and expertise is one an important factor facilitating the companies' success. Only successful commercial application can harness already developed technological and organisational capabilities, and allow further expansion. To the extent that the latecomer companies may possess (sometimes very) limited knowledge about the structure and functioning of international markets, this might limit their abilities to identify the right approach for entering a particular market, positioning themselves in the market and identifying the right customers. Further, even if successful in all of the above and having identified the right clients, the latecomers may fail in approaching and establishing contacts with them for a variety of reasons. In the domestic market, the latecomers have access to local customers with whom their share the same cultural and business background, which makes establishment and maintaining contacts easier. In the international markets the latecomers need to build relationships taking into account international business ethics and management, and dealing with inter-cultural differences like different norms or values, and this might not be a straightforward task. Thus, developing skills in

[3] Some studies consider marketing capabilities as separate from organisational capabilities. Following the definition of organisational capabilities as the ability of the company to execute, coordinate and systematise different business processes, this research treats marketing capabilities as part of organisational capacity and also as representing one type of organisational capabilities.

marketing and international business management becomes one of the prerequisites for latecomers' success.

The abilities to negotiate contracts are other outward-facing organisational capabilities. These capabilities are outlined separately from marketing capabilities and general management capabilities to emphasise their importance. Negotiating contracts is not straightforward and requires tacit knowledge and skills that latecomers may not possess. Due to their limited business experience the latecomers may not possess deeper understanding about the negotiation process, the international business practices, etc. In this sense, capabilities for negotiating contracts may emerge as a hindrance for the latecomer companies to get recognition and enter the international markets.

Overarching organisational capabilities

Following the recognition that learning is a major driving force for creating and nurturing company's capability base, a vast body of literature has highlighted that the ability to establish organisational culture facilitating learning emerges as a core capability, which should be developed both by the advanced (Levitt and March 1988; Cohen 1989; Cohen 1990; Dodgson 1991; Leonard 1992b; Dodgson 1993; Teece and Pisano 1994; Pisano 1996; Teece, Pisano et al. 1997; Tidd 2001) and latecomer companies (Bell and Pavitt 1993; Hobday 1995c; Hobday 1995b; Kim 1997b; Kim 1997a; Ernst, Ganiatsos et al. 1998; Kim 1998; Kim 1999; Dutrenit 2000; Kim and Nelson 2000; Figueiredo 2001; Marcelle 2004). To maintain competitive positions the companies need to constantly learn, i.e. to become 'learning' organisations (Leonard 1992b; Senge 1992; Garvin 1993) and therefore learning has to be interwoven in the very fabric of the firm. Successful learning requires establishment of an interactive and open environment in the organisation, which allows it to be receptive to new ideas and developments (Leonard 1992b; Senge 1992; Garvin 1993; Tidd 2001). Studies in capability building in the latecomer companies have repeatedly emphasised that it is crucial for the latecomers to establish a culture facilitating learning, as this creates a fruitful base for upgrade (Kim 1997b; Kim 1997a; Ernst, Ganiatsos et al. 1998; Kim 1998; Kim 1999; Dutrenit 2000; Kim and Nelson 2000; Figueiredo 2001; Marcelle 2004). They have demonstrated that establishment of an environment for accumulation of information, exchange of ideas, and knowledge generation and re-combination appears to be a critical driver for successful and swift technological learning and upgrade (Hobday 1995b; Kim 1997b; Kim 1997a; Ernst, Ganiatsos et al. 1998; Kim 1998; Kim and Nelson 2000; Figueiredo 2001; Marcelle 2004). The ability to establish organisational culture facilitating learning can be considered as a fundamental capability, as it underlies the development of all technological and organisational capabilities. Developing this "learning to learn" capability may not be straightforward for the latecomers, as results from some studies have suggested (Figueiredo 2001; Marcelle 2004; Tsekouras 2006). Learning involves acquiring new knowledge and abilities, and it may also challenge some already established routines in the company, and require 'unlearning' and abandoning some of them. Adopting new ideas and developments often necessitates undergoing some sort of change. In this sense, the abilities to learn are closely coupled with change management skills. Case studies of successful technological development often confirm that change management capabilities underpin dynamic technological and organisational learning (Kim 1997b; Kim and Nelson 2000; Marcelle 2004).

The ever growing dynamics in technological change and competition require firms to become more flexible and adaptive to external pressures, to become agile companies. An agile firm is fast moving and flexible company capable of rapid and cost efficient response to unexpected challenges in the external environment and opportunities for innovation by assembling essential assets, knowledge and relationships with speed and surprise (D'Aveni 1994; Goldman, Nagel et al. 1995). Its culture is based on active exchange of information, non-hierarchical relationships, flexibility and fast-changing roles, trust within the company and with clients and suppliers. An agile firm supports its members to rapidly evaluate feedback and new information, and learn continuously, and the main driving force in an agile company that distinguishes it from a bureaucratic organisation is the speed of reaction and change, and implementation of new ideas and innovations (D'Aveni 1994; Goldman, Nagel et al. 1995). Agile companies are built on flexible and ad-hoc policies and processes that facilitate change, for example: projects are generated everywhere in the organisation, and many times even from outside affiliate; fast-changing roles; knowledge and power are distributed, intelligence is spread throughout the organisation; working groups communicate directly, not hierarchically, key decisions are made collaboratively, etc. (D'Aveni 1994; Goldman, Nagel et al. 1995; Brafman and Beckstrom 2006).

Agility is closely coupled with the capabilities to establish a culture facilitating learning and capabilities for expeditious learning. The learning capabilities refer to the capacity of the firm to learn: to establish a general environment conducive to learning, and to learn in a dynamic manner, while the agility refers to speed of changes and dynamics of innovative activities in the company. Therefore, the speed and the dynamics is what distinguish an agile company from a learning organisation. A company might be a learning organisation (i.e. the company acquires new knowledge actively; it might also have a capacity to learn in an expeditious manner) but it may not necessarily be an agile company (i.e. a company that undertakes changes rapidly in response to outside challenges or opportunities). Therefore, although learning capacity and agility are closely coupled they are separate capabilities that have to be developed.

It has been highlighted that agility is an important element in the organisational capability in the latecomers (Li et al. (2006) but it has not been elaborated whether agility involves different aspects in the latecomers. An agile firm is prone to undertake more changes than normal bureaucracies and in this sense if latecomers nurture agility this would benefit the upgrade process. If the latecomer companies manage to become agile and respond rapidly to external challenges and to pursue emerging opportunities, in the initial phase the change activities are most likely to be associated with upgrade in the products and services or capability base rather than innovation. Although in this case the changes might involve upgrade, it is important that these changes come as a response to external challenges and emerging opportunities, and that the latecomer firm has established an agile internal environment enabling it to respond to them in a dynamic manner. Once the latecomers develop advance capability base their agility will start to nurture their advanced innovative and dynamic capabilities, and then they will be able not only to respond rapidly and adjust to challenges in the environment but eventually they might start introducing innovations. Therefore, if the latecomer companies nurture agility they will develop an ability to monitor and detect challenges and opportunities in their environment and respond rapidly, which will facilitate the upgrade process and eventually will allow them to start innovating.

Entrepreneurial alertness is the last but not least overarching capability.

Entrepreneurial alertness has been defined in two ways (Kirzner 1973; Kirzner 1979; Kirzner 1980; Kirzner 1985): as 'the ability to notice without search opportunities that have hitherto been overlooked' (Kirzner, 1979, p. 48) or as 'a motivated propensity of man to formulate an image of the future' (Kirzner, 1985, p. 56). The main proposition is that the entrepreneurs seem to posses an unique capability of being alert to opportunities in the external environment. The exercise of the entrepreneurial alertness leads to a 'shrewd and wise assessment of the realities' (Kirzner, 1980, p. 7) which may lead to identification of opportunities in the external environment. The crucial difference between opportunity finders (e.g. entrepreneurs) and non-finders are based on their relative assessment of the market situation (Kirzner 1973; Kirzner 1979; Kirzner 1980; Kirzner 1985; Kirzner 1999). In other words, compared to other economic actors entrepreneurs have a better grip on reality because they perceive it more accurately and are better at inferring the likely implications and consequences (Kirzner 1973; Kirzner 1979; Kirzner 1980; Kirzner 1985; Kirzner 1999; Gaglio and Katz 2001; Yu 2001). In a company context entrepreneurial alertness implies that a firm has established an open environment that actively supports entrepreneurial ideas and undertakings of its members. In the context of latecomer companies entrepreneurial alertness may have its specifics. Entrepreneurial alertness implies that the initiative for the new undertakings comes from the entrepreneur or the company (in some cases entrepreneurial ideas may originate from a client but are materialised by the company, which takes the risk to pursue the undertaking). Therefore, the entrepreneurial alertness and the initiative to pursue the entrepreneurial undertaking come from the company itself. In the context of the latecomer companies however this may not always be the case. The latecomers may have low ability of entrepreneurial alertness and may not necessarily be able to identify opportunities themselves. Nevertheless, if the latecomer companies create an organisational culture, which is open to new ideas and undertakings, it may adopt and implement entrepreneurial ideas coming from outside agents (e.g. clients, consultants). The most important is that the latecomer company has established an environment conducive to entrepreneurial activities, which makes it alert and willing to explore entrepreneurial undertakings.

4. Conclusions

This paper contributes to the literature on technological capabilities and organisation science by developing a classification of organisational capabilities that scrutinises their nature and their role in development of technological capability. The research identifies five major types of organisational capabilities: background capabilities, capabilities directly underpin the development of technological capability, boundary capabilities, outward-facing capabilities, and overarching capabilities, and a wide array of component elements in each category.

This classification aims to highlight the differences in the nature of organisational capabilities and to create a base for investigating possible differences in the impact of these different types of organisational capabilities in development of technological capability. The differences in the nature of organisational capabilities might have implications for the ease with which the latecomer companies develop and deploy them, and this might have implications for development of technological capabilities, and these are all questions for further research. Further, as learning and development of technological capability in latecomer and advanced companies is qualitatively different, it might impose different requirements on the companies with

respect to the extent of engagement of certain types of organisational capabilities, and this is another direction for further research. This paper lays the foundations and will be augmented by further theoretical and empirical research in the above directions.

In refining the interface between technological and organisational capabilities, the research in this paper disentangles the notion of organisational capabilities and introduces the notion of organisational capacity. In doing so, this paper integrates the perspectives of the existing studies so far and elaborates the treatment of organisational capabilities in organisational studies. It suggests that technological and organisational capabilities can be treated as abilities in functional areas and an additional category can be introduced, the organisational capacity, to reflect the broader capacity of an organisation to renew its capabilities. In other words, the organisational capacity consists of a wide array of abilities in functional areas – some of which are organisational and some are technological capabilities.

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