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Technological innovation: a resource-based view

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Introduction

This free course, *Technological innovation: a resource-based view*, gives an overview of the concepts, ideas and debates which all contribute to a critical understanding of technological innovation. The course covers aspects such as the different types of innovation. It also explores how this is applied in the workplace, and how it has changed over time.

This OpenLearn course is an adapted extract from the Open University course T849 *Strategic capabilities for technological innovation*.

Learning Outcomes

After studying this course, you should be able to:

- understand the genesis and continuing development of the resource-based view of organisations
- understand the distinction between organisational resources, competences and capabilities and their significance for technological innovation
- understand the development, use and management of a range of capabilities for technological innovation and innovation more generally
- recognise the importance of knowledge management and organisational learning to the development and application of capabilities for technological innovation.

1 Introducing innovation

We inhabit a world where there is widespread agreement that the history of technological and organisational innovation and change has been remarkable. Indeed, approaching this issue from entirely different ideological perspectives, Karl Marx in the 19th century and Joseph Schumpeter in the early to mid 20th century both recognised technological and organisational innovation as a fundamental feature of the 'creative-destructive' tendencies of capitalism, although the extent to which the costs of the destructive aspect of this phenomenon are considered acceptable is a subject that divides opinion to this day. As Godin (2008) notes, Schumpeter (1912, 1934) provides us with an early characterisation of innovation as any of five phenomena:

- the introduction of a new good
- the introduction of a new method of production
- the opening of a new market
- access to ('conquest of') new sources of raw materials or components
- or the introduction of new forms of organisation.

The term 'innovation' has since been extensively debated, and used in a wide range of ways. One study (Baregheh et al., 2009) identified 60 definitions of innovation in organisations alone. In part, at least, these differences are a result of the differing concerns of different academic disciplines, the perspectives of different stakeholders in the innovation process and the different contexts in which innovation is considered. Thus, for example, an economist may be concerned with the contribution of innovation to the performance of a national economy and so be interested in the generation of entirely new products or processes, while a social scientist may be concerned with how individuals decide whether or not to adopt an innovation, and therefore less interested in whether a product is new to an individual or organisation or not. Alternatively, managers may be concerned with how to prepare their organisation to generate innovations that are new to their industries and markets, or with how their organisation might most effectively adopt or configure innovations generated elsewhere to use within their own organisation. What the term 'innovation' means, then, appears to depend on who is using the term and the context in which it is used.

A contemporary definition widely used by governments and institutions, such as the Organisation for Economic Co-operation and Development (OECD) and the European Commission (EC), to inform innovation policy sets out four main types of innovation (OECD/Eurostat, 2005):

- Product innovation – a good or service that is new or significantly improved. This is perhaps what we think of most often when we think of an innovation.
- Process innovation – a new or significantly improved production or delivery method. Innovations in the way things are made can critically effect, for example, how widely accessible they are.
- Marketing innovation – a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
- Organisational innovation – a new organisational method in business practices, workplace organisation or external relations.

2 Innovation: adding value

The OECD/EC definition focuses on what is innovated – product, process, marketing or organisation – rather than how or why people or organisations choose to use an innovation, or how an innovation might be produced. Similarly, in the UK, the Department for Business, Innovation and Skills (BIS) defines innovation as: 'The process by which new ideas are successfully exploited to create economic, social and environmental value.' (BIS, 2011). Again, this definition draws our attention towards two fundamental features of innovation: that a new idea or invention is not by itself enough, and that it needs to be part of a wider process that realises value.

Figure 1 below illustrates this process as a series of activities progressing from 'idea generation' (loosely, invention) through to marketing and adoption in the market place ('diffusion'). It is argued that this usually happens in the context of the 'push' of new technologies ('state of the art in technology and production') and the 'pull' of societal and economic demand ('needs of society and the market place').

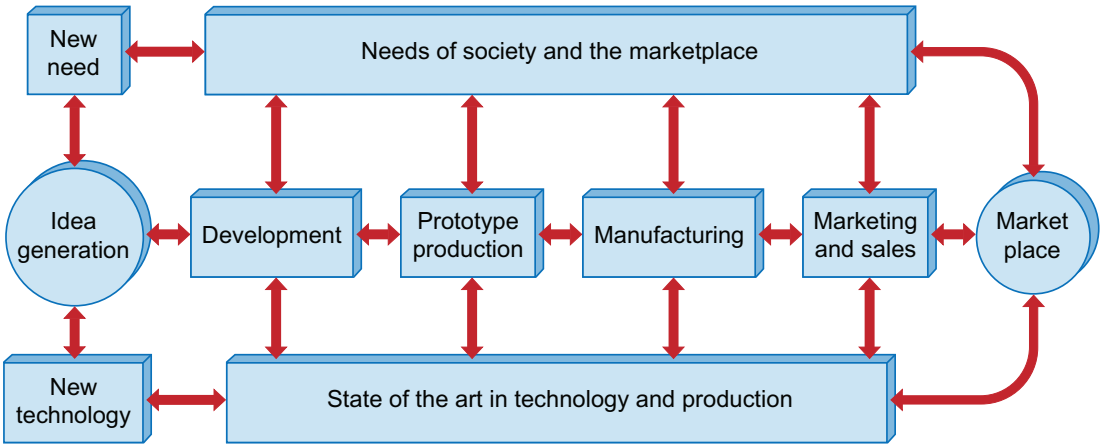

Figure 1 The coupling model of innovation (adapted from Rothwell, 1992).

Although this diagram is a rather stylised and simplified model of innovation (for example, it portrays innovation solely in relation to manufacturing, whereas service innovation represents a hugely significant arena), it does illustrate that innovation is a complex process and also serves to remind us that innovation happens in both technological and socioeconomic contexts, influencing them and being influenced by them. This brings us nicely to another important feature of innovation that also has a bearing in how we define it: how and why people and organisations decide whether or not to adopt an innovation. That is, how innovations spread or 'diffuse'. As Rogers (2003, p.12) notes, from this perspective 'An innovation is an idea, practice or object that is perceived as new by an individual or other object of adoption. It matters little, so far as human behaviour is concerned, whether or not an idea is 'objectively' new as measured by the lapse of time since its first use or discovery.'

2.1 Discontinuous innovation

Of course, this viewpoint runs counter to the strong tendency in contemporary societies to think of innovation only in terms of new products – which is an understandable trend given the scale and frequency with which the public are regularly bombarded with advertising for

'stuff', and particularly technological artefacts such as, ever 'smarter' phones, mini remote controlled drones, apps for just about everything, and many other forms of techie gadget. Yet arguably the greatest single innovation of the 20th century (and still as significant today) – the one which most changed society, the patterns of living and our economies – was not a new product but a *process, a way of producing a product*. Henry Ford's production line for manufacturing automobiles made them affordable for the first time to people on moderate incomes. But it also had a profound impact on the way in which work within Ford's factories was structured and carried out. In came the production line, with workers carrying out the same tasks, at a set speed, over and over for the duration of their shift.

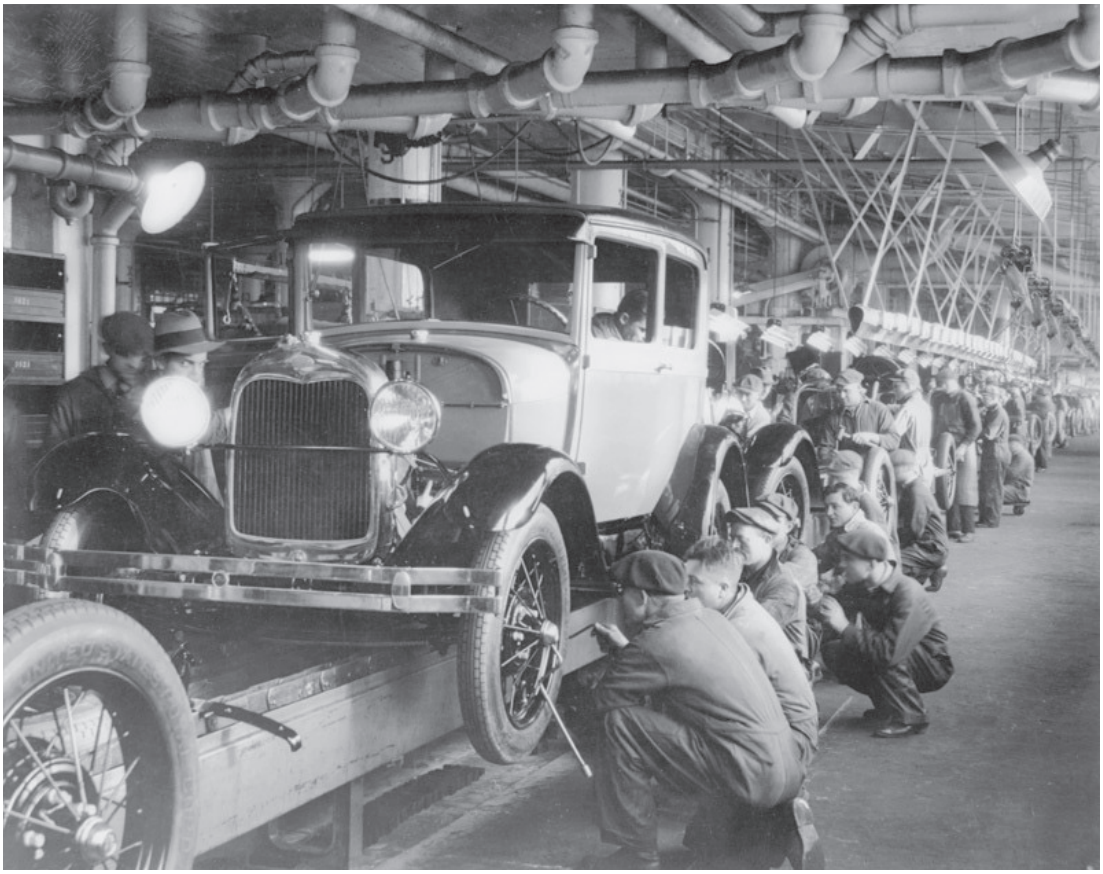

Figure 2 Ford production line from 1928.

The benefits (and costs) arising from Ford's process innovation, obviously had a significant and lasting impact on the world for consumers and manufacturers and more widely. But there are, of course, many newer examples of technological innovations (and inventions) that have enabled more wide ranging process and organisational innovation – most obviously, the advent of the internet and World Wide Web.

These examples and many others of similar magnitude are frequently referred to as 'discontinuous innovation' in that they:

> involve a fundamental change in an approach or technology. Every now and then a disruptive event occurs that changes markets, industries and even societies … Such world changing events give rise to a wave of discontinuous innovation across many industries. This has a destabilising – or disruptive – effect for established firms. (Together with management innovation, discontin-

> uous innovation constitutes higher order innovation, which can be the source of lasting competitive advantage)
>
> (Bessant et al., 2009, p. 7)

Clearly, both Ford and the internet are examples of discontinuous innovation. In practice, however, what most organisations and people experience are examples of innovation that are more incremental in nature and more limited in scope and scale. Nevertheless, as the quotation above indicates, it is discontinuous innovation that is the 'game-changer'. It is worth noting, however, that evidence has existed for some years that demonstrates that organisations that are first to market with an innovative product or services are frequently less successful than those who follow on later (Rogers, 2003; Hippel, 2005). Why this arises is particularly important in a commercial setting, of course, and thus why some firms outperform others has been a long running subject of interest to researchers and commentators from a wide range of academic disciplines. Furthermore, in an age when it has become widely accepted that innovation is an important force in driving economic growth and creating various forms of value – as well as essential to the success or survival of any organisation, whether commercial or not – this issue takes on a far broader significance.

2.2 Innovation capabilities

There are competing views and theories as to how to explain this and other key characteristics of innovation, of course. This course provides an introduction to one approach that has become increasingly popular over recent decades: the dynamic capabilities approach or perspective (also referred to as a framework). Put briefly, this approach argues that as new bases of competitive advantage have become more significant across ever more globalised markets, so old ways of examining competition – such as Porter's 'Five Forces' framework (Porter, 1985, cited in Teece, 2011) – have become increasingly redundant because they are 'not up to the task of revealing the dominant logic of value capture in most new industries, as well as many of the old.' (Teece, 2011, p. 4). Consequently, firms (and organisations more generally, it can be argued) need to develop a much more comprehensive view of the environment(s) in which they do, or seek to, operate. For example, the 'components' of these environments stretch well beyond buyers and suppliers. They include local labour markets (particularly for skilled workers), legal and regulatory systems, education systems (particularly the university sector), banking and finance, and national, regional and pan-national political and governmental systems and situations (e.g. the EU, OECD, etc.).

This course begins by explaining the genesis of the capabilities approach – which lies in the resource-based view (RBV) of organisations – before moving on to discuss resources, competences and capabilities. A word of warning about RBV terminology is in order however. The terminology can be confusing, with different terms used to describe similar things, and the same things labelled differently across the literature. Unfortunately, this is the nature of the RBV/capabilities beast, as it is with other topics across not just academia but management consulting and journalism, for example. As such, it is a feature of the subject that cannot be avoided when citing or drawing on work from across the field. Nevertheless, effort will be made to mitigate this issue wherever possible.

3 The resource-based view of organisations

Since the 1950s scholars and researchers of innovation have tried to analyse and explain innovation and what makes some organisations successful at it while other organisations are not (e.g. Penrose, 1959; Wernerfelt, 1984; Kim and Chang, 2009). An increasingly influential sector of this research has focused on the resources held by an organisation and how these are managed and used. The resource-based view of the firm (RBVF), or, put more simply, the resource-based view (RBV) as this approach is now known, argues that the essence of competition – and thus the basis for the success of an organisation – centres on an organisation's resources, not its goods and services. Thus RBV research and theorising seeks to analyse the relationship between organisations and innovation by focusing on the resources and capabilities organisations possess and questions whether it is the level of resources or the deployment of such resources that leads to differences in firm performance (DeSarbo et al., 2007; Newbert, 2007).

Leaving aside, for the moment, the observation that it might be a bit of both, it is necessary at this early stage to note the relationship between capabilities and resources and why the distinction is important. The nature of the relationship is often reflected in definitions of capabilities, such as 'Capabilities, defined as the *ability to deploy resources effectively* so that inputs can be transformed into desirable outcomes, may be at the root of why two firms that have similar resources obtain drastically different levels of performance.' (Emphasis added.) (Menguc, et al., 2014, p. 315). In this example, a capability is fundamentally an 'ability' to do something: 'deploy resources effectively'.

3.1 Technological capability

In many of the early RBV studies, the accepted premise was that this ability related to the possession of new technologies and access to technological innovation, and that it was this that delivered competitive advantage for a firm (e.g. Katz, 1984) – hence the focus on *technological* capability (e.g. Lall, 1992; Bell and Pavitt, 1995). On the basis of this research it was argued that 'firms that have developed technological capabilities increase their chances of success in relation to those with weak technological capability.' (Tello-Gamarra and Zawislak, 2013, p. 3). More recent studies have also confirmed a positive relationship between this particular type of capability and an organisation's ability to innovate and/or perform innovatively (e.g. Coombs and Bierly, 2006; Reichert, et al., 2011). It is therefore worth briefly adding a little more on this particular capability before continuing our review of RBV.

A technological capability has been defined as 'a body of knowledge, skills, routines and abilities that lead to technological change (innovation) in order that the firm exceeds its competitors.' (Tello-Gamarra and Zawislak, 2013, p. 4). We can illustrate the existence of a technological capability with the example of hospitals that possess the ability to use robotic surgery. Minimally-invasive (keyhole) surgery has now become routinely used in a range of procedures such as gall bladder, knee operations and hernia repairs. Many of the technologies that have been developed for minimally invasive surgery over the past couple of decades are relatively easy to acquire because of the range of products on the market, but also the relatively large number of staff with experience in the use of the

techniques. Robot technology can be seen as a complementary asset to the broader and more commonly held capability of minimally-invasive surgery. A major benefit for hospitals that adopt robot technology – and something that will rely heavily on the organisation's ability to learn – will be the potential to provide a better service to patients and develop a competitive advantage in systems where hospitals compete against each other to provide services. In this case, a capability in minimally-invasive surgery using robots can potentially create a capability of strategic importance: a 'core' capability for a hospital, one that is potentially difficult for other hospitals using traditional minimal-invasive surgery techniques to imitate or develop.

Figure 3 Robotic surgery.

3.2 Core and strategic capabilities

Core capabilities are discussed more fully in Section 4 but it is worth briefly elaborating further here, using the example of robotic surgery, by asking the question: how would the hospital know whether this is a capability of strategic importance? First, we might consider the environment in which a hospital operates. Even within a predominantly state-operated health service, such as the NHS in the UK, competitors such as private healthcare providers exist. In addition, the funding of a hospital department may also be based on specific funding regimes. In this case, the use of novel surgical techniques may indeed be of strategic importance because they create the potential to process more patients, with fewer complications, while consuming fewer hospital resources. Conversely, and importantly, once all hospitals in the public and private sectors possess the technology to carry out robotic surgery, there will be little competitive advantage between organisations possessing the same capability. At this stage the capability is likely to become a strategic *necessity* – required even to qualify as a certain type of healthcare provider.

Further examples of capabilities

It is clear from the brief discussion of a technological capability that capabilities consist of combinations of organisational and technical components. It is unsurprising, then, that as the body of research into technological capability grew it became increasingly evident that while possessing this capability is important, focusing on this alone is not sufficient to explain why some organisations are successful at innovation and others are not. The study of organisational capabilities has therefore broadened and deepened, leading Menguc, et al. (2014, p. 315) to conclude that: 'The RBV has proven to be an instructive theoretical framework for explicating how sources of competitive advantage (e.g. resources, assets, and capabilities) lead to marketplace positional advantage (e.g. innovation and marketing differentiation or cost leadership).'

At this point it is worth reiterating my earlier contention that the RBV approach has far wider utility than simply commercial organisations. However, as innovation is typically seen as of most importance to commercial enterprises, it is unsurprising that 'firms' and 'companies' – commercial entities – are the focus of attention rather than organisations more generally. Nevertheless, you should keep the caveat about wider applicability in mind as we begin to explore the nature and significance of capabilities in greater depth. Before moving on, however, the following list is useful because it illustrates how the RBV has extended in scope (as well as spawning new terminology) since its early focus on technological capability.

- Core capabilities (e.g. Prahalad and Hamel, 1990)
- Organisational capabilities (e.g. Chandler, 1992)
- Operational capability (e.g. Miller and Roth, 1994)
- Dynamic capabilities (e.g. Teece et al., 1997)
- Product development capability (e.g. Subramaniam and Venkatraman, 2001)
- Marketing capabilities (e.g. Kotabe et al., 2002)
- Information technology capabilities (e.g. Santhanam and Hartono, 2003)
- Managerial capability (e.g. Saloman, 2009)
- Intercultural capability (e.g. Gómez-Schlaikier, 2009)

Note that the terms used above appear to indicate the existence (and study) of individual capabilities as well as combinations, many of which focus on the internal processes and activities of organisations. Additionally, in most cases the terminology used is descriptive enough to provide us with a clear indication of the nature of that capability. The exceptions are core and dynamic capabilities. The former has already been noted (i.e. a strategic capability). The latter are not discussed further in this course.

3.3 Continuing development

Given its utility, it is unsurprising that extension of the RBV approach continues, as the two following examples illustrate. Tello-Gamarra and Zawislak (2013, p. 4) argue that the extent of the internal focus indicated by the list in Section 2.3 tends to downplay the skills and capabilities an organisation needs to 'maintain a constant link with its surroundings and to address the market and carry out transactions.' They therefore suggest that a further 'transactional' capability needs to be recognised:

> A transactional capability is defined as *a repertoire of abilities, processes, experiences, skills, knowledge and routines that the firm uses to minimise its transaction costs* … the transactional capability has two dimensions, one (a) customer-centred, and another, (b) supplier-centred.
>
> (Tello-Gamarra and Zawislak, 2013, p.5, (original emphasis))

Again, the point can be made that transaction costs are not only a concern of commercial, for profit 'firms', but of many types of organisation, as indeed are suppliers and customers, although the latter may not be defined in terms of a commercial transaction if, for example, the organisation in question is a government agency or other entity supplying a public service.

The second example returns us to a question posed earlier in the course: if, as is widely accepted, innovation as a source of competitive advantage is achieved when organisations possess or develop their technological capabilities, why is it that some organisations that invest in this capability are not innovative? Or, why do other organisations who invest far less enjoy innovative performance? It is claimed the answer can be found in a more recently identified (or perhaps it would be more accurate to say 'labelled') capability, which is in fact 'a meta capability called innovation capability' (Zawislak et al., 2012, p. 15).

> The innovation capability is understood as both the technological learning process from the firm translated into technology development and operations capabilities, as well as the managerial and transactional routines represented by the management and transaction capabilities. The integration between these four capabilities effectively promotes innovation which creates competitive advantages.
>
> (Zawislak et al., 2012, p. 17)

On the basis of a wide ranging and extensive review of literature on innovation and capabilities, Zawislak et al. conclude that all firms have all four capabilities, but that 'to be innovative at least one of the firm's capabilities must be predominant.' (p. 14). This predominance is not fixed, and may therefore shift over time. In short, some capabilities are clearly 'dynamic' and therefore potentially highly significant. I hope this brief review of the RBV demonstrates that the approach fully acknowledges that the capabilities of organisations are multiple, and that what they are and how they combine and interact over time – and therefore how they are developed, reconfigured, managed, and so on – is crucial to understanding and explaining why some organisations are successful at innovation and others are not, even when they may appear to possess the same capabilities. The material that follows seeks to analyse and explain in more detail some of the key features of capabilities and thus the relationship between organisations and innovation.

4 Anatomy of a capability

Capabilities are clearly central to the resource-based view of an organisation, and the examples in the previous sections indicate the types of capability that are said to exist. But pinning down what it is in an organisation that *creates and sustains* a capability is not easy. Some obvious clues can be found in some of the definitions, of course. For example, in similar vein to Menguc et al.'s definition noted in Section 2, Teece (2014, p. 14) notes that 'A capability is the capacity to utilise resources to perform a task or an activity, against the opposition of circumstances. Essentially, capabilities flow from the astute handling and orchestration of resources.' The question then is, what creates the 'capability/capacity' for 'astute handling and orchestration'?

If you refer back to the quotation from Tello-Gamarra and Zawislak (2013, p. 5) you will notice they specifically refer to 'abilities, processes, experiences, skills, knowledge and routines' – most of which are largely intangible. This is where Leonard's (1995) work is useful. Although over two decades old, it still provides a model that encapsulates both what it is that constitutes a capability and what activities create and renew capabilities over time. Within this model a capability comprises four dimensions, which are detailed in the following sections.

4.1 Skills and knowledge

Employees hold the knowledge and skills that underpin a capability. It is important to recognise, however, that this component of a capability is a complex blend of different types of skill and knowledge. Leonard suggests that there are three types: public/scientific, industry-specific, and firm-specific. Firm-specific knowledge is the least codified and transferable. The implication of this is that a capability is not based only on generally understood scientific or technological principles, or industry consultants. The major, yet most difficult to imitate, dimensions are the skills and knowledge that develop within an organisation.

4.2 Physical technical systems

This is the most tangible part of a capability. The machines, databases and software acquired or developed over time are probably the only part of a capability that does not disappear once an organisation's employees leave a building. The physical system is made up of many widely available machines, but some machines may have undergone development or modification within an organisation over time and so may not be available on an open market. These modifications are the result of learning within the organisation and are a way of embedding the knowledge gained. This makes the knowledge accessible into the future, even after the individuals involved leave.

The availability of physical systems to all organisations is complicated by the existence of patents and other restrictions on use. Many industrial processes may have their specifications clearly described within patent specifications, although in the public domain their use is restricted. This makes their imitation by competitors difficult. For this reason, some physical technical systems are kept secret, although it is worth noting that as the skills and knowledge required to utilise physical systems resides with employees, simply

imitating a competitor's 'secret' technology cannot guarantee gaining the competitor's capability.

4.3 Managerial systems

Leonard stresses the importance of managerial systems for channelling the management of knowledge. Additionally, recruitment, education, training and incentive practices can all influence a capability.

4.4 Values and norms

Values and norms within an organisation will often influence the type of knowledge and, hence, the capabilities seen as important to an organisation. These norms are likely to be longstanding and traceable to the organisation's inception and/or founders, as for example, is frequently claimed to be the case for Apple, Google, Wikipedia, or the successful retail chain, John Lewis, in the UK. Expression of these values will have an effect in that people in an organisation are partly self-selected and the legitimacy of potential new product developments is often validated by the overarching values of the organisation.

Any discussion of the anatomy of a capability would not be complete without recognising two further, fundamental features – organisational routines and learning.

4.4.1 Organisational routines

It is clear that the individual components of a capability should not be seen as separate: managerial systems, skills and knowledge and values and norms are all inextricably linked. Furthermore, they develop in parallel over time as a result of an organisation's learning processes. Thus, it is the various dimensions acting together that constitute the capability – but, crucially, the formation and enactment of capabilities rely on organisational routines (Leonard, 1995).

Organisational routines are the organised activities carried out by an organisation as a result of learning and experience. They may be clearly described within an organisation's policies and procedures, or may be only partially described, with a large proportion of how and why a particular process is being used held tacitly in the heads of individuals or within or between groups.

Organisational routines develop informally within organisations. They reflect the influence of the organisation's management but also other influences on the way that things are done, such as peer or group pressure or tradition and long established practice within an organisation. They are the result of learning from experience on the part of many individuals. Routines can therefore be seen as part of organisational memory.

Organisational routines are important because they represent how tasks and processes are actually carried out within organisations. Thus, for a particular process there will often be a formal specification of how this operates that constitutes the espoused way of doing things. Unfortunately, owing to the difficulty of describing every minute detail of a process, some activities are likely to remain unspecified. Coupled with this, individuals and groups involved in operating a process will often find better and different ways of operation. This may be because they find a more efficient method or they may find that some unforeseen constraint makes the espoused process impractical and some 'work around' is developed.

In the context of a specific technology, for example, the associated 'informal' organisational routines may be more effective than the espoused mode of operation. But it might also be the case that these new 'informal' routines are only optimal for the group of people developing them and not necessarily for others, or indeed the organisation as a whole.

In summary then, there are two important implications of Leonard's model that are now widely accepted. The first is that *a capability does not exist in a single dimension*. For example, possessing a machine (a physical technical system) does not constitute having the capability to make use of it. Likewise, possessing employee knowledge and skill *and* the physical systems does not constitute a capability if the organisation has neither formal (managerial systems) nor informal (appropriate values and norms) control systems. The second is that the dimensions of a capability are essentially subsystems of a system; *a capability therefore constitutes an emergent property* of such a system (i.e. they emerge from the combination of the subsystems).

4.4.2 Learning

Knowledge as a core capability is of relevance to learning, and so it is useful to briefly examine a few points about learning here. The first is to recall Zawislak et al.'s (2012) definition of an innovation capability and their acknowledgement that organisational learning sits at the core of that capability. It also means that as this is a meta capability, and therefore incorporates other capabilities, learning is therefore relevant to them all. The second is to record Dodgson et al.'s succinct note that 'Learning can be described as the ways firms build, supplement, and organise knowledge around their capabilities and processes and within their cultures, and adapt and develop organisational efficiency through improving their use.' (2008, p. 121).

Note, once again, that this description of learning is not only relevant to 'firms' but to organisations more generally. Thus any organisation can and should aim to be a learning organisation. But I should also add that for organisations that operate in environments that are subject to rapid and disruptive economic, technological or social change, a certain type of learning is important. Specifically, this means moving beyond 'learning' by 'doing' or 'using' (frequently referred to as 'single-loop' learning), which follows a linear process of error-detection-correction which is suitable for adapting and improving existing competencies/capabilities (and is probably the type of organisational learning most of us will be familiar with) to double- and even triple-loop learning (Argyris and Schon, 1978).

There is a wealth of material on these forms of learning available on the internet and as they are also the staple of many training and management consultancy programmes you may well be familiar with them. Indeed, many organisations claim to have moved beyond single-loop learning to the more sophisticated double and triple-loop examples.

Double-loop learning is a four stage process of error – detection – correction – modification 'which questions the validity of current competencies and facilitates the construction of new ones … It is a key element of a firm's [an organisation's] innovative capabilities.' (Dodgson et al. 2008, p. 121). Double-loop learning is often associated with 'thinking outside the box'. In other words, creativity and critical thinking are (or should be) a core feature of this approach.

Triple-loop learning is frequently seen as learning how to learn, primarily by reflection on the learning process. It is also sometimes referred to as double, double -loop learning (i.e. double-loop learning about double-loop learning).

Having now established what the basic anatomy or building blocks of a capability are, it is an appropriate point at which to move on and delve deeper into the composition and strategic significance of competences and capabilities.

5 Resources, competences and capabilities

The resources an organisation possesses are clearly central to the RBV but as the approach has developed, the idea of what constitutes a resource has been refined. This is largely due to attempts to distinguish between resources that are strategically important and those that are not. The result, as we have already seen from the material discussed so far, has been that many scholars of RBV use the terms 'capability' and 'competence' rather than 'resource' when discussing RBV research and theory. However, the meaning of capability and competence overlaps and thus establishing what is what can be confusing. Both terms relate to knowledge and its use in organisations, and are consequently a product of organisational learning, which is to be expected given the discussion in previous sections of the anatomy of a capability.

For example, Boisot (1998, p. 5) defines a competence as 'the organisational and technical skills involved in achieving a certain level of performance.' He then defines capability as a higher level concept: '[Capabilities] are focused on a broad range of characteristics that together explicitly address customer needs. Competences are narrower and more technically defined.' To use Boisot's example: a competence in jet engine design and manufacture may produce one with low fuel consumption and low noise − essentially a technically defined skill. By contrast, a capability relates to the organisation's ability to produce engines with price, performance, and delivery characteristics that respond to a wide variety of clients.

A further refinement of RBV terminology is the use of a term that has already been noted: 'core capability' or 'core competence'. In essence, this implies that the capability or competence has a higher degree of *strategic importance* (as we saw with the example of robotic technology and minimally invasive surgery earlier in the block). Teece describes a core competence as:

> Those competences that define a firm's fundamental business as core. Core competences must accordingly be derived by looking across the range of a firm's (and its competitors) products and services. The value of core competences can be enhanced by combination with the appropriate complementary assets.
>
> (Teece, 1986, p. 23)

Complementary assets in this context are those resources or capabilities that enhance a core competence in some way. They may already be available within the organisation, or they may need to be acquired. This may mean licensing a technology, building alliances, or buying out other organisations.

A comparatively recent example of this has been the way the British retailer Tesco launched the Hudl, its own tablet computer. It is clear from the 'Extend your learning' activity that follows, that Tesco were not attempting to switch markets to become a direct competitor to Apple or Microsoft. Instead, it is important to see this in terms of acquiring a complementary asset to its core business of retailing. The launch of Hudl represents a conscious development of capabilities that underpin Tesco's core business of multi-channel retailing and its high-level strategic aspiration to develop sustained customer

loyalty. It should be noted that the technology for Hudl was by no means specialised, comprising relatively standard hardware and software that could be regarded as commodities to be bought in. The strategic importance of Hudl is that it underpinned the important aim of developing Tesco's core capability in managing big data.

Extend your learning

For more on the Hudl tablet, read the following article from The Independent newspaper: Gallagher, P. (2013) 'Hudl tablet: Move into digital market is a significant step in Tesco's data-driven business', *The Independent*, 15 October [Online]. Available at http://www.independent.co.uk/life-style/gadgets-and-tech/hudl-tablet-move-into-digital-market-is-a-significant-step-in-tescos-data-driven-business-8881027.html

5.1 Recognising a core competence/capability

Prahalad and Hamel (1990) suggest that recognising a core competency when you see one hinges on the answers to three questions:

- Does the competence provide access to a wide variety of markets?
- Does the competence make a significant contribution to the perceived customer benefits of the end products?
- Is the competence difficult to imitate?

If the answer is yes to all three, the competence is probably core to the organisation. However, and as previously noted, not all competences (or capabilities) are of equal strategic importance; although even when they are not, they may still be significant in that their absence would be detrimental to the organisation in some way. The four characteristics that are commonly accepted as defining a strategic resource are: value, rarity, inimitability and non-substitutability (commonly referred to as the VRIN criteria). To help differentiate between what is what and why, Leonard (1995) usefully outlines three levels of capability (her preferred term) that give increasing levels of strategic significance: *supplemental*, *enabling* and *core* capabilities.

Activity 1

Using an organisation that you are familiar with, or one of your choice, use the criterion set out above to identify at least one core competence.

We have already established that a core capability is the most valuable to an organisation due to its strategic importance and the difficulty a competitor would have in imitating it because organisations build up core capabilities over a long period. Enabling and supplemental capabilities have less competitive importance.

5.2 Enabling capabilities

Enabling capabilities are those that, on their own, do not provide a competitive advantage but are necessary because they provide an organisation with the means/ability to operate

at the same level of competitiveness as other, similar, organisations. In the case of a hospital, for example, the capability to carry out certain advanced procedures may be possessed only by leading teaching hospitals. In other words, the capability of a hospital to combine supplemental and enabling capabilities so that the resulting capability is difficult to imitate and has direct patient benefit would then constitute a core capability. Note that enabling capabilities may still be difficult for competitors to imitate.

5.3 Supplemental capabilities

By contrast, supplemental capabilities are easily accessible to all organisations, often being freely and/or commercially available. Supplemental capabilities add value to core capabilities but on their own are not particularly distinctive. For example (and sticking with the medical theme used previously), the provision of an intensive care unit in a hospital is not in itself a core capability. The capability of providing intensive care to patients is well developed, with both the necessary people and technologies freely available to employ or purchase. However, provision of an intensive care facility is supplemental to a more core capability such as expertise in heart surgery.

In the context of the RBV and the capabilities approach more generally, the crucial point to reiterate is that core competences and capabilities are not bought 'off the shelf' and it is this that makes them so powerful. Instead, and crucially, a core capability will be the product of learning in the organisation over a long period, as previously noted. For example, Tesco's (and other large retailers') core capability in managing big data is a distinct and difficult capability to replicate, having developed through their experience over a sustained period in developing web-based business and operating a long running loyalty (card) scheme. Clearly, a core capability such as this cannot be bought in. However, it is important to note that many of the complementary assets that support the core capability – such as IT hardware and software, expertise in programming and data capture and so on – can be bought in, and these supplementary and enabling capabilities must be in place to allow core capabilities to be developed.

Activity 2

Using an organisation you are familiar with, or one of your choice, identify at least one example of a supplemental and one example of an enabling capability that relates to the core competence you identified in the previous activity.

6 Core rigidities

It is one of the enduring features of innovation that the capabilities that can make an organisation innovative and successful at one time and in one set of conditions can also be responsible for its decline in another. Or, as one of the pioneers of the approach succinctly put it:

> The perplexing paradox in managing core capabilities is that they are core rigidities. That is, a firm's strengths are also – simultaneously – its weaknesses. The dimensions that distinguish a company competitively have grown up over time as an accumulation of activities and decisions that focus one kind of knowledge at the expense of others. Companies, like people, cannot be skilful at everything. Therefore, core capabilities both advantage and disadvantage a company … So long as conditions remain constant, managers experience the advantages of that interdependent system. In the face of a changing business environment, or when the system itself matures into mindless routine, managers find themselves fighting the very underpinnings of the firm's success. One or more of the dimensions are pathological, are clogging up the flow of knowledge.
>
> (Leonard, 1995, p. 30)

Again, the point has to be made that core rigidities are not simply a feature of commercial 'companies', they can and do afflict all types and sizes of organisation. Consequently, if we return to the dimensions of a capability noted in my earlier discussion of Leonard's work, the following three sections are examples suggested by Leonard of why core rigidities develop that are actually applicable to any organisation.

6.1 Managerial systems

The way that a capability develops is affected by the managerial systems in place. Indeed, managers and the systems they operate that are overly risk-averse; based on blame and punishment, as opposed to trust and rewards; bullying and inflexible, and so on, can all block the development of a capability before it has even begun.

6.2 Values and norms

The values that underpin a capability can, if not modified, prove to be limiting to an organisation. This is particularly the case as technology changes and in turn the match between customer expectation and what is technically possible diverges.

6.3 Insularity

In some cases there is group think or simply a culture that does not encourage the challenging of an organisation's currently successful actions. This has been widely

accepted as the root cause of the problems experienced by IBM during the 1990s when its management failed to respond to changes in the computer market.

In summary then, we might accurately describe how the trajectories of organisations (and in turn their capabilities) can lead from success to failure as a problem rooted in finding a good thing to do but then continuing to do it in spite of the situation changing. Or to put it even more succinctly, doing the wrong thing well (Miller, 1990).

Figure 4 An example of a technology that eventually became a core rigidity in many organisations: the mainframe computer.

7 Core capabilities as knowledge assets

There may have been a time in history when it was possible to value an organisation simply on the basis of its physical assets (e.g. goods, materials, plant, and buildings) and a very small number of intangible assets such as the goodwill of customers. But now the global economy, and society more generally, has moved towards one based on information and knowledge, putting a value on an organisation has become much more complex, largely because of the increased emphasis on and recognition of the value of an organisation's intellectual capital – or knowledge assets.

In the case of many of our most well-known IT and technology companies, for example, this value is often in the source code of their software, their patents, and their brand names. By comparison, the physical assets they hold may be relatively low in value.

As Dobni (2010, p. 56) notes:

> This knowledge is fuelled by interaction with customers and value chain members in the competitive cluster. Second, knowledge is power, and for organizations, knowledge only becomes powerful if it is disseminated amongst those who possess common goals. The degree to which this knowledge is shared (the organization's knowledge dissemination capacity) will propel innovation as it affords an organization both offensive and defensive positioning options.
>
> (Dobni, 2010, p. 56)

7.1 The human dimension

Dobni's points also reinforce the importance of organisational learning that has already been noted on more than one occasion in this course. Furthermore, the point about knowledge dissemination propelling innovation is clearly pertinent to any type of organisation. And given the integral relationship between any organisation's employees and knowledge it is (or ought to be) not only knowledge assets and their creation that are recognised as of strategic importance to all organisations - people should be, too. Unfortunately, the human dimension of knowledge assets is often overlooked or undervalued (as it is in the case of most capabilities), both by scholars of the RBV and the management of organisations. This is both short-sighted and dangerous, of course, given that within any organisation it is its employees who are the primary repository for and source of knowledge.

Leaving this potentially thorny issue to one side, however, an obvious question arises concerning how we treat intellectual assets such as those that underpin a capability. The answer is not in the same way as other assets because there are differences between intellectual assets and the other categories of asset found in an organisation. This means we need to find new ways of thinking about their management. In some cases, for example, knowledge may need to be kept secret, as in the case of the source code of software/apps. In other situations, allowing knowledge underpinning a capability to diffuse to suppliers or customers may result not only in payment for the knowledge but other benefits, such as refinement of, or addition to, the original knowledge asset. But how can

knowledge assets be managed so as to gain most value from them? To answer this question it helps to understand the forms that knowledge takes in an organisation.

7.2 Knowledge creation: codification, abstraction and diffusion

Recognising that knowledge does not exist in a single form is the first step in knowledge creation. The first distinction to be made is therefore between 'tacit' and 'explicit' knowledge. The difference between the two can be illustrated by the analogy of teaching someone to ride a bicycle. The basic technique of riding can be explained but it is impossible to communicate the nuances of coordination required to balance the machine upright or negotiate a bend in the road. Similarly, the written convention of how to proceed on the public highway can be explained, but it is much more difficult to transfer the skills required to anticipate another road user's actions.

Figure 5 New York riding school, circa 1869.

In this example, the *explicit* knowledge is that required to understand and apply the conventions of what part of the bicycle to hold onto and the basic sequence of events to pedal, brake and steer successfully. This knowledge is easily communicated and is very often codified into some standard form. In the UK the rules and conventions for travelling on public highways is expressed in the 'Highway Code'. We can see from this that explicit knowledge is relatively easy to transfer but the nuances of coordination or the craft of negotiating heavy traffic is less simple to transfer effectively. Both these areas of knowledge are *tacit* in their nature. In fact, it is impossible to put this knowledge into words in a complete manner. Tacit knowledge is embedded in the individual or shared between groups of people. It can only be transferred through gaining experience of the relevant domain.

Within the knowledge management literature there has been much discussion about the problem of transforming tacit to explicit knowledge. A particularly useful approach for this course – because it helps us gain insights into the relationship between a capability and its potential for value creation (and therefore in a commercial setting, competitive advantage) – is the argument that there are three dimensions to knowledge. Boisot (1998) identifies these as, codification, abstraction, and diffusion.

7.2.1 Codification

Codification relates to the degree to which knowledge has been formalised. It is an important process for knowledge as it increases its potential for communication and transfer. Boisot suggests that uncodified knowledge is knowledge that cannot be captured in writing or stored without losing the essentials of the experience it relates to. It relates closely to the idea of tacit knowledge, though it could remain uncodified for a number of reasons:

- some knowledge is not codified because it is commonly held by a specific group. It is not that it cannot be codified, it is simply ubiquitous to that situation or culture and remains to be taken for granted
- some knowledge may not be codified because no one can fully understand it and so it remains elusive and inarticulate
- some knowledge remains uncodified because there is a cost associated with codifying it. This may be the cost of the process to articulate the knowledge. It may also be the (personal) cost to the holder of the knowledge of yielding it to a wider audience.

The benefit of codified knowledge is that it allows greater access to it. In many areas the codification of a procedure packages the knowledge to give more individuals and organisations the opportunity to use it. In some cases this leads to de-skilling of the task in hand. For example, transferring a craftsperson's skill into a computer program for operating a lathe allows a lower-skilled operator to produce a finished article to the same standard as the original craftsperson. And the development of a 'script' for use in a telephone call centre allows the de-skilling of people doing customer-facing jobs such as telephone selling or customer support. The original knowledge from experts is codified into the script. The importance of codified knowledge is that the 'friction' of transfer is greatly reduced.

Activity 3

Using an organisation you are familiar with, or one of your choice, identify an example of the codification of knowledge into a form that allows wider understanding and use to be made of it.

7.2.2 Abstraction

Codification of knowledge is obviously attractive for an organisation when it wants to extend the number of individuals and groups making use of it. The limitation of codification is that the knowledge can remain local to its original domain or purpose. A call centre script for selling double-glazing may well prove of limited use to a person working in a call centre providing customer support for a public utility.

However, in many cases there is likely to be an aspect of local domain knowledge that has a broader relevance to other domains and contexts. To make the transfer from one domain/context to another possible knowledge must be transformed from the highly concrete experiences in which it was produced and abstracted. The result is knowledge that is more conceptual and is therefore no longer tied to a specific local domain. An example would be undergraduate degree programmes where the knowledge taught to students has been abstracted. For mechanical engineers, for example, their study of stress analysis may later be applied in a range of contexts from aerospace to consumer goods. For computer science students their study of systems analysis may later be applied in many different commercial sectors.

7.2.3 Diffusion

The third dimension of knowledge is its degree of *diffusion*. This is a central theme in technology and innovation management where interest in how technology transfer occurs has been the focus of many studies. For our purposes, however, we can think of diffusion as relating to the extent to which knowledge has transferred within a population of potential recipients. The population may be made up of individuals, groups, organisations or even industry sectors. Diffusion can be measured in percentage terms, though care needs to be taken about being clear as to how the *relevant* population is defined. For example, members of the population for whom knowledge about a continuous improvement methodology is relevant may not all possess either the means or the ability to make use of the knowledge. In this case 100% diffusion is both inappropriate and unlikely.

Activity 4

Using an organisation you are familiar with, or one of your choice, identify an area or type of technological knowledge that has been diffused. Briefly assess how diffusion occurred over time and the extent of the diffusion.

As noted previously, the ‘dimensional’ approach to the classification of types of knowledge is a very useful way of looking at capability, particularly in terms of how capabilities develop and also change in their potential for creating value. For example, we can see that for technological capability we are likely to be interested in all three dimensions. By codifying the knowledge defining a capability, it increases the potential for diffusing the capability to other parts of an organisation or even outside the organisation. Similarly, by abstracting the knowledge, the potential for applying the capability into new areas is also enhanced. Finally, the degree of diffusion will define the potential for gaining value from the capability.

Conclusion

We have now examined why the RBV and capabilities approach is so important to understanding and delivering innovation; briefly reviewed the genesis and development of the approach; outlined the anatomy of a capability, and the nature of – and differences between – resources, competences and capabilities and their 'core' variants; and discussed knowledge assets as core capabilities. This free course *Technological innovation: a resource-based view* has enabled you to develop a critical understanding of the development, management and application of some of the most important capabilities of technological innovation.

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References

Argyris, C. and Schon, D. (1978) *Organisational Learning*, Boston, MA, Addison-Wesley.

Baregheh, A., Rowley, J. and Sambrook, S. (2009) 'Towards a multidisciplinary definition of innovation', *Management Decision*, vol. 47 no. 8, pp.1323–1339.

Bell, M. and Pavitt, K. (1995) 'The development of technological capabilities', *Trade, technology and International Competitiveness*, vol. 22, pp. 69–101.

Bessant, J., Moslein, K., Neyer, A-K., Piller, F., and von Stamm, B. (2009) *Radical Innovation: making the right bets*, London, Advanced Institute of Management (AIM). [Online]. Available at http://www.aimresearch.org/uploads/File/Publications/Executive%20Briefings%202/Radical_Innovation_Making_the_right_bets.pdf (Accessed 19 April 2016).

Bessant, J., and von Stamm, B. (2012) *Is discontinuous innovation on your corporate radar? Twelve search strategies that could save your organisation*, London, Advanced Institute of Management Research (AIM). [Online]. Available at http://www.aimresearch.org/uploads/File/Publications/Executive%20Briefings%202/12_search_strategies.pdf (Accessed 19 April 2016).

BIS (2011) *Innovation and research strategy for growth* [Online]. Available at: https://www.gov.uk/government/publications/innovation-and-research-strategy-for-growth (Accessed 18 December 2015).

Boisot, M.H. (1998) *Knowledge Assets: Securing Competitive Advantage in the Information Economy*, Oxford University Press.

Coombs, J. and Bierly, P. (2006) 'Measuring technological capability and performance', *R&D Management*, vol. 36, no.4, pp.421–438.

Chandler, A.D. (1992) 'Organizational capabilities and the economic history of industrial enterprise', *Journal of Economic Perspectives*, vol. 6, No. 3, pp. 79–100.

DeSarbo, W. S., Di Benedetto, C.A. and Song, M. (2007) 'A heterogeneous resource based view for exploring relationships between firm performance and capabilities', *Journal of Modelling in Management*, vol. 2, no. 2, pp. 103–30.

Dobni, C.B. (2010) 'Achieving synergy between strategy and innovation: The key to value creation', *International Journal of Business Science and Applied Management*, vol. 5, no. 1, pp.49–59.

Dodgson, M., Gann, D. and Salter, A. (2008) *The Management of Technological Innovation*, Oxford University Press.

Gallagher, P. (2013) 'Hudl tablet: Move into digital market is a significant step in Tesco's data-driven business', *The Independent*, 15 October [Online]. Available at http://www.independent.co.uk/life-style/gadgets-and-tech/hudl-tablet-move-into-digital-market-is-a-significant-step-in-tescos-data-driven-business-8881027.html (Accessed 18 December 2015).

Godin, B. (2008) 'In the Shadow of Schumpeter: W. Rupert Maclaurin and the Study of Technological Innovation', *Minerva*, vol. 46, no. 3, pp. 343–360.

Gómez-Schlaikier, S. (2009) *The Intercultural Competence As A Key Element For The Development Of Peru* [Online]. Available at http://econpapers.repec.org/article/risjoefas/0005.htm (Accessed 4 December 2015).

Hippel, E, von (2005) *Democratising Innovation*, Cambridge, MA, MIT Press.

Katz, J. (1984) 'Domestic technological innovations and dynamic comparative advantage: Further reflections on a comparative case-study program', *Journal of Development Economics*, vol. 16, nos 1−2, pp. 13−37.

Kim, S.E. and Chang, G.W. (2009) 'An Empirical Analysis of Innovativeness in Government: Findings and Implications', *International Review of Administrative Sciences*, vol. 75, no. 2, pp. 293–310.

Kotabe, M. Srinivasan, S.S. and Aulakh, P. (2002) 'Multinationality and Firm Performance: The Moderating Role of R&D and Marketing Capabilities', *Journal of International Business Studies*, vol. 33, no. 1, pp.79–97.

Lall, S. (1992) 'Technological capabilities and industrialisation', *World Development*, vol. 20, no. 2, pp. 165–186.

Leonard, D. (1995) *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*, Boston, MA, Harvard Business School Press.

Menguc, B., Auh, S. and Yannopoulos, P. (2014) 'Customer and Supplier Involvement in Design: The Moderating Role of Incremental and Radical Innovation Capability', *Journal of Product Innovation and Management*, vol. 31, no. 2, pp. 313–328.

Miller, D. (1990) *The Icarus Paradox: How Exceptional Companies bring about their own Downfall: New Lessons in the Dynamics of Corporate Success, Decline, and Renewal*, New York, Harper Business.

Miller, J. and Roth, A. (1994) 'A taxonomy of manufacturing strategies', *Management Science*, vol. 40, No. 3, pp. 285−304.

Newbert, S.L. (2007) 'Empirical research on the resource-based view of the firm: an assessment and suggestions for future research', *Strategic Management Journal*, vol. 28, no. 2, pp. 121–46.

OECD (2005) *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, 3rd ed., Luxembourg, OECD/Statistical Office of the European Communities.

Penrose, E.T. (1959) *The Theory of the Growth of the Firm*, New York, Wiley.

Prahalad, C.K. and Hamel, G. (1990) 'The core competences of the corporation', *Harvard Business Review,* vol. 68, no. 3, pp. 79–91.

Reichert, F., Beltrame, R., Corso, K., Trevisan, M. and Zawislak, P.A. (2011) 'Technological capability's predictor variables', *Journal of Technology Management & Innovation*, vol. 6, no. 1, pp. 14–25.

Rogers, E. (2003) *Diffusion of Innovation*, London, Free Press.

Rothwell, R. (1992) 'Successful Industrial Innovation: Critical Factors for the 1990s', *R&D Management*, vol. 22, no. 3, pp. 221–239.

Saloman, J. (2009) 'Managerial capabilities in Peruvian family companies: An exploratory study', *Journal of CENTRUM Cathedra*, vol. 2, no. 1, pp. 108–135.

Santhanam, R. and Hartono, E. (2003) 'Issue in linking information technology capability to firm performance', *MIS Quarterly*, vol. 27, no. 1, pp. 125–153.

Schumpeter, J.A. (1912) [1934]) *The Theory of economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle*, Cambridge, MA, Harvard University Press.

Subramaniam, M. and Venkatraman, N. (2001) 'Determinants of transnational new product development capability: testing the influence of transferring and deploying tacit overseas knowledge', *Strategic Management Journal*, vol. 22, no. 4, pp. 359–378.

Teece, D.J. (1986) 'Profiting from technological innovation: Implications for integration, collaboration, licensing and public-policy', *Research Policy*, vol. 15, no. 6, pp. 285–305.

Teece, D.J. (2011) 'Dynamic Capabilities: A Guide for Managers', *Ivey Business Journal Online*, vol. 75, no. 2. p. 29.

Teece, D.J. (2014) ‘A dynamic capabilities-based entrepreneurial theory of the multinational enterprise’, *Journal of International Business Studies*, vol. 45, no. 1, pp. 8–37.

Teece, D.J., Pisano, G. and Shuen, A. (1997) ‘Dynamic capabilities and strategic management’, *Strategic Management Journal*, vol. 18, no. 7, pp. 509–33.

Tello-Gamarra, J. and Zawislak, P.A. (2013) ‘Transactional capability: Innovation’s missing link’, *Journal of Economics, Finance and Administrative Science*, vol. 18, no. 34, pp. 2–8.

Wernerfelt, B. (1984) ‘A resource-based view of the firm’, *Strategic Management Journal*, vol. 5, no. 2, pp. 171–80.

Zawislak, P.A., Alves, A.C. et al. (2012) ‘Innovation Capability: From Technology Development to Transaction Capability’, *Journal of Technology Management & Innovation*, vol. 7, no. 2, pp. 14-26.

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