Journal of Business Chemistry

Commentary

The long term survival through innovation

John Bessant*

* Technology Management Consultants, Teignview Rd 54, TQ14 9SZ, Bishopsteignton, United Kingdom, johnrbessant@gmail.com

DOI:10.17879/55199637235 ; URN: urn.nbn:de:hbz:6-55199640533

1 Introduction

Next time you switch on your TV or computer display spare a thought for the company who probably produced the liquid crystal display. With over 60% of the global market, the German company Merck is probably not one which would instantly come to mind. Nevertheless, they dominate this and a wide spread of other activity in the chemical and pharmaceutical world (Bessant, 2017).

Or think about the headlights in the car you are driving – there's a pretty good chance that they will be made by another hidden champion, the German company Hella. They are a major international player in this market with an increasingly significant role in the expanding world of automotive electronics.

Turn on your air conditioner or your heating system and the chances are the pump driving it is made by the German company Wilo. Founded in 1872 it has evolved into one of Europe's most successful manufacturers of pumps for a wide range of domestic and industrial applications.

And if you ever need your aircraft, car or truck modified, upgraded or configured for some special application there's a good chance you might approach the Marshall Group in the UK. Once again a major global player in the specialized area of adaptive engineering.

Even something as basic as eating breakfast offers an interesting story. There's a good chance that you are in the company of around one billion people who like you have consumed cheese, perhaps a yogurt, or some delicately colored juice drink, all products enabled by the Danish company Christian Hansen. They have spent the last two hundred years developing and supplying a huge range of live bacterial cultures to the food industry around the world. These days they also dominate the world of food coloring and have a growing presence in the field of healthcare via probiotics.

Visiting your supermarket to buy your breakfast goodies you might still be paying in cash. And if you did there's a good chance that the banknotes you exchanged were made by another company, De La Rue. Like the others, they have been doing this a long time, specializing in high precision printing for the past two hundred years. Their track record of world first includes inventing the modern playing card in 1831 and diversifying through postage stamps, identity documents and high security products.

2 The 'one-hundred club'

These are all examples of the 'Hundred Club' – companies which have survived and prospered for over a hundred years. (In the case of Merck they will need a very big cake to take all the candles for their celebrations – the company was founded back in 1668 and is the world's oldest pharmaceutical and chemical company!)

Needless to say not many organizations manage to do this over an extended period. Anyone might get lucky once - but whilst we hear a lot about start-ups as the exciting 'sharp end' of innovation, the reality is that most of them do not stay the distance. Growing a business from these early seeds is not simply a matter of time – there is no guarantee of survival. It's a process fraught with challenge and based on crisis – riding the waves of change and being able to stay on top (even if its' a rough ride) rather than being drawn under.

Those organizations, which do survive over the long-term, may come from many different sectors. But they share the ability to ride out

the waves of change which a turbulent and uncertain environment creates. They may find themselves blown a long way from their original course – for example the German firm of Preussag began life as the (public sector) state lead mining and smelting company in Prussia, back in 1917 (Francis et al., 2003). These days it still trades very effectively but now as one of the world's major players in the tourism and transportation sector. Corning began life as glassmaker back in the 1850s; these days its world is more concerned with life sciences and communications technology. Moreover, there is the well-known example of Nokia, beginning its hundred year plus journey as a paper and pulp producer in the Swedish forests, moving through the world of mobile phone handsets and currently dominant in the cellular network technologies behind telecommunications. Rather like its slightly older cousin, the Stora company which began as a paper-maker in the thirteenth century and is now a key player in the energy industry.

Riding out these waves of change also involves being prepared to refit and sometimes redesign the ship. Long-term survivors also change the ways in which they work, especially in the underlying innovation processes, that they use. For example Procter and Gamble spent over a century working very well to bring a steady stream of household product innovations to market using a model based on internal R&D and extensive market research. But in 1999 they shifted the whole basis of their innovation approach form this rather closed system to a new model, called 'Connect and develop', which embraced the idea of openness and connectivity with a wider external world. Or Philips, closing its vast Eindhoven R&D complex and repopulating it with a wide range of small and start-up firms, creating its version of an innovation ecosystem.

There are others for whom a long period of success is followed by a sudden violent storm that threatens to destroy the whole business, outstripping its ability to stay afloat. Kodak dominated the imaging world, innovated successfully from George Eastman's start-up through generations of change – but nearly crashed on the rocks of trying to make new sense of the digital imaging world. It survives but in a slimmer form, working now to reuse its deep knowledge base in new directions, rather like the survivors of a near shipwreck lashing together a new vessel from the wreckage of the old.

Importantly size is not the issue; survival is not about scale. In this field big is not necessarily beautiful; while it might mean organizations have extra resources to draw upon when times get difficult this alone does not guarantee survival. The statistics on membership of the Dow Jones index give a sobering reminder of that – of the large corporations which were present in 1900 only General Electric made it through to the year 2000 and they eventually fell out in 2018 (Foster and Kaplan, 2002).

3 Innovation at the heart of long-term survival

Survival depends on taking an approach which by its nature is agile and resilient. These might be 'buzz' words today but essentially, they characterize what these players have been doing for an extended period of time. They have grown through an ability to navigate stormy waters and to weather often difficult external market and technological conditions.

At its heart, this requires a commitment to innovation – being prepared to change what the company offers and how it creates and delivers that offering. Such innovation behavior is not about having a lucky new product or service at the right time, or a magic machine, which enhances productivity. It is about a sustained organized commitment and the underlying structures and processes to enable it to happen. In addition, a key part of this commitment is recognizing the need for 'dynamic capability', constantly reviewing the ways they innovate and being prepared to change or adapt the fundamental model underneath.

Each of our examples from earlier began as a start-up – an entrepreneur spotting an opportunity. For David Marshall it was the idea of using the new idea of motor cars to provide an early chauffeur-driven taxi service in the town of Cambridge in 1909. And for Sally Windmüller it was the chance to take his business selling whips, horns and lights as accessories for the horse-drawn vehicles of his time and apply these skills to the newly emerging world of motor cars, founding his company (Hella) in 1899. For Christian Hansen it was the research he was doing on digestive enzymes, which gave him a clue about the need for a business to produce products like rennet – his was a very early ex-

ample of a science-based university spinoff. For Thomas de la Rue it was adapting the emerging science of typography to specialist stationery production – including inventing the modern playing card.

Caspar Opländer's original factory in 1872 was set up to produce copper and brass distillation equipment for the drinks industry. Wilo developed from this primarily through a commitment to innovation, developing the world's first heating pump in 1928.

However, for each of them the bright idea that got them started was just the beginning. Growing through innovation requires a different approach, putting structures and processes in place where there was once fluidity and informal exchange. Striking the balance between creativity and control, between exploration and exploitation, between do better and do different – these are the day-to-day challenges of organizations moving from entrepreneurial start-up mode to long-term large-scale activity.

Their success lies in understanding and managing innovation for the long haul – and this is not an accident. Extensive research suggests that five core themes are involved (Tidd and Bessant, 2018):

- Build competence – grow through what you know.
- Build via networking – organizations don't have to know it all but they do need the ability to find, form and build high performance networks of knowledge.
- Build a capability for innovation, embedding key behavior patterns into routines which can be repeated and form the underlying structure and process.
- Focus innovation in key strategic directions, fully exploring and exploiting innovation space.
- Build dynamic capability – the ability to review, reconfigure and change their innovation models and approaches to suit a constantly changing external environment.

We will look in more detail at each of these in the following section.

4 Five core themes for managing innovation

4.1 Competence - building on knowledge

Innovation relies on new knowledge. Characteristic of all our examples is a story of investing in building a knowledge base, providing the wellsprings from which new opportunities could flow. Marshall's began life in the earliest days of the car industry – they had to learn to repair and maintain their vehicles by themselves, building a deep understanding of how to modify things. This opened up new opportunities; for example, they took a standard Austin saloon car and, using the skills and equipment learned from years of repairing this model in their limousine business, developed an open top sports car. Later on, these skills were transferred to the newly emerging world of airplane maintenance and repair as the next generation of the family moved into this business.

For Sally Windmuller the early days of horns and simple lights drew on a simple knowledge base, one grounded in making and repairing horse drawn buggy equipment. But soon came the need to specialize and learn to understand and control. He had seen the need to invest in what we would now call R&D; for example, early on he saw a key development was going to be the new acetylene lamp – a big move forward compared to the old oil or even candle powered lights. Recognizing the importance of technology led to the award of their first patent, in 1901; this also gave them valuable experience in the process of assembling and protecting intellectual property. In 1906 German light bulb manufacturer, Osram invented the first light bulb suitable for use in automobiles. Because of their early commitment to R&D Sally's company was able to capitalize on this development, making battery-powered electric lamps for cars, including sidelights, rear lights with a red glass cover, and license plate lights.

The same pattern runs through Merck's early history – not just selling pharmaceutical products but also developing a deep understanding of formulations and of the manufacturing techniques needed to make them safely and to high quality. On his gravestone in Darmstadt the tribute to Johann Franz Merck (the 3rd generation of the family) says he was a man who "made great contributions to the pharmaceutical arts" while Emanuel Merck's

1826 work on opium and morphine published in the 'Magazin für Pharmacie' represented a milestone in the transformation from pharmacy handcraft to a research-based industrial company. By 1895, Merck had established a department of bacteriology producing smallpox vaccines, diagnostics for tuberculosis and typhus, as well as sera for anthrax, streptococci, pneumococci and diphtheria.

Christian Hansen's painstaking laboratory work gave him an appreciation of the power of a strong science base from which to grow a business. Developing a deep understanding of enzymes and their properties was part of the story but so too was the underlying process technology needed – understanding how to grow, how to stabilize, how to transport them. These skills embedded in his product technology enabled the company to become a major supplier in the world of cheese making and to build a strong applications base out from that. Their continued investment in understanding the science of microbiology enabled them to enter increasingly sophisticated markets in food and healthcare sectors.

In similar fashion, Wilo's early days as a specialist foundry gave them a deep understanding of how to work complex shapes in metal and maintain precision and quality. De la Rue can trace its technological competence back through a long history of learning about and applying key specialist knowledge in the printing and stationery world.

This is not about making occasional and lucky investments; it is about a sustained commitment to knowledge creation. For example back in 1980 Hella was an early entrant into the emerging world of intelligent electronics – a move which was high risk at the time, costing a great deal with little apparent short-term payoff. However, the seeds sown then have blossomed forty years later with the electronics side of their business now the main driver and likely to grow further with the explosion of applications of intelligent electronics in driverless cars.

Similarly, Christian Hansen's sustained investment in understanding and learning to work with the underlying science of microbiology has made it an essential player in many markets, able to configure solutions based on this deep long-standing knowledge resource. Wilo's pump technology is underpinned by decades of investment in learning by doing coupled with R&D-based scientific understanding. Companies of this kind spend a significant proportion of their turnover on design, research and development activities. For example, Wilo spends around 5% whilst De La Rue recently announced a commitment to double their R&D commitment by 2020.

4.2 Competence is not enough – developing innovation capability

However, knowledge is not enough – we also need to learn how to create value from it. Innovation is not a magical event like the cartoons, where a light bulb magically flashes on above someone's head. It is about turning those ideas – knowledge – into value and that involves a long and uncertain journey. We might manage to get to our destination once by sheer good fortune, but being able to make the journey repeatedly needs much more in the way of a map, provisions, experience.

Successful innovation requires careful management, organizing key behaviors into embedded routines which define the way we approach the challenges of searching for opportunities, selecting the right ones and implementing innovation against a background of uncertainty (Tidd and Bessant, 2018).

Extensive research on innovation management capability over a long period consistently points to the same themes. Innovation does not happen by accident. Successful organizations develop 'routines' – patterns of behavior which become embedded in core processes, structures and policies – they become 'the way we do things around here' (Nelson and Winter, 1982). They put in place processes, which enable search, selection, implementation and the capture of value from their ideas, and they learn from that experience, gradually reinforcing and building innovation management capability.

Of course, the reality of the journey is never as simple as the linear map offered in most textbooks. It is a messy process of stops and starts, dead ends and blocked roads, diversions and hold-ups. On many occasions, we may need to abandon the journey, dust ourselves off and start again in a different direction. But a wide range of studies suggest that there is an underlying journey and there are consistent lessons about the kinds of thing we can do to improve the ways we make it (Van de Ven, 1999).

4.3 Networking – building an ecosystem of innovation

Building a core knowledge base is important – but it can also represent a significant cost to small organizations. This has often been used in the past as an explanation of their lack of innovativeness, but the reality is that it is not an issue of knowledge ownership so much as knowledge acquisition and deployment. Innovation is increasingly recognized as a multiplayer game, one in which the ability to connect to complementary resources is the key (Birkinshhaw et al., 2007).

This concept of 'open innovation' was memorably expressed by a comment made by Bill Joy of Sun Microsystems. He observed that in a knowledge-rich environment of the kind in which we now operate even the largest company has to recognize that 'not all the smart guys work for us'. This has huge implications for the way the innovation game gets played – essentially it flattens the landscape and creates conditions which are more favorable for smaller enterprises. It is not a problem of being small but rather of ensuring that they are connected – and building networks for innovation has become a key success factor in the 21st century (Bessant and Venables, 2008).

'Open innovation' as a formal term was coined by Henry Chesbrough in an influential article and book back in 2003 (Chesbrough, 2003). Since then there has been an explosion of interest in the concept and extensive experimentation with new models for managing innovation more effectively based in increasing the flow of knowledge, both into and out from organizations. The somewhat static picture of the last century where knowledge production and ownership were seen as important has given way to more of a trading environment where managing knowledge flows is the key skill.

Although fashionable now open innovation is not a new message. Our 'hundred club' members have long had an appreciation of this principle and have developed successful growth models, which build on a networked approach to innovation, assembling and managing knowledge partnerships. This has meant they have been able to leverage their own knowledge base and also to take advantage of complementary skills and resources held by others through various forms of collaboration.

The widespread availability of knowledge 'out there' does not mean that organizations can abdicate their own responsibility to develop a knowledge base. Instead it is the presence of that knowledge base which gives them the ability to assess and evaluate external knowledge and to deploy it to advantage – a concept termed 'absorptive capacity' (Cohen and Levinthal, 1990). This is the ability of an organization to identify, acquire, absorb and deploy new knowledge in order to grow. If there is no understanding of the core content then such organizations won't be able to assess what might be relevant to them and they won't have the ability to adapt and configure new knowledge to work for their advantage (Zahra and Georg, 2002).

Track each of our example companies back and we can see that there is a pattern – consistent investment in acquiring knowledge and deploying it in a series of successful new products and processes. For example during the 1990s Hella recognized that the world of the automobile was changing and that trying to compete along such a complex technological frontier required developing networks and partnerships. They began to put these in place via a mixture of acquisitions, mergers and joint ventures, steered by a deliberate 'network strategy' which helped fuel knowledge-led growth across the business (Bessant, 2017).

This move anticipated what was to become an increasingly important shift in the role of automotive suppliers, moving from being simply shops where components could be purchased towards players with strategic knowledge and capability to put together whole systems. Today's elaboration of that network strategy involves strategic partnerships and joint ventures with dozens of companies supporting along the knowledge frontier and feeding into lighting, electronics, aftermarket and special applications fields. A good example is the current ability to work in the strategically important field of camera-based driver-assistance systems. Hella's ability to work in this space comes from their acquisition in 2006 of a small Berlin-based specialist for visual sensor systems.

Open innovation as a principle involves networking widely outside and inside the organization to leverage a broad knowledge base. Companies like Wilo work with customers in close fashion, with many of their projects essentially a result of co-creation amongst part-

ners, and Marshalls have long recognized the value of such user input in their design work. Nor is the networking confined to external sources; Wilo also operates an internal collaborative platform on which all of its 7000 employees can contribute ideas and build and share these to help mobilize their innovation capacity.

4.4 Strategy – direction and distance

Having the capability to innovate and a strong internal and external knowledge base on which to draw is important, but another key element is making sure innovation is strategically directed. Successful innovators recognize that there is a wide field of opportunity and build a portfolio covering and exploring all the innovation space.

In particular, there is the need to balance exploitation and exploration – doing what we already do but better and occasionally doing something completely different. Innovation inevitably involves risk and a balanced portfolio would seek to have a range of projects distributed along this incremental/radical spectrum with the majority around 'do better' improvement agenda but with others pushing the frontiers of radical innovation.

But there is a second challenge in innovation strategy – making sure that the full space available for innovation is explored. It is helpful to think of this space as being mapped by an 'innovation compass' (Francis, D. and Bessant, J., 2005). Essentially innovation can take place in a number of directions but principally we can think about:

- The product or service – what we offer the world.
- The process – the way we create and deliver that offering.
- The position – who we offer it to and the story we tell about it.
- The 'business model' – the way we think about what our organization does and who we do it for.

Most organizations begin life as start-ups with a core product or service offering. But over time innovation needs to move along other directions as well. For example, Christian Hansen's pioneering science in the laboratory would have remained there without the underlying process innovation able to enable reproduce ability, scale, transportation, etc. Wilo's early work as a specialist foundry was customer -led application of process technology and skill; only later did their core product work around pumps come into the equation.

Marshalls demonstrates what happens when companies develop capabilities along both product and process innovation directions – they can configure and create new products through the interplay of these complementary capabilities.

But whilst product/process innovation remains a key axis along which considerable activity can take place a key characteristic of hidden champions is their exploration of innovation space enabled by position innovation. By entering new markets, especially internationalizing at an early stage, they confront key challenges which require very different configurations to solve. Drawing on their product and process innovation skills but also learning with the new marketplaces stretches and extends their capacity as innovators, expanding their markets in the process.

Relationships with key customers matter because they enable a flow of key knowledge between the players – for example, Christian Hansen's ability to configure bacterial strains for different environments owes much to its close links with cheese makers around the world, established and worked on over decades. Marshall's business has been built on close partnerships with customers, learning from and with them in what is essentially joint problem-solving activity.

Of growing significance in todays' environment is the ability to innovate the underlying core business model, which drives the business – 'paradigm innovation'. We can see this willingness to reframe in our examples; each of them has had episodes in their history where they have redefined themselves, letting go of some of their original core and identifying new ways in which the business will create value in the future. For example, Marshall's moved in the post-war years from a contractor model, relying on its close links with key customers to one in which they increasingly became a design and knowledge partner. Rethinking that business model anticipated in many ways the move towards 'servitization'; which characterizes and increasing number of project-based manufac-

turing organizations today.

For De La Rue the shift was from working with advanced and specialized printing technologies to reframing the business as one in which security was the defining feature. It had the effect of moving them out of certain markets but also towards close relationships of trust with key agencies for whom high security documentation is of central importance. As their business moves increasingly into the digital world, so this business model has to adapt again.

Christian Hansen's business moved, like Marshalls, from supplying products to increasingly delivering a science-based service, customizing and configuring to suit highly specific needs. And Hella is now in the position of adapting and extending its business model as it moves from a role as an automotive component supplier to a high technology provider of intelligent electronics with potentially wider application possibilities in the emerging markets created by the 'Internet of Things'.

4.5 Dynamic capability - modifying the DNA of innovation

As if innovation was not already a tough enough order there is one final element which comes into play. We also need the capability to step back from time to time and reflect on how well we are managing it. In a changing world are our recipes, our organizational structures and processes still the right ones? Do we to keep on, cut back or develop new routines? Does our approach to managing innovation still fit the world in which we are trying to operate? So as well as the capability to turn knowledge into value we need a second order capability to reflect and learn, constantly tuning our approach. What we could term dynamic capability.

In 1962 the Nobel Prize for Medicine was awarded to Frances Crick, James Watson and Maurice Wilkins for their work unravelling the structure of the DNA molecule. Together with others in the team like Rosalind Franklin they were able to open the door to our better understanding of genetics – how characteristics are passed on from generation to generation.

Strands of DNA make up genes and these provide the carriers for what makes an individual in terms of their make-up and behavior – blue eyes, long legs, stronger heart, etc. Genes encode the programs for the future and being able to carry forward key characteristics enables us to survive in hostile and complex environments.

Understanding the building blocks through which genetics operates moved us to a new world where we can now engage in genetic engineering – removing troublesome genes or switching them off, splicing in new ones with additional capabilities, improving the health of existing ones.

We often use the metaphor of DNA when talking about organizations. Their routines for innovation are effectively the expressions of 'genetic coding' around how we tackle the day-to-day challenges of creating value from knowledge. How we search, how we choose projects, how we allocate resources, how we build teams, and so on.

The big difference between an organizational model and the wider world of evolutionary genetics is that we do not have to wait for random mutations to modify the genes. Within organizations, we can carry out 'genetic engineering' to revise and reshape the genes in more active ways. That is the role of innovation leadership, trying to create organizations, which are well adapted for their current and future environments.

So over time if an organization is to survive and continue to innovate it needs to find some way of passing on its genes – continuity. And it also needs to have the capacity to review, revise and modify its genetic make-up for innovation – changing some and splicing in others, adding to the overall capability.

'Dynamic capability' of this kind is the third key to innovation longevity (Teece and Pisano, 1994). Being able to step back and review routines, asking key questions like:

- More of - of the routines we have in place which ones do we need to strengthen, build on?
- Less of – of our routines which ones should we change, or perhaps eliminate, since they are no longer appropriate?
- Different – which new tricks do we need to learn, which new behavior patterns do we need to rehearse and embed?

Once again, we can see this ability – to review and to reconfigure innovation routines –

at the heart of organizations with long-term aspirations. Businesses like 3M are renowned for their reflection, their ability to look at their routines and change them – for example modifying their Six Sigma efforts when those seemed to be stifling the flow of breakthrough ideas within the business. Or companies like Philips and Procter and Gamble, radically reconfiguring the way they worked with knowledge and moving from an emphasis on knowledge production and ownership towards more open fluid approaches involving rich external linkages.

This willingness to challenge and revise approaches, which have worked in the past, is another feature of our long-term survivors. In the case of Hella we can see innovation move from a fairly ad hoc informal process to one which is at the heart of their success. Their history has been one of reviewing and adapting innovation capability, adding new elements, adapting others, letting others go. Their early commitment to R&D led to increasing formalization, to recruitment of specialist staff and establishment of departments within which they could operate. That commitment remains today with around 10% of turnover being ploughed back into knowledge creation – but the structures to enable the work of those scientists and engineers have changed. At key points in their history, we can see this kind of strategic reflection at work.

For example in the 1980s there was an explosion of product development, new ideas flaring up everywhere, some customer-led, some opportunistic deployment of new technologies. What was clear was an increasing lack of focus or control – one review suggested that of around 4000 projects a small number – less than a hundred) made up the main contribution to sales, accounting for around 80%. A further 300 delivered around 15% of sales and the remainder – 3000 plus – delivered less than 5% of sales whilst consuming over 30% of the R&D investment. Rethinking product development and putting in place disciplines and structures for portfolio management was a key intervention, a major reconfiguration of the innovation model.

Or the move towards networking – the foundations of the open innovation approach discussed earlier. Once again, there was a key reflection point and a recognition that the model, which had brought the company through much of its early life, needed to give way to a newer model based far more on building knowledge networks with others.

More recent activity has focused on how to deal with disruptive innovation. In an industry which has suddenly become much more fluid and uncertain there is great risk but also opportunity for entrepreneurs. For an established player like Hella this implies the need to build a very different kind of innovation capability, one geared much less to the 'do what we already do but better' agenda and instead focusing on doing something completely different. At the limit, this may require letting go of core parts of the company to replace them with new businesses. Building such a capacity for corporate entrepreneurship has involved some fundamental rethinking of the innovation model, letting go some old approaches and adding new capabilities with new operating tools and processes more linked to entrepreneurial start-up culture.

5 Conclusion

Innovation matters today more than ever. Managed effectively it can provide the underpinning resilience and agility to enable organizations to weather the storms of a turbulent and uncertain environment. However, this requires much more than wishful thinking around the desire to be innovative. As our examples and others show there is a need to focus on some key themes around competence, networking, strategy and innovation management. And there is a need to underpin all of this with a willingness and capacity to step back, reflect and retune the overall approach – dynamic capability.

References

Bessant, J. (2017): *Riding the innovation wave, London*, Emerald.

Bessant, J. and T. Venables (2008): *Creating wealth from knowledge: Meeting the innovation challenge,* Cheltenham, Edward Elgar.

Birkinshaw et al., (2007): Finding, Forming, and Performing: Creating Networks for Discontinuous Innovation, *California Management Review,* **49**(3): 67-83.

Chesbrough, H. (2003): *Open innovation: The new imperative for creating and profiting*

form technology, Boston, Mass., Harvard Business School Press.

Cohen, W. and D. Levinthal (1990): Absorptive capacity: A new perspective on learning and innovation, *Administrative Science Quarterly,* **35**(1): 128-152.

Foster, R. and S. Kaplan (2002): *Creative des truction,* Cambridge, Harvard University Press.

Francis, D. and J. Bessant (2005): Targeting innovation and implications for capability development, *Technovation,* 25(3): 171-183.

Francis et al, (2003): *Managing radical organisational transformation,* Management Decision, **41**(1): 18-31.

Nelson, R. and S. Winter (1982): An evolutionary theory of economic change, Cambridge, Mass., Harvard University Press.

Teece, D. and G. Pisano (1994): The dynamic capabilities of firms: an introduction, *Industrial and Corporate Change* , **3**(3): 537-555.

Tidd, J. and J. Bessant (2018): *Managing innovation: Intergating technological, market and organizational change,* Hoboken, New Jersey, John Wiley.

Van de Ven, A. (1999): The innovation journey, Oxford, Oxford University Press.

Zahra, S. A. and G. George (2002.): Absorptive capacity: A review, reconceptualization andextension, *Academy of Management Review,* 27:: 185-194.

