

# Chapter 19

## Skin Elements Ltd—The Importance of Knowledge Management in Commercialisation



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**Abstract** This Chapter examines the case of Skin Elements Ltd., a Biotech start-up enterprise that successfully created, manufactured and commercialised an innovative skincare technology into a global market. The principal focus of this case study is on the role played by knowledge management and how this shaped the innovation strategy that saw the technology successfully commercialised and positioned within the global natural skin care market. The chapter examines the process of commercialisation, and demonstrates how knowledge management (KM), open innovation (OI), absorptive capacity (ACAP), and entrepreneurial operations management (EOM) played key roles in evolving the innovation strategy and commercialisation process. The chapter opens with an overview of the case study before introducing the concepts described above, and then enfolded the academic literature into the case to illustrate the relationships found. It then draws conclusions from the findings and lessons for research, policy and practice. The case draws from the personal experience of the lead author, who has provided first hand observations of the company's foundation and evolution over its first 12 years of operations.

### 19.1 Introduction

Skin Elements Ltd is a small, publicly listed biotechnology company headquartered in Perth, Western Australia, which produces a range of natural organic products under the *Soléo Organics* (sun care) and *McArthur* (skin care) brands. The company was founded in 2006, by inventor Leo Fung, financial specialist Craig Piercy, and serial

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entrepreneur Peter Malone. By 2018, the company had publicly listed, undertaken a major corporate acquisition of the *McArthur* brand, expanded its brand distribution into 16 countries, launched an e-commerce strategy via an online sales channel, and launched a range of new products, including the *Elizabeth Jane* natural cosmetics skin care range. The commercialisation pathway followed by Skin Elements has evolved through four distinct phases as shown in Fig. 19.1, each of which are described in the following sub-sections.

### **19.1.1 Phase 1—Invention and Proof of Concept**

This first phase took place between 2006 and 2009 and involved the initial R&D that created the formula for the *Soléo Organics* sun care product, through to the formal regulatory approvals for the product by the Federal Drug Administration (FDA) in the United States, and the Therapeutic Goods Administration (TGA) in Australia. As noted above, Skin Elements was born as a result of an alliance between three founders: the inventor, Leo Fung, who contributed his knowledge and expertise of naturopathic science; Craig Piercy, who brought his knowledge and expertise in financial management and capital raising; and Peter Malone, who contributed his knowledge and experience of successfully launching and scaling innovative entrepreneurial ventures.

The trio invested start-up capital of A\$120,000 and spent the first year together in a micro office as they examined and tested the concept. This involved working across a number of laboratories in search of the right ingredients and manufacturing partners. Everything was being tested as part of the R&D proof of concept process. What was being developed was the first new sunscreen formula in forty years, and would need to meet and exceed all the attributes of the existing products available in the marketplace.

By early 2007 the first tubes of the *Soléo Organics* sunscreen were in test markets and certification programs. The partnership evolved to a private company structure to better reflect the ownership and accounting for further investment that would eventually be needed. The commercialisation process relied on the collective knowledge and expertise of the team, as well as their ability to access third party assistance. As the firm's Executive Chairman, Peter provided the overall leadership and strategic direction, while Craig, as Company Secretary, focused on operations. In turn, Leo focused on R&D and new product development (NPD).

Leo's research created a base formula around the use of natural zinc metal, a proven block to ultra violet (UV) radiation, and a selection of natural organic ingredients that provided cohesion and substance for the mixture when applied to human skin. A small laboratory was set up in an industrial estate within the Perth suburb of Canning Vale, in which the initial R&D was undertaken, and where the firm's offices were co-located. The founders maintained a close working relationship, retaining commercial confidentiality over their formulas, while also engaging selected third-party scientific testing services in the eastern city of Melbourne.

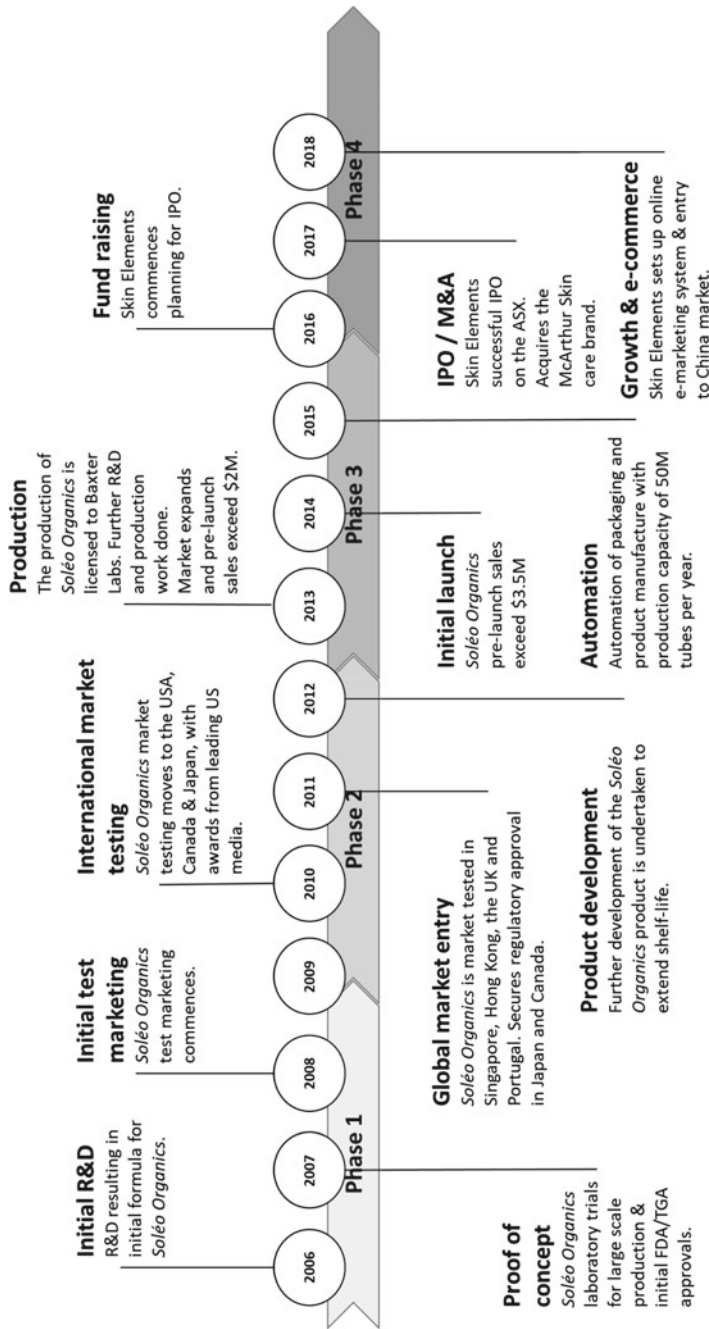


Fig. 19.1 Timeline of the skin elements case study

The primary focus of the R&D at this early stage was to identify and isolate the active ingredients, and create a stable formula that could be produced in volume. Due to the need for trade secrecy, independent test labs were selected carefully and only parts of the entire formula were revealed to each laboratory. Even then, such testing took place under strict confidentiality using non-disclosure agreements (NDA). The key active ingredient in the formula centred around zinc metal, and potential sources of the ingredients were examined from five international and domestic suppliers. A final supplier was selected, in the form of a scientist based in Melbourne, who had worked for the prestigious Commonwealth Scientific and Industrial Research Organisation (CSIRO), which is Australia's national science agency. He had commenced the manufacture of micronized zinc, which provided an important element within the formula. Zinc particles of one thousandth of a millimetre, invisible to the human eye yet larger than the pores in the skin, offered an alternative sunscreen formula when compared to existing formulas in commercial production.

At the end of the first year, from a technical perspective, the new product exceeded all criteria set in relation to the chemistry benchmarks, and was on track to deliver a significant improvement to the prevailing industry standards. Further modelling was undertaken on what the market attributes that the product would be required to meet and exceed. However, financial modelling and projections of future expenditure requirements undertaken by Craig, identified the need to secure additional funding to support the ongoing R&D and proof-of-concept work. A budget of \$300,000 was signed off by the team.

Throughout the second year, Peter and Leo travelled extensively across Australia visiting suppliers and chemists to listen and examine the 'state of the art' in new natural ingredients, and obtain a clear set of specifications for both the product and the market. For example, Tea tree oil was examined as a natural preservative, but was not proceeded with even though it had strong preservative qualities. A barrier to its adoption was the feedback from focus groups that indicated its aroma was considered to be too overpowering. A final combination of sixteen natural ingredients was selected to form the recipe of the formula and provide a platform for further development.

The appearance of the cream was a heavily debated issue. White or skin colour or both options. The consistency of the cream was critical to success. It needed to be easy to apply and non-greasy, yet able to adhere to the skin for a minimum three hours of water resistance. Other essential product attributes were a sun protection factor (SPF) of at least 30+ and the cream to be hyper allergenic.

Packaging was also going to be critical for the product to be able to stand out in an already overcrowded market space where the chemical ingredients of the incumbent products were the best of the out of patent synthetic formulations. A new incumbent would have to be able to differentiate itself. This saw the group explore various concepts, with Peter convinced that the packaging needed to clearly differentiate the product from the standard 'synthetic chemical tubes.' The product's name *Soléo Organics* reflected the organic natural shift. It was decided all products needed to be presented in a box telling the story on the ingredients, and the opportunity for

customers to move to safer ingredients. Not only did the product need to stand out, it also needed to create a point of difference.

At this stage the Skin Elements team began the process of signing off on the product specification and securing the intellectual property (IP) rights to the formula. An important milestone for the commercialisation process was securing approval from the TGA and FDA in order to allow the product to be sold for human use. This required a significant amount of testing. As this work progressed, the project team began to hear that rumours were spreading about a new sunscreen formulation based on natural ingredients was being tested for national release, which began to generate public interest.

The process of securing patent protection was therefore initiated covering Australia and all countries that would be targeted for future sales, and a full IP rights review was undertaken. However, an alternative IP protection program was examined, which adopted a trade secrecy approach using the concept of the ‘secret formula.’ This was considered to offer better protection for the product, which could potentially be replicated by competitors once the formula was disclosed as would occur with a patent. The success of *Coca Cola* and their “Formula X” was viewed as an example. This use of trade secrecy was considered to be especially relevant if the product was to be sold into markets where the governments and legal systems do not provide support to patent infringement. As a result, the company decided to opt for trade secrecy in relation to the protection of the *Soléo Organics* formula.

### ***19.1.2 Phase 2—Market Testing and International Expansion***

By early 2009 the Skin Elements program had reached the point where the ‘voice of the customer’ needed to be heard. The *Soléo* product also needed to be signed off by regulatory agencies within international markets to verify that it met their drug testing regimes and commercial criteria. The company also needed to assess its funding requirements to enable it to have sufficient financial resources to move forward. Leo was busy ensuring that the product was ready for market insertion, and Craig examined the opportunities for the company to raise capital to fund the next stage of its growth, with ambitious plans for entry into the multi-billion-dollar sunscreen market. This identified the need for a minimum capital investment of A\$1 million, and all three founders liquidated assets to generate the funds needed to commence the work.

However, while the product was deemed ready for large-scale production, there remained many unanswered questions about consumer willingness to adopt a new, natural sun care product from an unknown Australian brand. What was becoming evident from the firm’s existing market research was that there were growing concerns amongst consumers over the use of chemicals and their cumulative effects. This was identified as the key selling point for the *Soléo Organics* brand. Global research

studies suggested that consumers were becoming concerned over the long-term health impacts of chemicals and other contaminants, in food and personal use products such as sunscreens and cosmetics. This was of particular importance in market segments such as baby or infant skin care products, or for older people with sensitive skin. These markets were not only large, but also less price sensitive, and willing to pay a premium for a product that was safe to use.

With the product ready to go, and eyes on the global market, Peter flew to the United States and met with a range of contacts he had made during previous projects and business ventures. His journey took him from New York to Los Angeles and ultimately to San Clemente in Orange County in Southern California. It was here that the hotbed for market testing was to commence. This provided a market environment that was not only affluent and open to innovation, but with a lifestyle that provided a substantial testing ground for sun care products. According to Peter, it was akin to the “Formula 1” racing circuit. Sun exposure in water sports was becoming a problem particularly for the international world surfing events which had been picked up by the new lifestyle companies of the early 2000s. Major surfing brands such as *Quiksilver*, *O’Neil*, *Hurley*, *BodyGlove* and *Ocean Pacific* were all on the west coast and heavily backed by mainstream investment funds. These were identified as the potential key to successful market entry into the north American market.

Skin Elements set up an office in San Clemente, hired a local team, and commenced its world marketing program. Meetings with the industry key players attended by Peter, Leo and Craig either individually or as a team, followed as the *Soléo* product was released into the USA. From California to Hawaii *Soléo* was soon visible in the surf industry. This marketing program ran for eighteen months and saw the product receive critical approval. Seventy-five thousand tubes were sold and/or given away as samples for ready to try customers. Selected retail outlets were given quantities to sell such as *Wholefoods* and *CVS Pharmacies*. Visibility was high and the company even secured the *Da Hui* or “Black Shorts” surfing gang of Hawaii to promote the product across the islands. The program saw the 2010 Hawaiian Triple Crown Surfing championships held at Waimea Bay promoted by Skin Elements with all other sponsors that year removed. No fees were charged to the company other than providing the new natural sunscreen. The significance of this decision by the Hawaiians didn’t resonate until later. The need for safe cover was seen as critical and they were keen to make the statement.

The feedback from mainstream America was also compelling and the Skin Elements team regrouped back in Australia to assess their market research lessons. What was clear was that the *Soléo Organics* brand had been rated the number one sunscreen out of a total of 1728 brands sold in the United States by the prestigious Environmental Working Group (EWG). Further, the *Washington Post* had awarded *Soléo* the best new sunscreen, and *Elle Magazine* had given *Soléo* the award of best new cosmetic product of the year. The high-performance market segment had been won, and America was giving *Soléo* the clearance to move into mainstream segments. As early innovators it demonstrated the opportunity available to Skin Elements.

Encouraged by these positive responses in the United States, Skin Elements contracted a Perth marketing and advertising agency Marketforce to undertake consumer

studies using focus groups to identify the key strengths of the *Soléo* brand across different market segments. This process lasted three months and led to findings that one of the most receptive consumers was the ‘young mother’, who sought a safe, but effective sunscreen suitable for babies and children. The natural formula of *Soléo Organics* sunscreen was viewed by these consumers as very important. Not only was the product safe for topical use on the skin, but also safe if ingested. Even a one-week old baby would be safe if it accidentally ingested the *Soléo* product. The baby-care market segment was therefore identified as a key potential market, and one that was both large and relatively insensitive to price.

The Skin Elements team therefore developed plans for future market testing to fully assess the product’s application to global skin types and fully assess and validate the formulation. The product was sent to a Japanese distributor that had seen the product in California and who saw the opportunity for the product with his customers. Leo wanted confirmation on the product’s compatibility with Asian skin types and this appeared to be a good way to collect this data. A container of product left for Tokyo and within six months the skin assessment had come up positive. Further trials followed in Hong Kong, China, Singapore and Indonesia—all confirming acceptability of the *Soléo* formula.

This market testing also necessitated a parallel program of registration and licensing with the relevant drug administrations within selected Asian countries. An early submission to the Australian Therapeutic Goods Administration (TGA) had now come through as approved and this saw the Ministry of Health in Japan accepting the tests that had been undertaken in Australia. With this success in Asia, Peter and Leo travelled to the United Kingdom (UK) and began to develop the opening up of that market, followed shortly thereafter with entry into Europe. However, initial problems were encountered with the European Union (EU) regulatory agencies over the use of zinc as an active UV radiation block and this led to the product’s entry being initially restricted for distribution in that market.

The cause of this problem proved to be largely one of bureaucracy. It had been over fifty years since natural minerals had been used in sunscreens and with the evolution of food and drug production licensing in Europe these had been long deleted from the codes. To address this challenge, Skin Elements linked up with a local EU manufacturer BASF from Germany, which was one of the five international companies pioneering the new micronized zinc products. Together Skin Elements and BASF brought this mineral back onto the register of effective UV radiation blockers. This subsequently paved the way for *Soléo* to move forward and saw the test marketing commence in the UK.

In selecting their foreign market entry strategy into the UK, the Skin Elements team searched for a partner able to provide both good initial market penetration and the opportunity to secure additional market research data. The *Fresh and Wild* store (later acquired by the Wholefoods Group of the USA) in the London suburb of Chelsea was identified as a prime candidate. Associated with the famous Chelsea Flower Show, the store was a major attraction for shoppers seeking natural and safe products. Peter and Leo travelled to London and met with representatives from *Planet Blue*, a company founded in London in 2005 by two Australians from Adelaide

who were representing new Australian companies. Furthermore, at that time, their focus was on marketing new food and skin care products to the UK. Following negotiations, this company was appointed to undertake test marketing of the *Soléo Organics* product range in the UK.

A public relations (PR) person was also hired to gain exposure in the mainstream newspapers and presentations were undertaken for the press who were briefed on the product to assess the strength of the market. However, it soon became apparent that the UK was not a sophisticated sunscreen market, and in fact there were not an array of products offered compared to the USA, or for that matter, Australia and Japan. In Britain, a sunscreen was something that you purchased if you were heading to Spain or the Caribbean on holidays to deal with the sun. The sophistication of UV radiation was not something that the UK had really encountered. With the findings of this test marketing, Skin Elements decided to view the UK market as something of a ‘green fields’ opportunity.

### ***19.1.3 Phase 3—Scaling Up for Full Product Launch***

By 2012–2013, and encouraged by their market testing in Asia, North America and Europe, the Skin Elements team commenced planning for a full-scale production and launch of the *Soléo Organics* sun care product range. They spent around six months reviewing all the data that had been collected over the previous three years of market testing and assessment. It was decided that the company was now ready to move from proof of concept and market testing into mass production for a global market. However, although the product and market issues were secured, Skin Elements needed reliable production facilities and a significant injection of capital to fund the planned growth. As an interim step the Skin Elements team raised another A\$1.5 million from within its own resources and a small group of private investors.

From a production perspective small batch product runs could be continued, but this was not sufficient to support large-scale market distribution. In 2013 an agreement was reached with Baxter Laboratories, a TGA accredited pharmaceuticals manufacturer in Melbourne, to sub-contract the production of the *Soléo* sunscreen product. Baxter Labs offered a range of services for skin care, sunscreen and topical pharmaceutical products. Under the production agreement the laboratory would produce 100,000 tubes of sunscreen in two 50,000 production runs. A 4-tonne vessel was used to mix the formula for the product.

This was a significant increase over previous production runs, which had involved only relatively small batches of 10,000 tubes. However, this scaling-up of production would offer an economy of scale that saved around 15% per-unit over the cost of the smaller production runs. All seemed set to go, with the ingredients delivered and the production runs commenced as planned, with each tube of sunscreen being filled within 30 min. Things seemed on track as far as production was concerned.

However, shortly after each tube came off the production line an inspection showed that all the ingredients had set hard like concrete! This threw the Skin Elements



product launch into chaos and cost around \$250,000. As Peter described it, this was “an unmitigated disaster for the company.” Leo quickly assembled a team from Baxter Laboratories and launched an investigation into what had gone wrong. This revealed that the product formula had been over mixed, in a manner similar to when cream turns into butter. Yet, in this case into a solid substance that was unable to be removed from the tubes. As Peter explained:

As this is pure research and development there was no manufacturing recipe for scaling up. Everything is under development until solved. The process for scale up manufacturing settled on moving to the 1.5 tonne vessels (20,000 tubes).

Using this smaller batch production run approach resolved the immediate problem with the manufacturer of the *Soléo* sunscreen. However, this was not the end of the company’s production difficulties.

Having resolved the problems in production in Australia, the first batch of 50,000 tubes for the UK market launch was shipped to London in late 2013. Within weeks of arrival the product was being distributed around the country through the Holland and Barrett Health stores. However, almost as soon as the product hit the street the company was hearing commentary coming back from the stores that the cream was ‘scratchy’ on the face especially if one rubbed the cream in hard. Customers were concerned, but had stopped short of actual complaints. Something wasn’t right.

In response, Peter and Leo announced an immediate halt to distribution to the stores until an analysis could be undertaken on what had occurred. A full review was undertaken within Baxter Laboratories and it was here that the problem was identified. The wax in the mixture had, during the cooling down of the cream prior to filling into the tubes, precipitated out of the mixture back into its crystalline structure. This was generating the rough feeling when rubbing the cream onto peoples’ faces. This resulted in yet another change to the way the formula was to be manufactured. The solution to the manufacturing process was to re-heat the mixture to its production temperature, and to ensure all the tubes were refilled prior to the mixture cooling down. In this way the wax remained in its liquid state for the life of the product. Despite these production difficulties Peter felt that the company had learned some valuable lessons that provided real benefits in the long-term, as he explained:

Again, the procedure for manufacturing natural organic sunscreen ingredients was nowhere to be found. The formula was the company’s and Skin Elements was the first in producing a mixture from these organic ingredients. It was part of the learning curve. And, it became part of the formula’s security. The ingredients were not the critical part of the product – it was the manufacturing process. And this was to provide a major marketing edge. The company began to capitalise on this fact.

After the UK test program was completed the company gained valuable feedback and instituted a full review of manufacturing with the Baxter Laboratories production system. Skin Elements had invented a new formulation. It did not behave like synthetic chemical formulations and it was not something that existing laboratory chemists were experts in manufacturing. As part of this program the Skin Elements team examined every ingredient and its impact on the formula and every part of the packaging and its impact on the final product. Every item was to be sourced from only

the certified suppliers and manufacturers. The manufacturing bill of materials was sealed and the process for manufacturing locked down. Each batch manufactured contributes to the body of knowledge on manufacturing the *Soléo* natural organic formula. All incremental improvements now are captured as part of each production batch. New approaches and systems are carefully managed before integrating into the manufacturing process. The formula is now finally robust for international commercialisation. What had been produced was not only a product innovation, but a process innovation.

#### **19.1.4 Commercialisation, Financing and Growth**

By 2016 Skin Elements had a decade of experience and had seen the product and its business model pivot through at least six cycles as it managed the flow of information between the market, the R&D/NPD process and the manufacturing operations. As a small company, Skin Elements relied heavily on the quality and integrity of its key suppliers and distributors. Peter had appointed four distributors to commence marketing the *Soléo Organics* product range within the Australian and New Zealand market. The market reaction was positive, and the product quickly became well-positioned within the retail health goods segment of the market, securing a place as a benchmark product. Sales were continuing throughout the USA via existing channels and through Asia where the initial test marketing programs had been operated. The company now seemed ready for a full-scale international launch.

It was clear that additional capital would be required, and Craig assessed the options for a final round of private financing. However, Peter felt that the future anticipated growth the company was forecasting would require a stronger capital base. Based on sales volume the estimated value of Skin Elements was approaching A\$5 million, with the primary asset the *Soléo* sunscreen formula. It was decided to issue a prospectus and seek a public listing on the Australian Stock Exchange (ASX). Over the course of 2016 the company issued its prospectus under which it sought a minimum of A\$3.5 million. The prospectus closed over-subscribed at A\$3.7 million, which saw the Company listed on the ASX in early January 2017.

Just after the company had listed it was presented with an opportunity to acquire another Australian based skin care company *McArthur Skincare Pty Ltd*, which produced a range of innovative skin creams and soaps that used papaya (paw paw) extract as the foundation of their formula. The range of products produced by *McArthur* were complementary to the *Soléo Organics* sun care range, and it was deemed to offer a way to strengthen the product range of Skin Elements. The natural and organic formulas of these sunscreen and skin care products offered a strong market positioning for the Skin Elements brand within national and international markets.

By the end of 2018 Skin Elements was targeting three key global markets for its product range within North America, Europe and Asia. It had invested in a new e-commerce and e-marketing package designed to support its global market expansion. This focuses on the company's *SKINLIFE* program, involving a direct retail focus

through on-line retailing and utilizing the SKINLIFE brand through selected retail stand-alone outlets. In addition, the company had entered into final negotiations with a health and medical group based in China, with plans to launch into the Chinese market with an initial A\$20 million sales order. In addition, negotiations were continuing in Europe and the USA for similar sized orders over the course of 2019.

## 19.2 Analysis of the Case

The Skin Elements case provides an example of the successful commercialisation of an innovative product by a small to medium enterprise (SME). It was specifically selected because it offers a longitudinal case example, and because one of the co-authors of this chapter was a founder and principal actor within the story. In the following analysis we will examine the case and enfold the literature as we do.

### 19.2.1 *Problems Facing SMEs in Commercialisation*

Commercialisation is relatively poorly defined within the academic literature, despite the fact that it is a widely used term within that literature. It is generally associated with the process of taking new products, processes or services to market (Chakravorti 2004). Yencken and Gillin (2006) used the Scottish Enterprise definition of commercialisation as:

The process of converting science and technology, new research or an invention into a marketable product or industrial process. (p. 215)

This conceptualisation of commercialisation as the successful launch and market adoption of an innovation, usually through securing good profits and returns to investment, is a consistent theme within the research literature (Chakravorti 2004). Further, the success of the commercialisation process is critical to the overall success of the entire innovation process and the competitiveness of the business, thereby making it an important area for research (Akgun et al. 2004; Pellikka and Lauronen 2007). However, as a concept, commercialisation has a range of meanings within the academic literature and encompasses a range of interrelated activities, or processes, that include the invention, early and late stage product development, proof of concept, new product launch and the subsequent marketing and distribution of the finished product (Ernst 2002; Ozer 2004; Yahaya and Nooh 2007). Despite its importance, the commercialisation process has been relatively poorly researched (Adams et al. 2006). This is a specific issue in relation to SMEs where there is not only limited research information, but unique conditions when compared to the environment experienced by large firms, which typically have superior resources, skills and knowledge (van Hemert et al. 2013; Mazzarol et al. 2014).

Pelikka and Virtanen (2009) identified at least four areas in which small firms engaged in technology commercialisation are likely to experience problems: (i) the commercialisation environment; (ii) marketing; (iii) financing; and (iv) management. Each of these will be discussed in relation to the Skin Elements case.

The first of these, the *commercialisation environment*, relates to the ability of the SME to gain access to the necessary support services needed for commercialisation (Kelley and Rice 2002; Malecki 1997; Dodgson 2000). In addition, the ability of the SME to access the necessary infrastructure (e.g. incubators, laboratories), to allow it to develop its technology and new products (Klofsten and Jones-Evans 1996; Autio and Klofsten 1998; Heydebreck et al. 2000). Finally, there is the firm's ability to secure the necessary resources for R&D and new product development (NPD) (Abetti et al. 1988; Dodgson 2000).

A second area is the need for the SME to develop the necessary competencies and resources to allow it to succeed in relation to *marketing* (Pelikka and Virtanen 2009; Kang et al. 2013; De Zubielqui et al. 2014). Marketing is critical for making assessments of the likely adoption rate of the new product, service or process (Jolly 1997; Ziamou 2002; Sedighadell and Kachquie 2013). This helps to gain clear insights into the needs and wants of the customer, and identify the value proposition that the customer is likely to respond to (Ford and Saren 2001; Huang et al. 2002; Ozer 2003). Also important is the ability to get the timing of any marketing, sales and promotion activities right so that they coincide with the NPD and production activities (Mohr 2001; Ford and Saren 2001; Pelikka and Lauronen 2007). Finally, there is a need for the SME to maintain close relations with their lead customers and/or end users to obtain real-time feedback on the product and address any problems (Athaide et al. 1996).

The third area that affects SMEs in relation to commercialisation is *financing* (Pelikka and Virtanen 2009). The ability of an SME to secure sufficient financial resources support the commercialisation of a new product, particularly within a national or global market, is a major challenge. Research into the *financing gap* for SMEs suggests that this problem is particularly focused on the innovative firms that are typically found in technology sectors, with "new business models and high growth prospects" (OECD 2006). NPD and commercialisation of innovative technologies generally demand significant investment in R&D, marketing and sales, and securing such funding is often difficult for small firms (Hoffman et al. 1998). The commercialisation process will place increasing costs on the SME and demand a substantial amount of working capital with which to support the R&D, NPD, production and marketing efforts required, as well as above average rates of profit from sales activity (Davidsson et al. 2009; OECD 2010, 2016).

The fourth area affecting commercialisation within SMEs is *management*, which relates to the ability of the firm's leadership team to manage resources, coordinate projects, undertake the often-complex processes of R&D, NPD, production, marketing and sales, which also need to be managed concurrently (OECD 2018; Do et al. 2018). In this area the overall success of the commercialisation process is likely to be found. Success may depend not just on the firm's R&D competencies, but also its ability to manage knowledge, learn and adapt to turbulent market environments,

and strengthen their organisational capabilities (Park and Ryu 2015). The success of an SME seeking to commercialise its intellectual property (IP), within an open technology market, may also be diminished from a return to investment perspective given the information asymmetries that are typically found between such firms and their potential buyers (Padula et al. 2015).

Table 19.1 provides a summary of these four common problems that face SMEs engaged in commercialisation, and how Skin Elements addressed each of these challenges over the four phases of the firm’s evolution 12-year journey from start-up to

**Table 19.1** Summary of skin elements ability to address commercialisation challenges

Problems facing SMEs	Resolution of problems
<p><i>Commercialisation environment:</i> Access to support services, infrastructure, regulatory approvals, R&amp;D and proof-of-concept</p>	<p><i>Phase 1:</i></p> <ul style="list-style-type: none"> <li>• Networking with many stakeholders in early Phase 1 R&amp;D to identify the formula</li> </ul> <p><i>Phase 2:</i></p> <ul style="list-style-type: none"> <li>• Initial problems of securing EU regulatory approval resolved via collaboration with BASF in Germany</li> </ul> <p><i>Phase 3:</i></p> <ul style="list-style-type: none"> <li>• Strategic partnership with Baxter Laboratories secured to provide long term production facilities for scale-up</li> </ul> <p><i>Phase 4:</i></p> <ul style="list-style-type: none"> <li>• Enhancing resources via supplier and distributor channels</li> </ul>
<p><i>Marketing:</i> Voice of Customer (VOC) test marketing, confirmation of customer value proposition (CVP), brand positioning, securing market access and sales distribution, and coordinating NPD, production and product launch activities</p>	<p><i>Phase 1:</i></p> <ul style="list-style-type: none"> <li>• Extensive ‘out of the office’ networking with key suppliers and chemists to identify ‘state-of-art’ product specifications</li> </ul> <p><i>Phase 2:</i></p> <ul style="list-style-type: none"> <li>• Test marketing in the USA (California and Hawaii) within surfing community, highlighting CVP of safe product</li> <li>• VOC test marketing in Australia identifying mother and child as key market segment</li> <li>• Test marketing in Asia to further assess VOC and CVP</li> <li>• Partnership with Planet Blue for UK market entry</li> </ul> <p><i>Phase 3:</i></p> <ul style="list-style-type: none"> <li>• Further test-marketing in UK highlights problems with ‘scratchy’ formula, which led to further refinement of the production process</li> </ul> <p><i>Phase 4:</i></p> <ul style="list-style-type: none"> <li>• Securing four primary distributors for the product in Australia and New Zealand</li> <li>• Development of market access into China, EU and USA</li> <li>• Creation of online e-marketing and e-commerce platform</li> </ul>

(continued)

**Table 19.1** (continued)

Problems facing SMEs	Resolution of problems
<p><i>Financing:</i>                      Securing start-up capital, ensuring that capital raising is able to keep pace with the firm's commercialisation strategy</p>	<p><i>Phase 1:</i>                      • Initial start-up capital was 'bootstrapped'</p> <p><i>Phase 2:</i>                      • Further 'bootstrapping' by founders                      • Systematic analysis of funding needs as the R&amp;D, NPD and market development process unfolded</p> <p><i>Phase 3:</i>                      • Fund raising of A\$1.5m via 'bootstrapping' and private investors</p> <p><i>Phase 4:</i>                      • IPO listing raises A\$3.7m</p>
<p><i>Management:</i>                      Ability to manage resources, coordinate projects, knowledge, IP rights and multiple stakeholders</p>	<p><i>Phase 1:</i>                      • Early use of NDA confidentiality and trade secrecy with stakeholders in Phase 1                      • Systematic approach to concurrent product R&amp;D, NPD, IP rights and regulatory approvals, marketing R&amp;D and capital raising</p> <p><i>Phase 2:</i>                      • Management of TGA, FDA and EU regulatory approvals, in conjunction with product and market development</p> <p><i>Phase 3:</i>                      • Proactive response to initial production problems by Baxter Laboratories turning disaster into IP rights benefit from new process innovation discovery</p> <p><i>Phase 4:</i>                      • Coordination of post-IPO investor relations, global market expansion, production and logistics, online business model and acquisition of <i>McArthur Skin Care</i> as complementary business</p>

global expansion. It is worth noting that the company was developing a new and potentially disruptive innovation, targeted at a mature, global industry, dominated by major corporations. If this weren't enough, the project team was continuously breaking new ground in terms of how the product would be designed, how it would be produced, how its IP rights would be protected, and how it would be branded, positioned and distributed.

The learning process within the three founders varied depending on their previous knowledge and experience. Leo, while knowledgeable in the field of science and applied chemistry, had limited previous experience with new venture creation and commercialisation. By comparison, Peter, saw the business from a broader perspective than most engaging in technology commercialisation for the first time. With

previous history in successful technology start-up enterprises he realised the need for ‘friends’ in the environment. As he explained:

Running from day to day with most things unknown the Skin Elements team needed to be strong of mind and want to succeed. Craig was not without experience in this sector and Leo was driven by a will to find a better solution to synthetic sunscreen formulations due to a skin cancer crisis in his extended family. I also understood the time periods that the team would be working to, my previous experience predicting a decade long drive to success would be required. This fact was signed off and imbedded into the team before commencement. I knew from experience that giving up was too often the result of start-up ventures due to the commercialisation environment.

This enabled the Skin Elements team to systematically manage the *commercialisation environment* to identify key contacts and potential alliance partners (e.g. Baxter Laboratories, BASF, Planet Blue) able to help the firm achieve its goals.

In relation to *marketing*, the Skin Elements team was well aware of the need for getting the marketing right. They were developing a very disruptive product to the prior art in their market. The team sought out from an early stage to determine the key customer value proposition in going natural and organic. The answer was safety. Pesticides and plastics from the petroleum discoveries half a century ago had seen many concerns surfacing. Public opinion was changing in relation to the perceived value of something that was useful on the one hand, but was now being questioned as injurious to health. As Peter explained:

Our focus groups confirmed these concerns. As a way of gaining a real time feel for this shift in mood a global test program was commenced. The early innovators were the water sports where the problems of chemicals on the body were better understood. They were soon eclipsed by the young mothers who without exception globally were conscious of the need to cover the skin of their babies from the dangers of UV light including sunburn. In a test marketing program in Slovenia young mothers were queuing up to access a tube of Soléo from the main pharmacy in Ljubljana (the capital) after the product went on sale. Though the cost of a Soléo tube was twice the cost as compared to most other countries (due in the main from government import charges) this did not stop the demand for the product increasing every month during the market testing programme. A young mother gave up a coffee a week to provide her child safety from UV radiation.

The firm’s approach to *financing* was also well-considered and systematic. As outlined in the case, an important aspect of the success Skin Elements had in securing financing was the ability of the founders to ‘bootstrap’ the venture in its early years, and then the skills and networks to raise additional private investment capital and ultimately take the company successfully through an IPO. As Peter explained:

Our ability to meet funding costs from the team members through our own resources initially allowed the project to move rapidly in the development of the ‘raw’ formula. And as the project grew Craig and I had an understanding on how to scale up the venture. I also had contacts that became part of the seed capital as the venture began to gain momentum. And finally, the company IPO’d with the listing driven internally by the team. I was able to steer the company through a path that delivered the capital. And now, conscious as we are of the need for the company to achieve significant sales quickly, the team have targeted three key international sectors that for different reasons offer above average sales growth.

Finally, the overall *management* demonstrated by the Skin Elements team during the commercialisation process can be characterised as one of systematic flexibility and adaptiveness. An important aspect of the success Skin Elements had in its commercialisation was the previous experience of the company's senior management team in launching innovative ventures and commercialising innovations. This allowed them to meet and address the many challenges that emerged during the commercialisation process. As Peter explained:

The team had been briefed on the need to back their own judgement and not give up against the odds. And this was the basis on which the three members of the project commenced. This proven track record by the three founders was a determining factor in the company's commercialisation success. Turbulent environments became everyday life and this became the norm. And as the company signed off on each stage of the program the investor assessments were able to be communicated directly from the team.

### 19.2.2 *Knowledge Management in SMEs*

As a concept, *knowledge management* (KM) refers to the way in which an organisation captures, stores, analyses and disseminates information, intellectual property, skills, competencies and knowledge, at the individual, group and enterprise level, so as to secure a competitive advantage (Civi 2000). According to Hedlund (1994) knowledge is found within organisations in at least three general forms. The first of these is *cognitive knowledge*, which is the theories and mental constructs that exist within the minds of the firm's employees and are used to guide thought and action. The second form is that of *skills*, which refer to the learned knowledge that comes from having the people within the organisation apply their cognitive knowledge and develop their own specific routines and rituals to achieve their desired goals. Finally, there is *embodied knowledge*, which refers to the products and services that the organisation produces, with each representing a manifestation of the cognitive knowledge and skills that transform the firm's resources into outcomes.

A critical aspect of KM is the relationship between *tacit* and *explicit* knowledge (Polanyi 1962). *Tacit knowledge* is that found within the individual, which represents their experience and wisdom. *Explicit knowledge* is that which has been codified into text, numbers, models or diagrams, and can be readily transfer from one individual to another. Thus, when an invention is codified into a patent and formally registered within a patent office, or literary works are copyrighted and published, this knowledge becomes transferable and moves from knowledge and intellectual capital or assets, to legally tradable intellectual property (Williams and Bukowitz 2001).

Research into KM within large organisations has focused on the need to establish systems for facilitating this process of transfer to and from tacit to explicit knowledge. For example, Nonaka and Takeuchi (1995), in their study of innovation within large Japanese corporations, developed the SECI model of knowledge transfer, which recognised the process as moving around four domains: (i) *socialisation*—converting tacit to tacit knowledge via interpersonal communication and social interaction;



(ii) *externalisation*—conversion of tacit to explicit knowledge via the formal codification of tacit knowledge via documentation and dissemination; (iii) *combination*—conversion of explicit to explicit knowledge through analysis of secondary sources, modelling, sorting and manipulation; and (iv) *internalisation*—conversion of explicit to tacit knowledge via learning and experience (Dimov 2007).

For knowledge to move effectively throughout an organisation Hedlund (1994) suggests that it must progress through three stages: (i) *articulation and internalisation*—where tacit knowledge is codified into explicit knowledge; (ii) *extension and appropriation*—where the codified explicit knowledge is distributed; and (iii) *assimilation and dissemination*—where the explicit knowledge is embedded into the organisation via formal training, procedures and coaching.

Within SMEs, the process of KM is generally highly idiosyncratic and informal in nature, typically centred around the knowledge and expertise of a small number of key people, who focus primarily within the *socialisation* domain of the SECI model. However, as the enterprise grows in size and complexity, more formal KM systems are needed, or are imposed by third-parties (e.g. investors, customers) to protect against the loss of key personnel (Bagshaw 2000). The formal management of KM within SMEs is therefore relatively poorly understood within the academic literature (Durst and Edvardsson 2012; Cerchione et al. 2016). What is identified within the literature is that most SMEs do not possess or use formal KM systems (Nunes et al. 2006), and where they exist, they generally are poorly aligned with the firm's corporate strategy (Pillania 2008). Many SMEs are aware of KM and its potential to add value (Radzeviciene 2008), but lack the resources, personnel and expertise to implement KM systems (Keogh et al. 2005). However, when SMEs do make active use of KM systems, they typically experience benefits to long-term sustainable growth (Salojärvi et al. 2005).

Figure 19.2 illustrates the Nonaka and Takeuchi (1995) SECI model and how it applied to the KM process within Skin Elements. In relation to the SECI model Skin Elements operated for the early period within the *socialisation* domain where knowledge transfer essentially was between the three partners. This shifted to *externalisation* after the company appointed Baxter Laboratories, but interestingly only after a lengthy period following their appointment. During the first two years as the company was still adjusting the *Soléo* formula, the exchange of knowledge between Skin Elements and Baxter Laboratories was essentially socialisation (tacit-tacit), and required regular visits by the team from Perth to Melbourne (at a distance of 2721 km or 3½ h flying time). It only changed fundamentally at the time the company moved to commence its IPO.

As the company began the international test marketing program and then continuing with its activities to the present-day Skin Elements progressively found it needed to move to a more codified and explicit knowledge management system. This was driven to a certain extent by the need to bring in additional staff who had no history with the team. Likewise, the development of formal procedures has been coupled

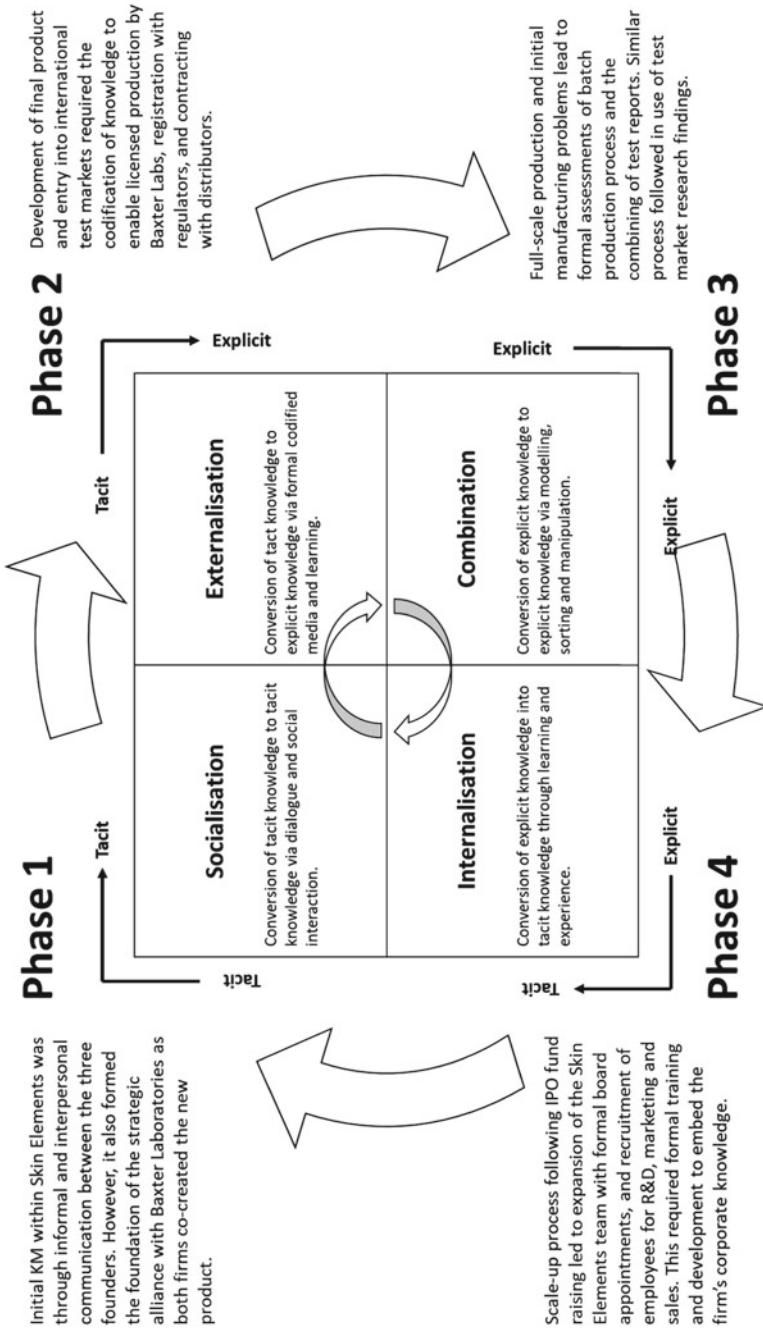


Fig. 19.2 SECI model applied to the skin elements case

with the need for regular reporting and this process has seen procedures developed for fast tracking work programs.

A specific example of this process was the evolution of the relationship between Skin Elements and Baxter Laboratories. As outlined in case study, Baxter Laboratories was first brought into the project after the Skin Elements team had undertaken a comprehensive assessment across Australia during Phase 1, to examine state-of-art knowledge in relation to the development of the product specifications, and to identify a long-term strategic partner to support the company's long-term ambition of scaling up the production of the *Soléo* product.

At the time of the initial contact between the two companies, Baxter Laboratories was also newly established and therefore open for discussion over a potentially new and innovative project. When Peter and Leo first met with the senior managers of Baxter Laboratories in Melbourne, the office and laboratory was still unfurnished. As Peter explained:

At the time Leo and I had our first project meeting the furniture had not arrived and the meeting was held sitting on crates in a brand-new laboratory in Boronia in Victoria just weeks after it had been built! Skin Elements was among the first customers and the building was only running at 5% capacity. Today the Laboratories are three times larger and capacity is over 80% on the expanded site which is 50 million tubes per year. And taking the brief to commence the production of a privately owned natural organic sunscreen formula was still viewed with some trepidation. This was still the world of synthetic chemicals full stop.

However, the business relationship between Skin Elements and Baxter Laboratories was not just between businesses, it was between the founders and shareholders of two young, entrepreneurial companies. The founders of Baxter Laboratories, Craig Baxter and his brother Brent, forged an alliance with the founders of Skin Elements, which was founded on a common purpose and sense of collaboration in an exciting and potentially valuable new product commercialisation opportunity. The interpersonal communications and *socialisation* (tacit to tacit) exchange of knowledge was a necessary and important aspect of this engagement. As Peter recalled:

The knowledge management process was tacit-to-tacit for good reason. Everything was new and time was precious. Meetings were face to face, secrecy was high and trips were often just for the day. Depart Perth at 6am arrive Melbourne at midday. Meeting 1 pm to 6 pm and back to Perth at 8 pm arriving at 9 pm. But when the crises occurred everyone knew their role and their place and what they had to do. Things went into overdrive without the need for procedures and instructions, and solutions were born.

However, after the product formula had been stabilised and subsequent production runs had become more orderly and routine, the KM process changed. The manufacturing process for the *Soléo* product and how to do a production run, was codified within a strict trade secrecy agreement between Skin Elements and Baxter Laboratories. This set clear, formal processes that included the procurement of the micronized

zinc from a selected manufacturer and not from one of the Baxter Laboratories regular suppliers. This evolution of the KM process between Skin Elements and Baxter Laboratories also followed the knowledge transfer process described by Hedlund (1994), flowing through the three-stages from articulation and internalisation, then through extension and appropriation, to assimilation and dissemination.

What seems to drive the adoption and use of KM systems are the firm's strategy, purpose, organisational culture, the leadership and support of the senior management, and the engagement of employees willing to share knowledge (Wong and Aspinwall 2004a, 2005; Shelton 2001). Sparrow (2005) found that in relation to KM systems adoption, most SMEs are either unengaged, focused on retaining knowledge ownership within a few key people, willing to share knowledge via learning and co-production on a project-by-project basis, or systematically engaged in formal KM practices. Despite this, most SMEs are informal in relation to KM (Hutchinson and Quintas 2008; Edvardsson 2009), relying on simple ICT support tools and knowledge exchange via interpersonal communication (Evangelista et al. 2010). Nevertheless, how well KM is embraced by SMEs and used within innovation and commercialisation processes is contingent on the firm's leadership and culture (Gray 2006).

Despite these limitations there is a general consensus that the ability to access external knowledge and bring it into the SME, and then make use of this knowledge is important (Chen et al. 2006). The adoption of KM is generally found within SMEs that are focused on innovation than those that are cost-driven (Levy et al. 2003). Further, it can be a source of competitive success for innovative SMEs (Perez-Araos et al. 2007; Harris 2008; Alegre et al. 2013), in particular those engaging in international growth strategies (Fletcher and Prashantham 2011). For SMEs seeking to adopt KM systems at least five steps should be followed: (i) develop a clear structure to organise the process; (ii) identify different types of knowledge within the firm; (iii) include any KM related processes or activities that can manipulate knowledge; (iv) identify forces that can affect KM outcomes; and (v) develop a balance between the use of ICT systems and social engagement (Wong and Aspinwall 2004b, 2006).

Initially as a team of three running a start-up program the KM system was limited. However, over time the company operated under a OI structure seeking links with specialists and third part contractors to work on the creation of the technology. This saw a change in KM controls. Ultimately the company completed the *Soléo Organics* formulation and subsequently re worked the papaya formulations and now *Elizabeth Jane* natural cosmetics. These are all filed under documentation and access is secure. Now as a public company post-IPO the communication is very formal given the laws of the ASX regulators. Peter explained the influence of this formalisation with the KM system of Skin Elements:

This has seen a change in how knowledge is managed within the firm. No longer are they idiosyncratic and social. Once the production process transferred to a formal plan with Baxter Laboratories the way communication and knowledge transfer was undertaken also followed suit. Orders became now formal, procedures are cast in stone for staff to follow and flexibility has now been removed from how communication and knowledge is transferred between the companies. Skin Elements delivers orders, Baxter Laboratories produces, packs and despatches to a clear specification and all under a GMP manufacturing agreement. Today there is an alignment of strategy, purpose and culture together with the leadership and staff of both companies. Both Baxter Laboratories and Skin Elements continue to review knowledge exchange processes and now access third party information as part of a continual knowledge management program.

### 19.2.3 *Open Innovation, Absorptive Capacity and Operational Entrepreneurship*

Closely related to KM are the concepts of *open innovation* (OI) and *absorptive capacity* (ACAP). The first of these (OI) was introduced by Chesbrough (2003) following his examination of how NPD and commercialisation processes worked within leading high-technology firms in the United States. The notion of *open* rather than *closed* approaches to innovation reflects the dichotomy between traditional in-house management of R&D, NPD and commercialisation, with all activities undertaken within the firm's own research laboratories and production plants. However, the increasing pace of competition and the emergence of new digital technologies, resulted in a change from a 'closed' to an 'open' approach to innovation management by large companies. Driving this change was the recognition that speed to market and competitive success was contingent on enhancing the flow of knowledge and ideas not only within the firm, but between it and a wider network of customers, suppliers and third-party actors (Chesbrough 2006). KM lies at the heart of this process, which has been identified as critical to success in the commercialisation of radical innovation. As noted by Greco et al. (2016) in a study of companies in the European Union:

**Firms seeking to engage in open innovation**, ...should enter into collaborative agreements with a few knowledge-intensive partners, ensuring frequent interactions that may favour the transfer of knowledge across organizational boundaries. (Greco et al. 2016, 514)

How formal such engagements are is likely to depend on the nature of the project and the firm's strategic goals (van de Vrande et al. 2009; Garriga et al. 2013). While OI has benefits, it has been viewed as a function of R&D management with less attention given to its place in general management and economics (West et al. 2014). For firm's seeking to engage in OI, a more flexible mindset within the management team is required, in particular in relation to how IP rights are managed (Gambardella and Panico 2014). It is also important for all employees to become involved, and to understand that they can and should develop and maintain commercially valuable relationships with outsiders (Carayannis and Meissner 2017). However, OI is not without its challenges, and requires a strong commitment from the top management,

supported by processes and ICT systems that enhance KM processes and other tools for innovation and commercialisation (Parida et al. 2012; 2014).

Skin Elements saw the need to form strategic alliances to help facilitate its commercialisation program from an early stage. As a result, it embarked on an OI program rather than the alternative of creating a large internal project team. After the breakthrough with the creation of the *Soléo* formula, the Skin Elements team linked with a group of three key technology partners. Initially a specialist medical advisor was contracted on signing off on the base formulation. Peter and Leo travelled to Melbourne to utilise the services of his dermatology labs and understanding of human skin as an expert cosmetic surgeon. The team worked in and out of his rooms in Toorak Victoria for the final six months of the development phase. This was followed by a concurrent tie up with a consulting chemist in Sydney, and a naturopathic specialist in practice in Brisbane. The key to the rapid prototyping was the use of the expert panel to round off the product development process. As explained by Peter:

Within these open innovation arrangements with partners the ability to solve problems constructively enabled Skin Elements to leverage our time and resources to maximum purpose. This mutual value cocreated at the end strengthened all parties.

Another important aspect of both KM and OI is ACAP, which relates to the firm's ability to effectively manage the flows of information and knowledge from a range of external actors (e.g. customers, suppliers, competitors and R&D partners), bring this into the firm, and integrate it into the commercialisation process (Huang and Rice 2009). ACAP is not just about how the organisation acquires and assimilates information and knowledge, but how it exploits it and how rapidly it can do so (Zahra and George 2002). Of prime importance is the firm's ability to connect and communicate with external actors and then between internal actors, facilitating meaningful knowledge exchange in the process (Cohen and Levinthal 1990). ACAP not only plays a key role in OI, it also helps to foster enhanced innovativeness and financial performance within firms (West and Bogers 2014). Within SMEs, the small size and close proximity of the firm's management and project teams means that the R&D, NPD, marketing and sales activities involved in commercialisation are usually undertaken by the same people, or at least with all members involved. Formal systems are uncommon and information flows largely interpersonal and informal (Sparrow 2001; Bougrain and Haudeville 2002).

Skin Elements exemplified this process within the product development and commercialisation undertaken in the creation of the *Soléo* product. As explained by Peter:

The closeness of the small team in the technology development phase saw the mode of communication able to be better managed. This delivered faster and more immediate decision making. The ACAP of the team was high and allowed for the exploitation of the opportunity quickly. Management systems were largely informal with communication and information flows between all more informal and interpersonal. When the formula initially failed Leo was able to assemble the team at short notice and solve the problem. The ACAP was there to do this. Similar issues occurred during the test marketing phase and again the ACAP of the company was able to deliver.

Shepherd and Patzelt (2017) suggest that ACAP and the application of systematic NPD processes such as *StageGate*<sup>®</sup> (Cooper and Edgett 2005; Cooper and

Kleinschmidt 1993, 1995), comprise a potential theoretical concept of *operational entrepreneurship*, which they define as follows:

*Operational entrepreneurship* can be defined as the selection and management of transformation processes for recognizing, evaluating, and exploiting opportunities for potential value creation. (Shepherd and Patzelt 2017, p. 122)

This concept focuses on the use of *transformation processes* to assist the firm's management team to reduce uncertainty and risk in the commercialisation process by applying a series of decision making frameworks and tools to help validate assumptions prior to making ever increasing levels of investment. A wide-range of techniques and methods have been developed that lie outside the scope of this chapter. However, a common feature of these transformation processes is that they seek to assess the customer and market perception of value in a new product or service, as an integral part of any R&D, NPD commercialisation process.

York and Danes (2014) reviewed three of the best known processes: (i) the *Stage-Gate*<sup>®</sup> NPD process (Cooper 2019); (ii) the *Fuzzy Front-End* (FFE) process (Koen et al. 2002); and (iii) the *Customer Development* (CD) process (Blank and Dorf 2012). Their analysis identified similarities and differences between these three approaches. Of them *StageGate*<sup>®</sup> is the most structured and formal, but this reflects its origins in large north American manufacturing companies. *StageGate*<sup>®</sup> has evolved over time since its launch in the 1980s is now offered in a variety of new forms for smaller projects, rapid development or technology development (Cooper 2019).

The FFE process is not a complete NPD system, but more an experimental approach designed to undertake initial customer and market assessments in the early stages of the NPD process. The CD process is developed from the work of Ries (2011) and the *Lean Start-Up* concept, which focuses on creating business models that are built on understanding the value proposition that can be made to customers, validating this through the creation of *minimum viable products* that enable early market testing, and then either preserving with future investment, or *pivoting* around one of a large number of pivots to reinvent the product concept and select one of three *growth engines* upon which to build the business growth strategy. A key attribute of the CD/Lean Start-Up process is the need to build any new products or services around what the customer/end-user views as representing value, rather than seeking to push technology onto a customer.

The key to the rapid prototyping and the use of the expert panel described above, was the ability to round off the product in a very short period as compared to alternative internal approaches. This allowed the Skin Elements team to commence the assessment of the market of the key value drivers of the natural organic sunscreen over the state of the existing market offering more effectively. The *operational entrepreneurship* transformation processes utilised by Skin Elements saw the team working through the application of FFE and CD principles as it progressed through the product identification and specification process, then the assessment of the needs of the customer and exploration of opportunities in selected international markets.

For example, as part of specification development for *Soléo Organics* the assessment of the customer needs commenced via an FFE process (Koen et al. 2002) that

saw Peter and Leo meet with and test the product in a number of targeted markets and market segments. This was part of the initial product discovery process. The Skin Elements team then progressed from this period to the more formal market insertion program in Phase 2, where they followed the basic principles associated with CD (Blank and Dorf 2012), and Lean Start-Up (Ries 2011). It should be noted that these techniques were not applied in a formal manner, although the project team did participate in commercialisation education programs run by a local university during 2015–2017 where they addressed these techniques through the course. This included the *StageGate*<sup>®</sup> NPD process (Cooper 2019), which became a more common approach within the firm from Phase 3 onwards. As Peter explained:

In the early phases, our ability to assess individual markets parallel, and pivot the technology offering for the market, resulted in a change to the selection of ingredients that in the laboratory appeared to meet what was required. Only by moving through a full market insertion of progressive versions of the Soléo Organics did the company develop the product that met market acceptance globally.

### 19.3 Conclusion and Lessons Learnt

The Skin Elements case provides a study of the evolution of an innovative SME from initial start-up to public listing and international market entry. It addresses a gap in the literature on how KM is understood and applied within SMEs (Durst and Edvardsson 2012; Cerchione et al. 2016). The case also highlights the importance of having within the foundation team, a good cross-section of experience, skills and knowledge. In the case of the three founders, Leo brought his scientific knowledge, Craig, his knowledge of finance and company operations, and Peter, his knowledge and networks in the foundation of entrepreneurial ventures and the strategic leadership required to navigate the challenging process of commercialisation.

As the case shows, the Skin Elements team successfully overcame each of the major problems that Pellikka and Virtanen (2009) suggest are common challenges facing SMEs engaged in commercialisation. Their ability to do this was made possible by their willingness to embrace OI practices and look for outsiders who could provide them with the necessary knowledge, skills and resources that they might otherwise have had to create in-house at much greater cost and time. The success of their concurrent securing of product and production systems, and market entry and distribution channels, reflected the team's ACAP, KM system and use of *operational entrepreneurship* techniques (Shepherd and Patzelt 2017). These also evolved and became more sophisticated as the company grew and developed its internal systems. The case suggests that SMEs can apply KM, OI, ACAP and formal NPD processes just as effectively as large firms. It also addresses the way effective interpersonal communications is the backbone of managing KM within such a company, building trust and understanding between the members of the project team, and their strategic alliance partners. This shows the importance of OI strategies for innovative SMEs (Wynarczyk et al. 2013).



The case is not without its limitations. It offers only one example of a case that was somewhat atypical due to the range of skills, knowledge and expertise that the three founders brought together. Future research should examine multiple cases of SMEs engaged in the commercialisation of innovative technologies and examine how they evolve their strategies in the successful creation of entrepreneurial innovation value (Malone et al. 2015).

Finally, for managers and entrepreneurs seeking to commercialise new innovations, the case highlights the importance of selecting the right cross-section of people, with the right skills, knowledge and expertise to address the major challenges that face SMEs. Having a clear roadmap for the concurrent evolution of the product technology, market development, capital raising to support growth, and expansion of the company is another key lesson. Finally, the case illustrates the vital importance of building and maintaining strategic alliances that can not only provide the SME with the resources and market access that it needs, but also access to new knowledge that can provide information that will prove essential to the team's learning and subsequent strategic decision making as they navigate through the uncertain waters of the commercialisation process.

## References

- Abetti, P. A., Lemaistre, C. W., & Wacholder, M. H. (1988). The role of Rensselaer Polytechnic Institute: Technopolis development in a mature industrial area. In R. W. Smilor, G. Kozmetsky, & D. V. Gibson (Eds.), *Creating the Technopolis* (pp. 125–144). Cambridge, MA: Ballinger Publishing.
- Adams, R., Bessant, J., & Phelps, R. (2006). Innovation management measurement: A review. *International Journal of Management Reviews*, 8(1), 21–47.
- Akgun, A. E., Lynn, G. S., & Byrne, J. C. (2004). Taking the guess work out of new product development: How successful high-tech companies get that way. *Journal of Business Strategy*, 25(4), 41–46.
- Alegre, J., Sengupta, K., & Lapiedra, R. (2013). Knowledge management and innovation performance in a high-tech SMEs industry. *International Small Business Journal*, 31(4), 454–470.
- Athaide, G. A., Meyers, P. W., & Wilemon, D. L. (1996). Seller-buyer interactions during the commercialisation of technological process innovations. *Journal of Product Innovation Management*, 13(5), 406–421.
- Autio, E., & Klofsten, M. (1998). A comparative study of two European business incubators. *Journal of Small Business Management*, 36(1), 30–43.
- Bagshaw, M. (2000). Why knowledge management is here to stay. *Industrial and Commercial Training*, 32(5), 179–182.
- Blank, S., & Dorf, B. (2012). *The start-up owner's manual: The step-by-step guide for building a great company*. Pescadero, CA: K&S Ranch Publishing.
- Bougrain, F., & Haudeville, B. (2002). Innovation, collaboration and SMEs internal research capacities. *Research Policy*, 31(5), 735–747.
- Carayannis, E. G., & Meissner, D. (2017). Glocal targeted open innovation: Challenges, opportunities and implications for theory, policy and practice. *Journal of Technology Transfer*, 42(2), 236–252.
- Cerchione, R., Esposito, E., & Spadaro, M. (2016). A literature review on knowledge management in SMEs. *Knowledge Management Research & Practice*, 14(2), 169–177.

- Chakravorti, B. (2004). The new rules for bringing innovations to market. *Harvard Business Review*, 82(3), 58–67.
- Chen, S., Duan, Y., Edwards, J. S., & Lehaney, B. (2006). Toward understanding inter-organizational knowledge transfer needs in SMEs: Insight from a UK investigation. *Journal of Knowledge Management*, 10(3), 6–23.
- Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston, MA: Harvard Business School Press.
- Chesbrough, H. W. (2006). Open innovation: a new paradigm for understanding industrial innovation. In: H. Chesbrough, W. Vanhaverbeke, J. West (Eds.), *Open innovation: Researching a new paradigm* (pp. 1–12). Oxford: Oxford University Press.
- Civi, E. (2000). Knowledge management as a competitive asset: A review. *Marketing Intelligence & Planning*, 18(4), 166–174.
- Cohen, W., & Levinthal, D. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128–152.
- Cooper, R. G. (2019). The drivers of success in new-product development. *Industrial Marketing Management*, 76(1), 36–47.
- Cooper, R. G., & Edgett, S. J. (2005). *Lean, rapid and profitable new product development*. Canada: Product Development Institute Inc.
- Cooper, R. G., & Kleinschmidt, E. J. (1993). Screening new products for potential winners. *Long Range Planning*, 26(6), 74–81.
- Cooper, R. G., & Kleinschmidt, E. J. (1995). Benchmarking the firm's critical success factors in new product development. *Journal of Product Innovation Management*, 12(5), 374–391.
- Davidsson, P., Steffans, P., & Fitzsimmons, J. (2009). Growing profitable or growing from profits: Putting the horse in front of the cart? *Journal of Business Venturing*, 24(4), 388–406.
- De Zubielqui, G. C., Lindsay, N., & O'Connor, A. (2014). How product, operations, and marketing sources of ideas influence innovation and entrepreneurial performance in Australian SMEs. *International Journal of Innovation Management*, 18(2), 1–25.
- Dimov, D. (2007). From opportunity insight to opportunity intention: The importance of person-situation learning match. *Entrepreneurship Theory and Practice*, 31(4), 561–583.
- Do, T. H., Mazzarol, T., Soutar, G. N., Volery, T., & Reboud, S. (2018). Organisational factors, anticipated rents and commercialisation in SMEs. *International Journal of Innovation Management*, 22(2), 1–30.
- Dodgson, M. (2000). *The management of technological innovation. An international and strategic approach*. Oxford: Oxford University Press.
- Durst, S., & Edvardsson, I. R. (2012). Knowledge management in SMEs: A literature review. *Journal of Knowledge Management*, 16(6), 879–903.
- Edvardsson, I. R. (2009). Is knowledge management losing ground? Developments among Icelandic SMEs. *Knowledge Management Research & Practice*, 7(1), 91–99.
- Ernst, H. (2002). Success factors of new product development: A review of the empirical literature. *International Journal of Management Reviews*, 4(1), 1–40.
- Evangelista, P., Esposito, E., Lauro, V., & Raffa, M. (2010). The adoption of knowledge management systems in small firms. *Electronic Journal of Knowledge Management*, 8(1), 33–42.
- Fletcher, M., & Prashantham, S. (2011). Knowledge assimilation processes of rapidly internationalising firms. Longitudinal case studies of Scottish SMEs. *Journal of Small Business and Enterprise Development*, 18(3), 475–501.
- Ford, D., & Saren, M. (2001). *Managing and marketing technology*. London: Cengage Learning Business Press.
- Gambardella, A., & Panico, C. (2014). On the management of open innovation. *Research Policy*, 43(5), 903–913.
- Garriga, H., Von Krogh, G., & Spaeth, S. (2013). How constraints and knowledge impact open innovation. *Strategic Management Journal*, 34(9), 1134–1144.
- Gray, C. (2006). Absorptive capacity, knowledge management and innovation in entrepreneurial small firms. *International Journal of Entrepreneurial Behaviour & Research*, 12(6), 345–360.

- Greco, M., Grimaldi, M., & Livio, C. (2016). An analysis of the open innovation effect on firm performance. *European Management Journal*, 34(5), 501–516.
- Harris, R. J. (2008). Developing a collaborative learning environment through technology enhanced education (TE3) support. *Education + Training*, 50(8/9), 674–686.
- Hedlund, G. (1994). A model of knowledge management and the N-form corporation. *Strategic Management Journal*, 15(2), 73–90.
- Heydebreck, P., Klofsten, M., & Maier, J. (2000). Innovation support for new technology-based firms: The Swedish Teknopol approach. *R&D Management*, 30(1), 1–12.
- Hoffman, K., Parejo, M., Bessant, J., & Perren, L. (1998). Small firms, R&D, technology and innovation in the UK: A literature review. *Technovation*, 18(1), 39–55.
- Hossain, M. (2015). A review of literature on open innovation in small and medium-sized enterprises. *Journal of Global Entrepreneurship Research*, 5(1), 1–12.
- Huang, F., & Rice, J. (2009). The role of absorptive capacity in facilitating “open innovation” outcomes: A study of Australian SMEs in the manufacturing sector. *International Journal of Innovation Management*, 13(2), 201–220.
- Huang, X., Soutar, G. N., & Brown, A. (2002). New product development processes in small to medium-sized enterprises: Some Australian evidence. *Journal of Small Business Management*, 40(1), 27–42.
- Hutchinson, V., & Quintas, P. (2008). Do SMEs do knowledge management? Or simply manage what they know? *International Small Business Journal*, 26(2), 131–154.
- Jolly, V. K. (1997). *Commercializing new technologies: Getting from mind to market*. Boston, MA: Harvard Business School Press.
- Kang, J., Gwon, S. H., Kim, S., & Cho, K. (2013). Determinants of successful technology commercialization: Implication for Korean government-sponsored SMEs. *Asian Journal of Technology Innovation*, 21(1), 72–85.
- Kelley, D. J., & Rice, M. P. (2002). Advantage beyond founding the strategic use of technologies. *Journal of Business Venturing*, 17(1), 41–57.
- Keogh, W., Mulvie, A., & Cooper, S. (2005). The identification and application of knowledge capital within small firms. *Journal of Small Business and Enterprise Development*, 12(1), 76–91.
- Klofsten, M., & Jones-Evans, D. (1996). Stimulation of technology-based small firms—A case study of university-industry cooperation. *Technovation*, 16(4), 187–193.
- Koen, P. A., Ajamian, G. M., Boyce, S., Clamen, A., Fisher, E., Fountoulakis, S., et al. (2002). Fuzzy front end: Effective methods, tools and techniques. In P. Belliveau, A. Griffin, & S. Somermeyer (Eds.), *The PDMA toolbook 1 for new product development* (Chapter 1). New York: Wiley.
- Levy, M., Loebbecke, C., & Powell, P. (2003). SMEs, co-opetition and knowledge sharing: The role of information systems. *European Journal of Information Systems*, 12(1), 3–17.
- Malecki, E. J. (1997). *Technology and economic development: The dynamics of local, regional and national competitiveness* (2nd ed.). Boston, MA, USA: Addison-Wesley Longman Publishing Co., Inc.
- Malone, P., Mazzarol, T., & Reboud, S. (2015). Understanding commercialization in entrepreneurial firms: A case example. In *International Council of Small Business (ICSB) 60th Annual Conference 2015*, 6–9 June, Dubai, UAE.
- Mazzarol, T., Clark, D., Gough, N., Olson, P., & Reboud, S. (2014). Commercialisation in SMEs: Case studies from Australia, New Zealand and the United States. In B. Kotey, T. Mazzarol, D. Clark, D. Foley, & T. McKeown (Eds.), *Meeting the globalisation challenge: Smart and innovative SMEs in a globally competitive environment*. Melbourne: Tilde University Press.
- Mohr, J. (2001). *Marketing of high-technology products and innovations*. Englewood Cliffs, NJ: Prentice-Hall.
- Nonaka, I., & Takeuchi, I. (1995). *The knowledge creating company: How Japanese companies create the dynamics of innovation*. New York/Oxford: Oxford University Press.
- Nunes, M. B., Annansingh, F., Eaglestone, B., & Wakefield, R. (2006). Knowledge management issues in knowledge-intensive SMEs. *Journal of Documentation*, 62(1), 101–119.

- OECD. (2006). *The SME financing gap: Theory and evidence* (Vol. 1). Paris: Organisation for Economic Co-operation and Development. [www.oecd.org/bookshop](http://www.oecd.org/bookshop).
- OECD. (2010). *High-growth enterprises: What governments can do to make a difference*. Paris: Organisation for Economic Co-operation and Development.
- OECD. (2016). *Financing SMEs and entrepreneurs 2016: An OECD scoreboard*. Paris: Organisation for Economic Co-operation and Development (OECD) Publishing.
- OECD. (2018). *Promoting innovation in established SMEs*. Paris: Organisation for Economic Co-operation and Development (OECD). [www.oecd.org](http://www.oecd.org).
- Ozer, M. (2003). Process implications of the use of the internet in new product development: A conceptual analysis. *Industrial Marketing Management*, 32(6), 517–530.
- Ozer, M. (2004). Managing the selection process for new product ideas. *Research Technology Management*, 47(4), 10–11.
- Padula, G., Novelli, E., & Conti, R. (2015). SMEs inventive performance and profitability in the markets for technology. *Technovation*, 41–42(2015), 38–50.
- Parida, V., Oghazi, P., & Ericson, Å. (2014). Realization of open innovation: A case study in the manufacturing industry. *Journal of Promotion Management*, 20(3), 372–389.
- Parida, V., Westerberg, M., & Frishammar, J. L. (2012). Inbound open innovation activities in high-tech SMEs: The impact on innovation performance. *Journal of Small Business Management*, 50(2), 283–309.
- Park, T., & Ryu, D. (2015). Drivers of technology commercialization and performance in SMEs. *Management Decision*, 53(2), 338–353.
- Pellikka, J., & Lauronen, J. (2007). Fostering commercialization of innovation in small high technology firms. *International Journal of Technoentrepreneurship*, 1(1), 92–108.
- Pellikka, J., & Virtanen, M. (2009). Problems of commercialisation in small technology-based firms. *International Journal of Entrepreneurship and Innovation Management*, 9(3), 267–284.
- Perez-Araos, A., Barber, K. D., Munive-Hernandez, J. E., & Eldridge, S. (2007). Designing a knowledge management tool to support knowledge sharing networks. *Journal of Manufacturing Technology Management*, 18(2), 153–168.
- Pillania, R. K. (2008). Strategic issues in knowledge management in small and medium enterprises. *Knowledge Management Research & Practice*, 6(4), 334–338.
- Pillania, R. K. (2009). Demystifying knowledge management. *Business Strategy Series*, 10(2), 96–99.
- Polanyi, M. (1962). *Personal knowledge: Towards a post critical philosophy*. London: Routledge.
- Radzeviciene, D. (2008). Developing small and medium enterprises using knowledge management frameworks. *Aslib Proceedings*, 60(6), 672–685.
- Ries, E. (2011). *The lean start-up: How constant innovation creates radically successful businesses*. London: Portfolio Penguin Books.
- Salojärvi, S., Furu, P., & Sveiby, K.-E. (2005). Knowledge management and growth in Finnish SMEs. *Journal of Knowledge Management*, 9(2), 103–122.
- Sedighadell, S., & Kachquie, R. (2013). Managerial factors influencing success of new product development. *International Journal of Innovation Management*, 17(5), 1–23.
- Shelton, R. (2001). Helping a small business owner to share knowledge. *Human Resource Development International*, 4(4), 429–450.
- Shepherd, D., & Patzelt, H. (2017). *Trailblazing in entrepreneurship: Creating new paths for understanding the field*. Cham, Switzerland: Palgrave Macmillan.
- Sparrow, J. (2001). Knowledge management in small firms. *Knowledge and Process Management*, 8(1), 3–16.
- Sparrow, J. (2005). Classification of different knowledge management development approaches of SMEs. *Knowledge Management Research & Practice*, 3(3), 136–145.
- Theyel, N. (2013). Extending open innovation throughout the value chain by small and medium-sized manufacturers. *International Small Business Journal*, 31(3), 256–274.
- van de Vrande, V., de Jong, J. P. J., Vanhaverbeke, W., & de Rochemont, M. (2009). Open innovation in SMEs: Trends, motives and management challenges. *Technovation*, 29(6), 423–437.

- van Hemert, P., Nijkamp, P., & Masurel, E. (2013). From innovation to commercialization through networks and agglomerations: Analysis of sources of innovation, innovation capabilities and performance of Dutch SMEs. *The Annals of Regional Science*, 50(2), 425–452.
- West, J., & Bogers, M. (2014). Leveraging external sources of innovation: A review of research on open innovation. *Journal of Product Innovation Management*, 31(4), 814–831.
- West, J., Salter, A., Vanhaverbeke, W., & Chesbrough, H. (2014). Open innovation: The next decade. *Research Policy*, 43(5), 805–811.
- Williams, R. L., & Bukowitz, W. R. (2001). The Yin and Yang of intellectual capital management: The impact of ownership on realizing value from intellectual capital. *Journal of Intellectual Capital*, 2(2), 96–108.
- Wong, K. Y., & Aspinwall, E. (2004a). Characterizing knowledge management in the small business environment. *Journal of Knowledge Management*, 8(3), 44–61.
- Wong, K. Y., & Aspinwall, E. (2004b). Knowledge management implementation frameworks: A review. *Knowledge and Process Management*, 11(2), 93–104.
- Wong, K. Y., & Aspinwall, E. (2005). An empirical study of the important factors for knowledge-management adoption in the SME sector. *Journal of Knowledge Management*, 9(3), 64–82.
- Wong, K. Y., & Aspinwall, E. (2006). Development of a knowledge management initiative and system: A case study. *Expert Systems with Applications*, 30(4), 633–641.
- Wynarczyk, P., Piperopoulos, P., & Mcadam, M. (2013). Open innovation in small and medium-sized enterprises: An overview. *International Small Business Journal*, 31(3), 240–255.
- Yahaya, S.-Y., & Nooh, A.-B. (2007). New product development management issues and decision-making approaches. *Management Decision*, 45(7), 1123–1142.
- Yencken, J., & Gillin, M. (2006). A longitudinal comparative study of university research commercialisation performance: Australia, UK and USA. *Innovation*, 8(3), 214–227.
- York, J., & Danes, J. (2014). Customer development, innovation and decision-making biases in the lean start-up. *Journal of Small Business Strategy*, 24(2), 21–39.
- Zahra, S., & George, G. (2002). Absorptive capacity: A review, re-conceptualization and extension. *Academy of Management Review*, 27(2), 185–203.
- Ziamou, P. L. (2002). Commercializing new technologies: Consumers' response to a new interface. *The Journal of Product Innovation Management*, 19(5), 365–374.

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