The Relationship Between an Innovation Strategy and a Technology Strategy

Department of Industrial Engineering Stellenbosch University, RSA

Abstract
The aim of this paper is to provide clarity on the differences and the relationship between a company’s technology strategy and its innovation strategy. Technology strategy and innovation strategy are often viewed as synonymous with each other. However this paper shows that they are two different but connected strategies. The paper initially focuses on the definition of each strategy, which includes their function. The paper goes on to present the relationship or alignment between these two strategies and how they align with other business strategies. Finally an example from the automotive industry is applied to test the developed alignment framework.

Keywords
Innovation, Technology, Strategy

1 INTRODUCTION
It has been said that structure follows strategy [1]. Mintzberg’s view is that structure follows strategy like ‘the left foot follows the right’ [2]. This means that structure should follow strategy, but a company’s current structure and capabilities will always play a role in the formulation of a new strategy. For this reason a clear understanding of the differences between a technology strategy and an innovation strategy with regards to their function, their form and their development process is essential for a company to decide on the correct structure with which to execute their technology and innovation activities. However this same structure will also influence and impact the thinking of the development of new technology strategies and innovation strategies. Structure refers to the processes, people, culture, information and tools required to execute a strategy successfully.

Technology and innovation are often viewed as synonymous with each other. Because of this a technology strategy is often viewed as a company’s innovation strategy. The aim of this paper is to provide clarity on the differences and the relationship between a company’s technology strategy and its innovation strategy.

The paper addresses the following questions:
- What is the difference in function between a technology strategy and an innovation strategy?
- How do these strategies align with each other and other business strategies?

2 DEFINITIONS
2.1 Definition of strategy
Although many different definitions for strategy exist [3], in its simplest form a company’s strategy is defined as a plan designed to achieve a particular long-term aim and as a guide for the allocation of resources in order to achieve the company’s objectives [1]. Strategy asks the question ‘How do a company’s competencies and capabilities help create and sustain a competitive advantage?’ [4]. Strategy therefore articulates how the opportunities created by a company’s capabilities can be exploited [4].

2.2 Definition of innovation strategy
The definition of an innovation strategy is linked to the definition of strategy. An innovation strategy is defined as a ‘functional, predetermined plan governing the allocation of resource to different types of innovations in order to achieve a company’s overall corporate strategic objectives’ [5].

Therefore the innovation strategy guides a company in deciding the correct level, type and impact of innovation which would most likely achieve its overall business goals. These decisions are therefore considered to be the main components of an innovation strategy:
- Innovation level runs on a continuum from incremental to radical [6].
- Innovation types include product innovation, process innovation and strategic innovation [7].
- Innovation impact runs on a continuum from sustaining innovation to disruptive innovation [8]. In turn these decisions will help a company conceptualise, design and implement the optimal innovation processes, systems and capabilities to deliver this innovation.

The function of an innovation strategy is to enable a company to align its innovation structures with its overall business strategy. These structures include the innovation department, innovation management reporting lines, idea management systems, innovation processes and innovation reports.
2.3 Definition of technology strategy
The concept of a technology strategy has been discussed in the technology management literature since the 1970's. The initial definitions described a technology strategy as a set of choices that needed to be made regarding the direction of a company's technology [9]. At a later stage knowledge based definitions of a technology strategy evolved. Ford's definition clearly illustrates the connection between technology and knowledge. 'A good starting point to understanding technology strategy is to affirm that the core of the company is what it knows and what it can do, rather than the products that it has or the market it serves. Technology Strategy centres on this knowledge and these abilities. It consists of policies, plans and procedures for acquiring knowledge and ability, managing that knowledge and ability and exploiting them for profit.' [10] The generic nature of knowledge in this definition does not adequately address the function of a technology strategy and therefore Davenport et al [9] selected a more specific definition as the basis for their work. 'Technology strategy encompasses the acquisition, management and exploitation of technological knowledge and resources by the organisation to achieve its business and technological goals.' [11]

The function of a technology strategy is to equip the company with the correct knowledge and technology to achieve its overall business strategy. A technology strategy creates a clear process for prioritising technology investments and a common viewpoint for different business units such as marketing, research and development and production. [12]

2.4 Difference between the two strategies
There is a close two-way link between innovation and technology. On the one side, technology plays a significant role in many innovations. New technologies, which are applied and add value, are often the drivers of innovation. Likewise customer driven innovation can be realised through the combination of diverse technologies. Furthermore, an established technology used in a different way or aimed at a different target market can lead to innovation. All three innovation types; process, product and strategic may or may not involve the introduction of a new technology.

On the other side many new technologies have been introduced through a formal innovation process. It is for this reason that the terms technology and innovation are often used synonymously or combined to form the phrase 'technological innovation' [4], [13]. The terms are also combined to define different strategies such as a product innovation and technology strategy [14]. This blurring of the lines between technology and innovation has meant that a company with a well-defined product or technology strategy may not see the need for a separate innovation strategy.

Based on the definitions and the functions of an innovation strategy and a technology strategy the difference between the two strategies and the difference in the functions of the two strategies is clear.

While a technology strategy prepares a company to focus on a specific technology, for a specific end purpose, an innovation strategy prepares a company to deliver the most appropriate innovations to achieve its business goals, including its technology strategy. The innovation strategy does not specify what those innovations would be; it simply defines the type, level and impact of innovation required and the company structures needed to maximise the possibility of achieving these innovations.

3 ALIGNMENT OF STRATEGIES
3.1 Strategic alignment
A successful strategy first has to be the correct strategy, then it needs to be aligned with the business values, structures, capabilities and other strategies and finally it needs to be executed [15].

Due to the close link between technology and innovation it is vital for both the technology and innovation strategies to be aligned with each other and the overall business strategy.

3.2 Alignment with overall business strategy
To understand the alignment with an overall business strategy the strategy hierarchy needs to be taken into consideration. At the highest level the company's mission explains what sort of businesses the company should be involved in. The company's overall business strategy explains what the emphasis should be with in these businesses. Next the business unit strategies explain how the company will compete in a specific industry. At the lowest level of the strategy hierarchy are the functional strategies. These explain how the company will maximise resource productivity [15].

Katz et al [16] reported that Kaplan and Norton's [17] strategic alignment and planning process, illustrated in figure 1, shows strategic alignment between the enterprise and strategic business units and between the corporate level functional strategies and the functional support units such as HR and Finance. The functional innovation strategy and the innovation support unit have been added to figure 1 to illustrate how an innovation strategy can align with other business strategies. A technology strategy is also analogous to a financial or human resource strategy [4] and therefore is also added to figure 1.
3.3 Alignment between the two strategies

In order to align the innovation strategy with the technology strategy of a company, a common reference is required. The four generic competitive strategies, defined by Porter [18], can be used as a common reference. It describes four generic business strategies, with which both the innovation strategy and the technology strategy needs to align. It is therefore possible to align the two functional strategies through the common generic business strategies.

Eight technology policies are described in table 1. For each of the four generic business strategies a technology policy for product technological and process technological change is defined [4]. Each of the four generic competitive strategies requires a different technology strategy which is focused by the selected technology policy.

<table>
<thead>
<tr>
<th>Porter’s Four Generic Competitive Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall cost leadership</td>
</tr>
<tr>
<td>Product technological change</td>
</tr>
<tr>
<td>Process technological change</td>
</tr>
</tbody>
</table>

The innovation strategy alignment framework developed by Katz et al [16] can be applied in order to align Porter’s four competitive strategies with the innovation strategy and therefore align it with the technology strategy. In the innovation strategy alignment framework the ‘overall cost leadership’ strategy is categorised as a combination ‘niche’ and ‘cost reducer’ generic strategic perspective, while the ‘focus-segment differentiation’ strategy is categorised as a true ‘niche’ generic strategic perspective.

Each generic strategic perspective has a different strength relationship with the components of the innovation strategy. The strengths of the relationships between the components of the
innovation strategy and the generic strategic perspectives and hence Porter’s four competitive strategies are presented in table 2. Evidence from the literature was used to determine the strength of the relationships in the innovation strategy alignment framework [16].

In figure 2 the alignment between the eight technology policies and the components of a functional innovation strategy are graphically represented. This representation is based on the alignment with Porter’s competitive strategies and the strengths of the relationships as defined in table 2. The impact of innovation is represented on the y-axis and the level of innovation is represented on the x-axis. Each of the eight technology policies are represented by the numbered circles.

<table>
<thead>
<tr>
<th>Components of an Innovation Strategy</th>
<th>Porter’s Four Generic Competitive Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall cost leadership (Cost Reducer)</td>
<td>Overall differentiation (First to market)</td>
</tr>
<tr>
<td>Innovation Type</td>
<td>Product</td>
</tr>
<tr>
<td></td>
<td>Strategic</td>
</tr>
<tr>
<td></td>
<td>Process</td>
</tr>
<tr>
<td>Innovation Level</td>
<td>Radical</td>
</tr>
<tr>
<td></td>
<td>Incremental</td>
</tr>
<tr>
<td>Innovation Impact</td>
<td>Sustaining</td>
</tr>
<tr>
<td></td>
<td>Disruptive</td>
</tr>
</tbody>
</table>

Table 2 - Relationships between Innovation components and competitive strategies

The innovation types are represented by the words ‘product’, ‘strategic’ and ‘process’. The relative size of the word indicates the strength of the relationship for that specific technology policy. Therefore technology policy three is aligned to an innovation strategy, which emphasises disruptive, radical and strategic innovations.

It is important to note that the relationships and strategic alignments defined in table 1 and figure 2 are not meant to restrict a company from any of the other innovation types, levels or impacts. They are merely a guide for a company to best align its innovation activities with its overall business strategy and technology strategy.
3.3.1 Alignment of technology policies one and two

Figure 2 illustrates how technology policies one and two, which are aligned with Porter’s ‘overall cost leadership’ strategy in table 1, are strongly aligned with an incremental and sustaining innovation strategy. The cost reducing strategy can also be seen as a reactive strategy. A reactive strategy involves a company improving on another company’s innovation so that it can deliver a product or service in high volumes and at low cost [19]. Therefore the cost reducing strategy generally involves incremental shifts in both products and process in order to reduce costs. Incremental innovations enhance or add value to current processes or products. In the case of a cost reducing strategy the value add, from incremental innovations; come in the form of reduced costs. These incremental shifts seldom produce a significantly disruptive innovation, but are more likely to sustain the current products, processes or technologies.

Neither technology policy one or two will require significant strategic innovation, which is usually associated with significant breakthroughs [20]. Because technology policy one is focused on technological product change a medium strength focus on product innovation type is required. Policy two focuses on technological process change. The cost reducers also have a strong process focus and therefore a strong relationship with the process innovation type is required.

3.3.2 Alignment of technology policies three and four

Technology policies three and four are aligned with Porter’s ‘overall differentiation’ strategy in table 1. The ‘overall differentiation’ strategy can be viewed as a ‘first to market’ strategy as overall differentiation is most likely to be achieved by the company which is first to market with the innovation. These strategies are strongly aligned with radical and disruptive innovation strategies. As stated by Katz et. al. [16] being first to market requires a strong commitment to creativity and risk taking [21]. Furthermore, ‘Innovations that are radical, inventive, and early have some characteristics in common,’ [19] This relationship between being first and having high levels of risk is what drives the strong relationship between the ‘overall differentiation’ strategy and radical innovation.

From an innovation type perspective, Hamel [20] explains that strategic innovation allows companies to break the traditional rules of their industry, to look at the future without the orthodox industry constraints. This would indicate that strategic innovations are strongly aligned with both technology policies three and four. There is also a medium relationship with product innovation in technology policy three but not with process innovation in technology policy four. This is due to the fact that process innovations seldom lead to radical and disruptive change.

3.3.3 Alignment of technology policies five and six

Technology policies five and six are aligned with Porter’s ‘focus-segment cost leadership’ strategy. The focus-segment component can be viewed as focusing on a niche market. High-levels of uncertainty experienced with first to market situations means the specific niches are not yet well understood and therefore companies tend to be more generalists [22]. Niche markets tend to form when an industry or product is well established. Companies are then able to adapt current products and processes to meet the specific needs of a niche customer segment. Therefore a more incremental and sustaining innovation strategy would align better with these technology policies.

The cost leadership component makes the alignment similar to technology policies one and two. However the lack of volume in the niche markets means the cost reductions have to come from a variety of other sources. These may include innovative business models and strategic partnerships, which is why there is a larger emphasis on strategic innovation.

3.3.4 Alignment of technology policies seven and eight

Technology policies seven and eight are aligned with Porter’s “focus-segment differentiation” generic strategy. For a company to differentiate its products in a niche market it has to be able to adapt current products to exactly meet the needs of the niche market, through incremental innovation, while at the same time look for radical innovations for the differentiating factor. This could lead to a certain amount of disruption in the markets as new features introduced for the specific niche may overtime be desired by the general market. Therefore the innovation strategy, which best aligns with this generic strategy and hence the technology policies seven and eight, is a blend of radical and incremental innovation and a slight emphasis on disruptive innovation.

From innovation type perspective, strategic innovations for both product and process technological changes are the main drivers of the differentiation along with significant product innovation for policy seven, the product technological change policy.

4 EXAMPLES OF INNOVATION AND TECHNOLOGY ALIGNMENT IN THE AUTOMOTIVE INDUSTRY

The automotive industry provides a good example of different original equipment manufacturers (OEM’s) each prescribing to different overall generic business strategies. In a study on innovation in the automotive industry [23] the innovation approaches of twelve OEM’s are presented. In this example the
innovation strategies and technology policies for five of the OEM’s in the study, plus Chery, are deduced, based on their generic strategy, and this result is then compared with the automotive innovation study.

4.1 Generic strategies
In figure 3 the six OEM’s are plotted on a matrix representing Porter’s four generic strategies. In reality this categorisation cannot be mapped on a simple matrix. However this matrix does provide a relatively accurate representation of the strengths and therefore the perceived strategies, of these well know companies.

![Matrix of Generic Strategies](image)

**Figure 3 - Automotive examples for Porter’s generic strategies**

Mercedes-Benz falls into the ‘overall differentiation’ category. They are at the bottom of the ‘overall’ segment as they are a mid-volume OEM, however they do produce products for a wide variety of market segments. Mercedes’s products and brand image has a clear focus on luxury and technological advancement. This places them firmly in the ‘differentiation’ category. Ford, Toyota and Hyundai all fall into the ‘overall cost leadership’ category. They each focus on a broad market and in their own unique ways have a strong cost focus. Toyota has tried to adopt a more niche market approach, while Hyundai has the smallest volumes and product range of the three. Chery’s entrance into the international automotive industry was led by low cost, bare minimum type products. This placed them in the ‘focus-segment cost leadership’ category. In recent years they have expanded their product offering and are targeting wider market segments. Porsche produce a low number of models for a very specific target market. This places them in the ‘focus-segment differentiation’ category.

4.2 Technology policies
Based on the generic strategies in figure 3 the appropriate and aligned technology policies are assigned to the different OEM’s by applying table 1.

Mercedes-Benz’s technology strategy should be guided by technology policies three and four. Therefore their technological changes on the product side should enhance product quality and features and on the process side support high quality and faster response time to orders. Ford, Toyota and Hyundai’s technology strategy should be guided by technology policies one and two. Therefore their technological changes on the product side should reduce product cost and on the process side enhance economies of scale. Chery’s technology strategies should be guided by technology policies five and six. Therefore their technological changes on the product side should provide only enough performance for the segment’s needs and features and on the process side should lower costs through tuning production and delivery systems to meet the segment’s needs. Porches technology strategies should be guided by technology policies seven and eight. Therefore their technological changes on the product side should exactly meet the needs of the segment and on the process side should improve performance through tuning production and delivery systems to meet the segment’s needs.

4.3 Innovation strategies
Based on the relationships defined between the generic strategies and the components of an innovation strategy in table 2 and the alignment of the components of an innovation strategy with the various technology policies in figure 2, appropriate and aligned innovation strategies for each of the OEM’s can be deduced. Mercedes-Benz’s innovation strategy should place a strong emphasis on radical and disruptive strategic innovations with slightly less of an emphasis on product innovation. This emphasis will depend on their balance between process and product technological change. Ford, Toyota and Hyundai’s innovation strategy should place a strong emphasis on incremental and sustaining process innovations with slightly less of an emphasis on product innovation. This emphasis will depend on their balance between process and product technological change. Chery’s innovation strategy should place a strong emphasis on incremental product innovations with slightly less of an emphasis on process and strategic innovation. This emphasis will depend on their balance between process and product technological change. Porsche’s innovation strategy should place a strong emphasis on product and strategic innovations with a balance between incremental and radical and sustaining and disruptive. This emphasis will depend on their balance between process and product technological change.
### Table 3 - Comparison with innovation study

<table>
<thead>
<tr>
<th>OEM’s</th>
<th>Innovation Study [23]</th>
<th>Technology policies (TP) and innovation strategies (IS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merc- Benz</td>
<td>- Product innovations&lt;br&gt;- Mid-size volumes&lt;br&gt;- High-end customers</td>
<td>TP3: Enhance product quality and features&lt;br&gt;IS: Strategic, product, radical, disruptive</td>
</tr>
<tr>
<td>Toyota</td>
<td>- Focuses largely on process innovation&lt;br&gt;- Cost-oriented</td>
<td>TP2: Enhance economies of scale&lt;br&gt;IS: Process, incremental, sustaining</td>
</tr>
<tr>
<td>Ford</td>
<td>- Adapts and improves existing products&lt;br&gt;- Low costs</td>
<td>TP1: Reduce product cost&lt;br&gt;IS: Product, incremental, sustaining</td>
</tr>
<tr>
<td>Hyundai</td>
<td>- Improves innovations&lt;br&gt;- Mass-market&lt;br&gt;- Low costs</td>
<td>TP1: Reduce product cost&lt;br&gt;IS: Product, incremental, sustaining</td>
</tr>
<tr>
<td>Porsche</td>
<td>- Premium product&lt;br&gt;- Systems and components innovations</td>
<td>TP7: Exactly meet needs of segment&lt;br&gt;IS: Product, strategic</td>
</tr>
</tbody>
</table>

4.4 Comparison with innovation study

The study on innovation in the automotive industry [23] determined different ‘innovation propositions’ for five of the six example OEM’s. Table 3 compares the innovation propositions from the study with the technology policies and innovation strategies deduced from the alignment model presented in figure 2.

The similarities between the results of the innovation study and the deduced generic strategies, technology policies and innovation strategies illustrates that such an alignment approach is possible.

5 CONCLUSIONS

The paper provides more clarity on the differences and the relationship between a company’s technology strategy and its innovation strategy by addressing the following questions:

- What is the difference in function between a technology and innovation strategy?
- How do these strategies align with each other and other business strategies?

The first question is addressed by first presenting definitions for both an innovation strategy and a technology strategy. Based on these definitions and the described function of each strategy it is concluded that while a technology strategy prepares a company to focus on a specific technology, for a specific end purpose, an innovation strategy prepares a company to deliver the most appropriate innovations to achieve its business goals, including its technology strategy.

The second question is addressed by identifying a common reference to which both the components of an innovation strategy and defined technology policies can be aligned. Porter’s four generic overall competitiveness business strategies are used as such a reference. Through this common reference it is possible to align the eight technology policies with the different components of an innovation strategy. This is illustrated in figure 2.

Finally the alignment between the technology policies and the components of an innovation strategy is tested, using the automotive industry as the real-life example. The results showed that it is possible to use the framework in figure 2 and the relationships defined in table 1 and table 2 to enhance the strategy development and alignment process and to better understand the relationship between the technology strategy and the innovation strategy. The framework does not provide hard and fast rules regarding these relationships; instead it provides a structure around which discussions, within a management team, can evolve and a common understanding develop.

6 REFERENCES

Proceedings of the South African Institute for Industrial Engineers (SAIIIE) Conference.


7 BIOGRAPHY

Niek du Preez is Emeritus Professor in Enterprise Engineering at Stellenbosch University, South Africa. He is founder of the Global Competitiveness Centre in Engineering and is currently the CEO of Indutech, an Enterprise-wide Innovation Management Company, based in Stellenbosch.

Corne Schutte is an Associate Professor at the Department of Industrial Engineering, University of Stellenbosch. His specific focus is in Innovation Management, Knowledge Networking, engineering Management and the strategic direction of Industrial Engineering in Southern Africa.

Bernard Katz holds an MSc.Eng and is working towards a PhD degree in Industrial Engineering from the University of Stellenbosch. He is currently the Business Process Manager at BroadReach Healthcare.