Dissertation

Success-Factors of Innovation Management in Automotive Supplier Industry

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Statutory Declaration

I declare that I have authored this thesis independently, that I have not used other than the declared sources / resources, and that I have explicitly marked all material which has been quoted either literally or by content from the used sources.

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date **signature**

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Abstract

This research work analyses and describes the vital importance of successful innovation management for Western automotive suppliers to survive in today's challenging environment. It is based on analysis of the automotive supplier industry, a key industry of great macro-economic importance for Western economies, which is currently undergoing a very disruptive phase of transformation and consolidation.

Beginning with an overview of the status of relevant innovation management research and linked to an analysis of the automotive supplier industry, a need was identified to adapt the existing innovation management concepts to better suit this industry. A set of specific key success factors for the automotive suppliers has been identified and characterized by comparing automotive Original Equipment Manufacturers (OEMs) and automotive suppliers with regard to the relevant elements of innovation management and the corresponding success factors. Within this set, four specific key success factors for innovation management of automotive suppliers were singled out. Their influence and impact were described in seven formulated hypotheses. Their empirical relevance could be validated through the analysis of the various case studies conducted. Based upon these findings, recommendations for automotive suppliers were formulated.

The results of this research work should provide researchers with a better understanding of the specific situation of innovation management in the automotive supplier industry and enable future research works to better apply innovation management concepts to this important industry. For the automotive suppliers themselves, the formulated recommendations derived from the validated hypotheses, provide a systematic framework that will enable them to identify those key elements they need to improve within their own innovation management architecture in order to become more successful innovators securing their overall long-term success.

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1 Introduction

This chapter first gives an explanatory introduction to innovation and the general automotive industry. Then it describes the specific characteristics of the automotive supplier segment that lead to the formulation of the goals of this research work and the approach used to achieve them.

1.1 Innovation in the Automotive Industry

Innovation and innovation management are by no means new topics of this century. SCHUMPETER's definition of innovation[1], which is considered to be the fundament of today's concept of innovation[2], is over 100 years old. However, his work may have been too visionary for his time, since enterprises and researchers only became mindful of this critical subject matter during the 1970s. Since the beginning of the 21st century, innovation has become one of the "hottest" topics in corporate strategy considerations and economic research. For instance, FAGEBERG[3] found that among all social science articles in 2005, the share of innovation related publications was 100% higher than ten years before as depicted in Figure 1.

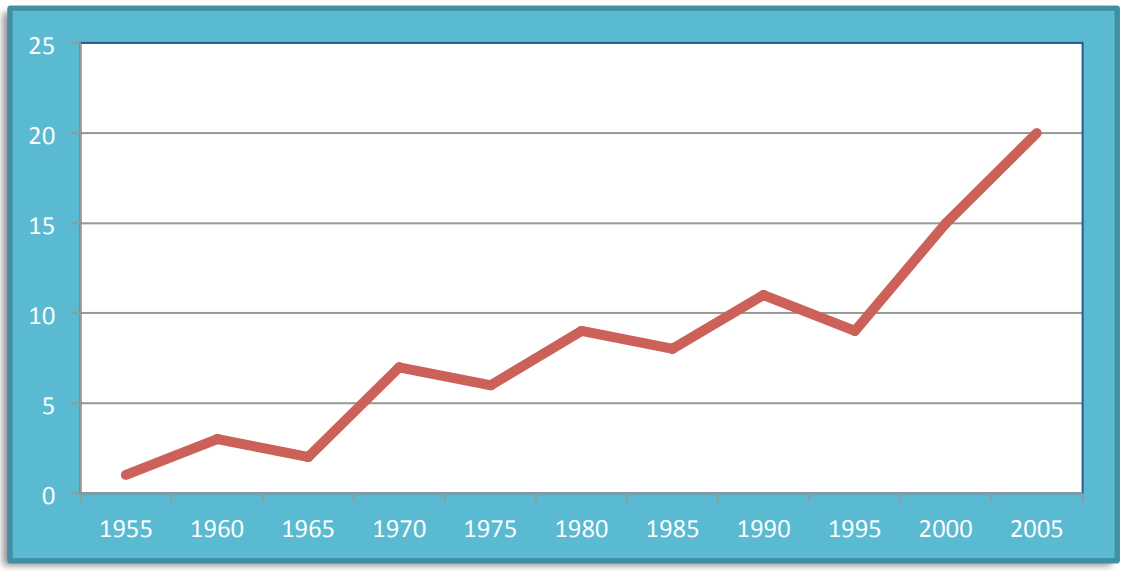


Figure 1: FAGEBERG's study on scholarly articles with "Innovation" in the title per 10,000 social science articles[4].

[1] SCHUMPETER, J. A. (1912)

[2] Cf. BROCKHOFF, J. (2008), p. 226

[3] Cf. FAGEBERG, J. (2005), p. 3

[4] FAGEBERG, J. (2005), p. 2

According to AFUAH, Innovation will become as relevant in this century as total quality management was in the 1970s, time-based management was in the 1980s, and efficiency was in the 1990s: in effect, “a precondition for gaining or maintaining competitive advantage”[5].

In spite of this increased focus on innovation, there is still a large need for research and improvement in the innovation management field, especially when it comes to the empiric implementation of the existing concepts within the specific environment of a given industry.

For instance, in the annual innovation management survey of the Boston Consulting Group out of over 2400 senior managers questioned, 66% named innovation as one of their top 3 strategic concerns. At the same time, the study shows that despite the high level of management attention and academic research, over half of the executives remain unsatisfied with the results of innovations in their companies[6]. Arthur D. Little presented similar results in a study stating that while most managers recognise the importance of innovation, the majority are dissatisfied with the results of innovation management in their firms[7].

These results can be fully applied to the automotive supplier industry. For an industry that has been suffering tremendous price pressure and is undergoing an intensive phase of global consolidation, a company’s ability to innovate and differentiate itself is key to its survival.

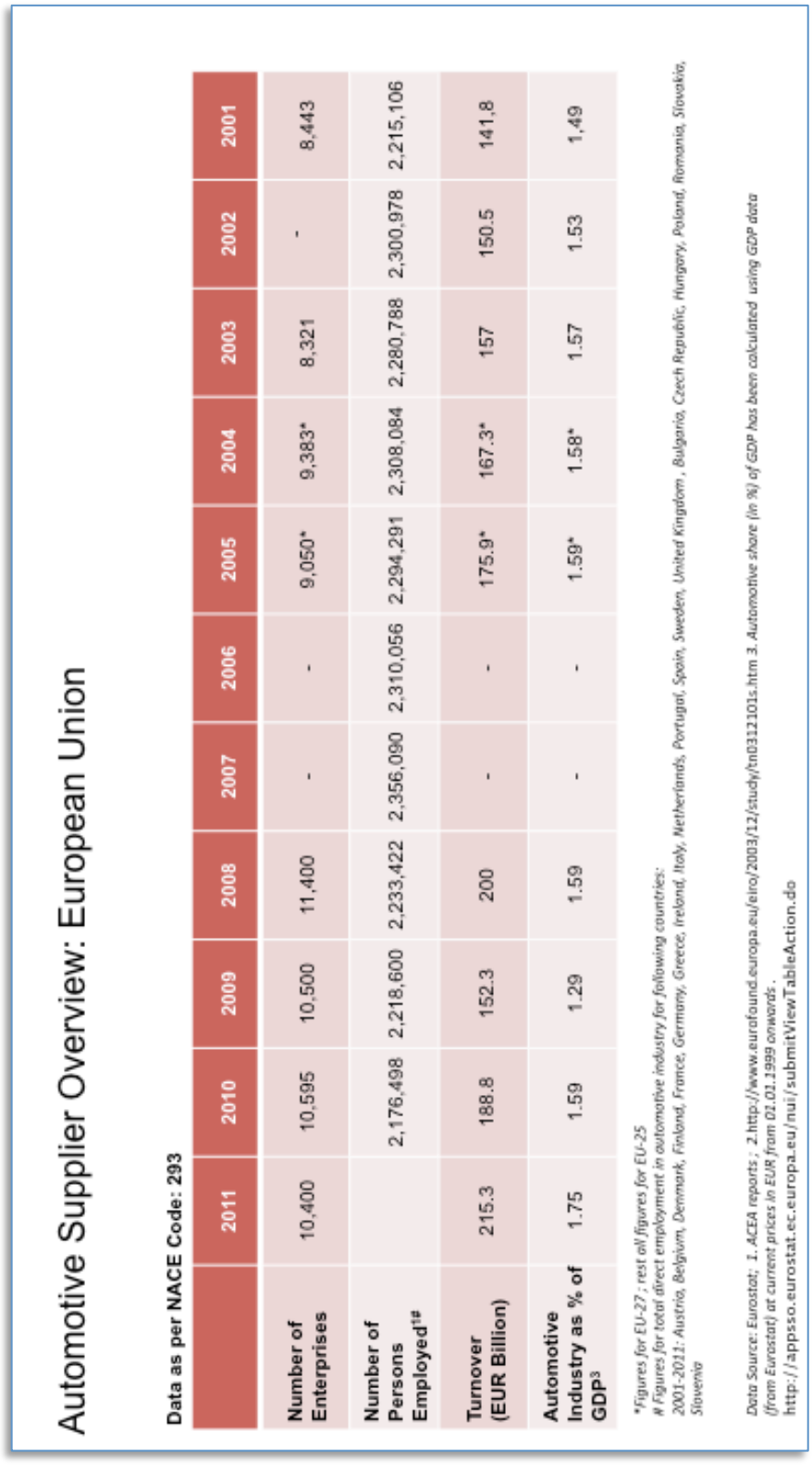
What makes innovation management for automotive suppliers so special and characteristically challenging is the supplier’s dependence upon their customers, the automotive car manufacturers, in a business-to-business market. As described in the following chapters, the innovation management strategies and activities of automotive suppliers are mainly driven by the market-pull from the car manufacturers while the opportunities for suppliers to actively push new products into the market are often very limited. Due to the specific conditions of the automotive industry, there is a need for automotive suppliers to implement a tailored innovation management approach in order to be successful.

[5] AFUAH A. (2003), p. vii

[6] Cf. BOSTON CONSULTING GROUP (2007), p. 6

[7] Cf. ARTHUR D. LITTLE (2010), pp.3

Consider the importance that this industry has in Europe, as pictured in the following two figures: more than 9.000 enterprises employ over 2,3 million people in the countries of the European Union, 175.000 of them in Austria alone where every eighteenth working place is directly related to the automotive industry. It becomes a matter not only of individual but also of macro-economic importance.



Automotive Supplier Overview: European Union

Data as per NACE Code: 293

	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
Number of Enterprises	10,400	10,595	10,500	11,400	-	-	9,050*	9,383*	8,321	-	8,443
Number of Persons Employed[1#]		2,176,498	2,218,600	2,233,422	2,356,090	2,310,056	2,294,291	2,308,084	2,280,788	2,300,978	2,215,106
Turnover (EUR Billion)	215.3	188.8	152.3	200	-	-	175.9*	167.3*	157	150.5	141.8
Automotive Industry as % of GDP[3]	1.75	1.59	1.29	1.59	-	-	1.59*	1.58*	1.57	1.53	1.49

*Figures for EU-27 ; rest all figures for EU-25
Figures for total direct employment in automotive industry for following countries:
2001-2011: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom , Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia

Data Source: Eurostat; 1. ACEA reports ; 2.http://www.eurofound.europa.eu/eiro/2003/12/study/tn0312101s.htm 3. Automotive share (in %) of GDP has been calculated using GDP data (from Eurostat) at current prices in EUR from 01.01.1999 onwards .
http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

Figure 2: Overview of the European Automotive Supplier Industry (author's illustration)[8].

[8] Data Source: Magna Exteriors & Interiors Systems Marketing.

Figure 3: Overview of the Austrian Automotive Supplier Industry (author's illustration)[9].

It is the goal of this research work, based upon the actual status of discussion in literature, to explore and analyse success factors of innovation management within the specific constraints of the automotive supplier industry and derive recommendations for their successful implementation.

This research work identifies three key success factors for innovation management by automotive suppliers:

- Defining and implementing the right innovation strategy.
- Implementing a cascading innovation management process that is fully synchronized with the targeted vehicle manufacturer's own innovation process.
- Having and maintaining an innovation friendly corporate culture, supported by top management's commitment to innovation.

[9] Data Source: Magna Exteriors & Interiors Systems Marketing.

The relevance of these key success factors in the automotive supplier industry has been analysed and positively validated through a series of empirical case studies.

Using the results of these case studies, suggestions have been made for improving the innovation management activities of automotive suppliers and recommendations given for future research areas.

1.2 The Automotive Supplier Industry

This section describes the most relevant characteristics of the automotive supplier segment. The Five Forces model is used to explain the competitive situation of automotive suppliers and the balance of power within the industry. First the current migration of value that affects this industry and its' effects are described then the strategic options of automotive suppliers to commercialize their products are characterized. Finally these facts are used to explain the vital importance of innovation for Western automotive suppliers.

1.2.1 Main Characteristics of the Automotive Supplier Industry

The Automotive Supplier Industry is a typical example of a business-to-business (B2B) market with a relatively low level of vertical integration. With the few exceptions of those companies that are active in the areas of accessories and aftermarket, the average automotive supplier doesn't have any direct interaction with the end users/consumers of the products they produce. Their direct customers are automotive manufacturers that own a brand and market complete vehicles, the so-called Original Equipment Manufacturers (OEMs).

The suppliers themselves can be characterized according to their position among the value chain respective to the OEMs, the tier 1 suppliers being those who directly supply the OEMs and the tier 1+n suppliers those who deliver their products to other suppliers.

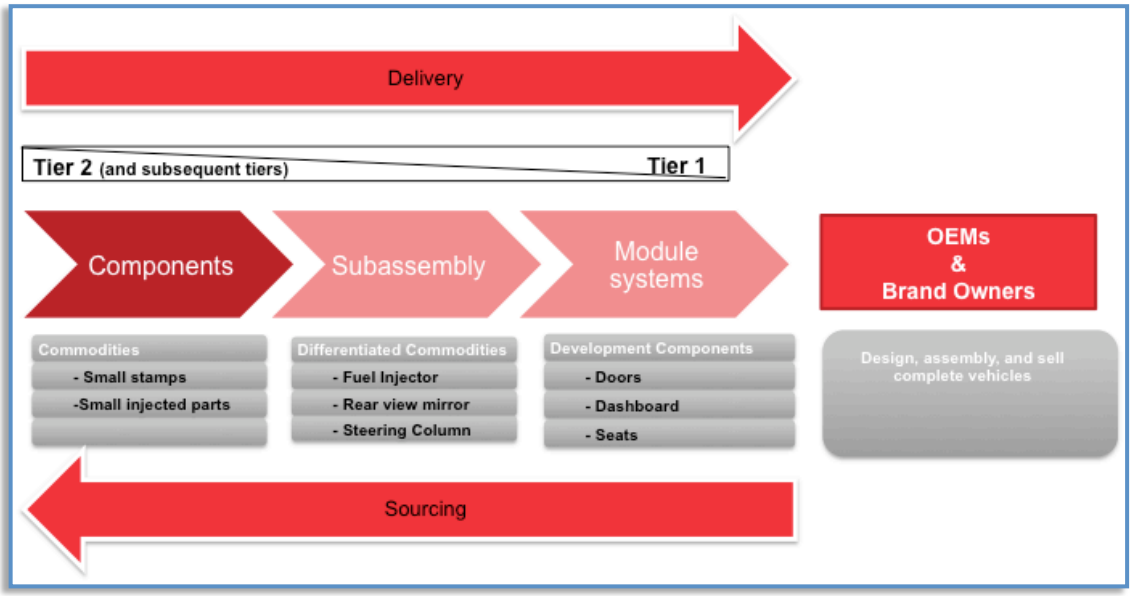


Figure 4: **Overview of the automotive supply chain (author's illustration).**

1.2.2 Market Forces Analysis: Buyer Dominance

Using PORTER's Five Forces Model[10] the supplier market can be described as follows:

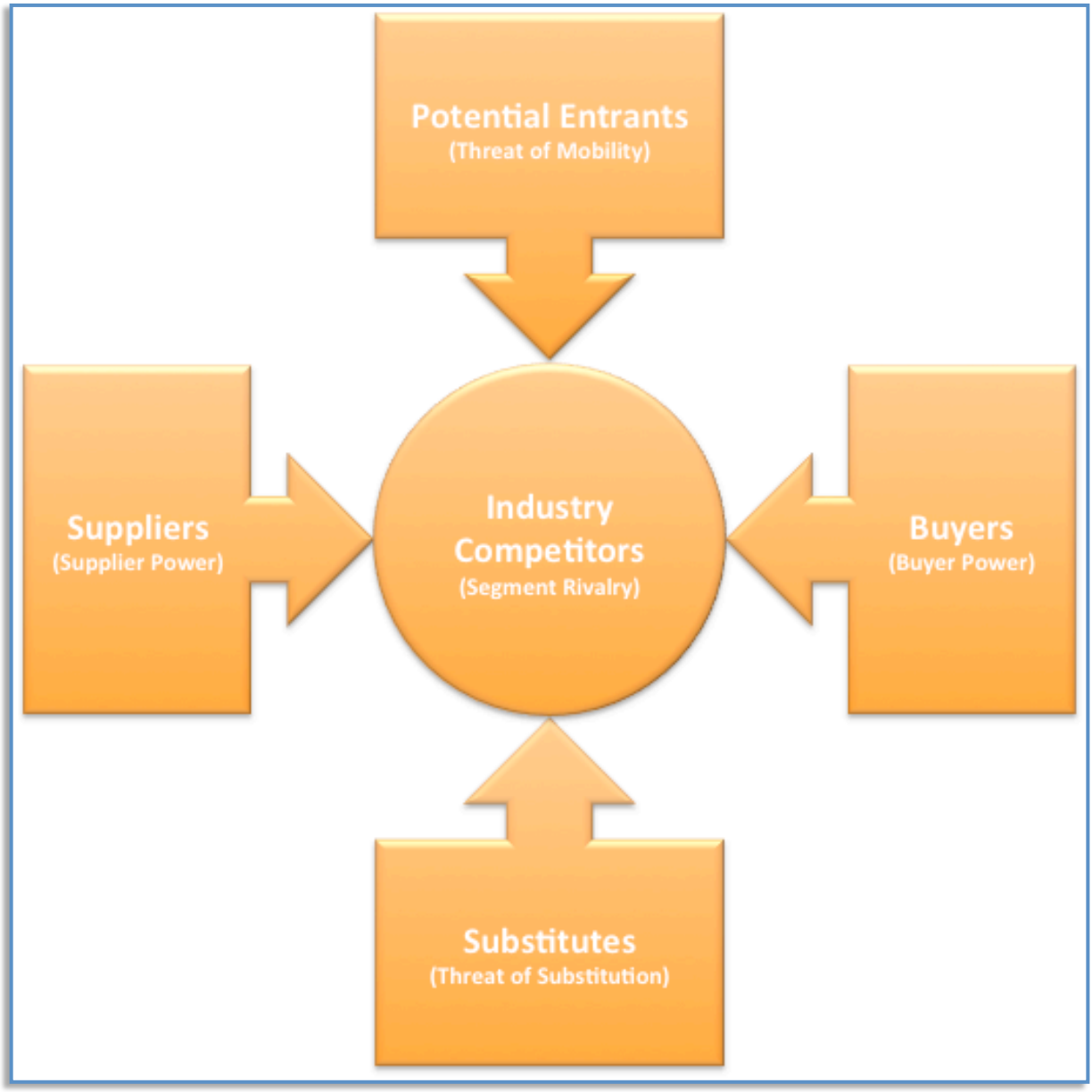


Figure 5: Five Forces Model according to PORTER[11].

Buyers

As is typical for business-to-business (B2B) markets, automotive suppliers have only a few customers to approach with their product and services. Recently, the extreme

[10] PORTER, M. E. (1980), p. 4

[11] PORTER, M. E. (1980), p. 4

concentration process of the automotive industry has further reduced the number of independent global automotive OEMs of relevant size, leading to a very small total number of possible customers for automotive suppliers, as shown in the following figure.

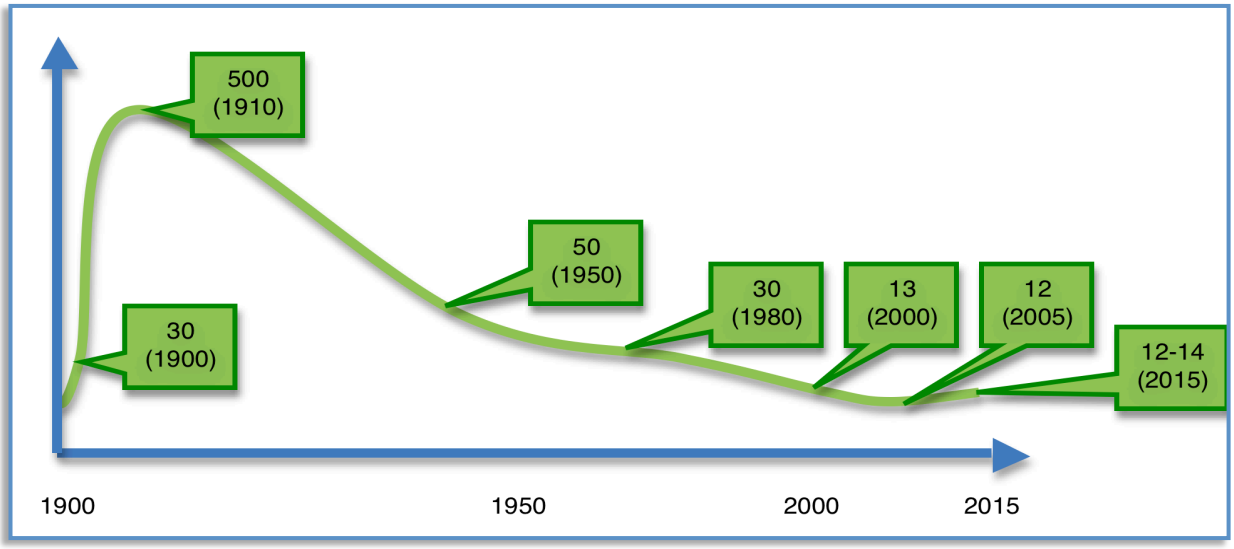


Figure 6: Number of large global independent automotive OEMs according to OLYVER WYMAN[12].

This extreme concentration on the buyer side has led to an imbalance of bargaining power, making the automotive supplier industry clearly a buyer dominated market, where, with a few exceptions, most automotive suppliers are strongly dependent upon their few automotive OEM customers.

Suppliers

The first tier automotive suppliers outsource a significant portion of their total purchasing volume either from other, mostly smaller, tier 1+n automotive suppliers or from raw material suppliers, for instance from steel, resin and paint suppliers.
The tier 1+n suppliers are mostly relatively small companies with limited financial and technological resources. Over the past several years their number has been consistently decreasing as many of them went out of business due to their inability to endure the price pressure passed on to them by the tier 1 suppliers. So in theory the tier 1 supplier should have a stronger bargaining position, however they are limited in their own execution abilities by the risk of losing their supplier base.

[12] Referring to OLYVER WYMAN (2007), p. 61

In the prime material market, automotive suppliers are small players in a global commodity marketplace with very limited bargaining power. When not supported by their OEM customers, automotive suppliers have to finance the volatile price development of these commodities on their own. The price increases during the past years for some of the key automotive raw materials like steel and resin, has had a hard impact on the bottom line results of the concerned suppliers, due to their limited possibilities of passing on the price pressure, either down the value chain to their own suppliers, or upward to the OEMs.

Potential Entrants

The threat of new-entrants and substitute products is also high within the automotive supplier industry. From a Western perspective, new-entrants come mainly from emerging markets like China and India, compensating for their technology gaps with a low manufacturing cost base.

Substitutes

The threat of being substituted can evolve from various directions; a typical example is the on-going replacement of mechanical elements through electrical/electronic functions; in the future this trend is expected to continue and increase due to new entrants coming in from the software industry. Currently, the average share of automotive electronics in a car has increased to as much as 35% of the total car value; in premium and upper mid-size cars this share will be even bigger.

Internal Rivalry

These strong market forces and threats add to the very high level of internal rivalry among suppliers themselves to create a very challenging environment for all industry participants.

The effects of this competitive environment can be recognized in the dramatic concentration process that the global supplier industry is suffering. This development can clearly be seen in the following chart taken from a study of the consulting firm Oliver Wyman[13] showing that the total number of global tier 1 suppliers projected for the year 2015 will only be around one tenth of the number existing 30 years prior.

[13] OLIVER WYMAN (2007), p. 61

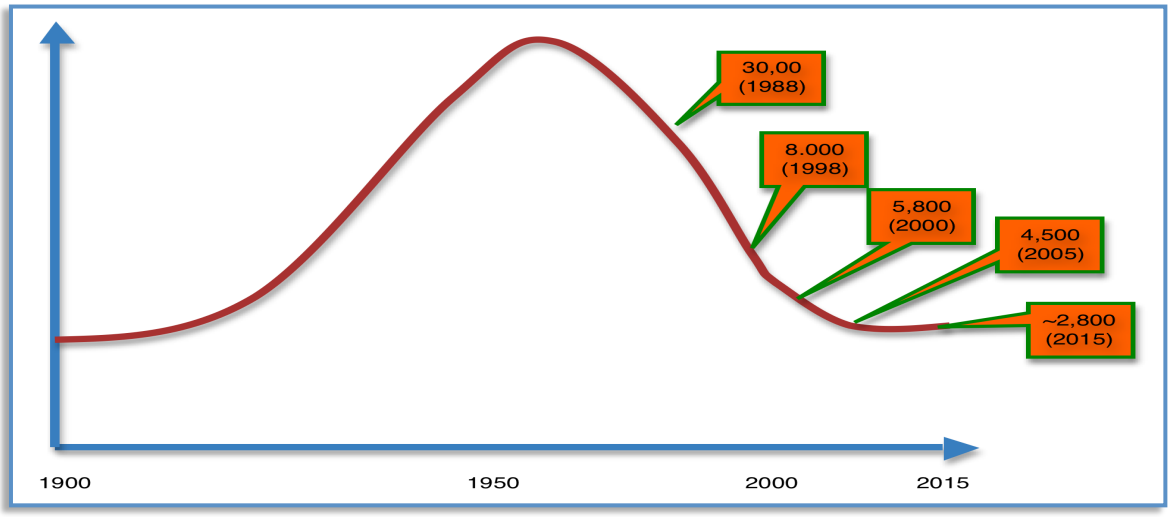


Figure 7: Number of automotive tier 1 suppliers according to OLYVER WYMANN[14].

1.2.3 Value Migration from Commodity to Innovation

A study conducted by the American Centre for Automotive Research and Accenture[15] analysing the financial results of the North American automotive industry during one decade (1990-2000), revealed that, while automotive original equipment manufacturers and suppliers have significantly increased car performance and safety features, the additional value created has migrated to the costumers. According to this research work, approximately $5,300 worth of features and options were added per car, yet prices increased by only $4,200.

This value migration to customers directly endangers the bottom line of the OEMs, who try to offset this issue by passing the burden to their suppliers in the form of price reductions. In other words, due to the OEM's inability to obtain higher car prices from the market when they introduce new features to a car, they have to offset their cost increases by reducing the price of the rest of the car, and they mainly focus hereby on commodity parts. For this purpose, OEMs use their buying power to create transparent commodity markets, in which quality, technology, products and services are comparable among all suppliers and cost/price is the main competitive factor. Tools and methods such as reverse auctions, cost-breakdowns and linear performance pricing models are used to control pricing and, in some cases, to even dictate the profitability level of their suppliers.

[14] Referring to OLIVER WYMAN (2007), p. 61

[15] Cf. ACCENTURE and Centre for Automotive Research (CAR) (2001)

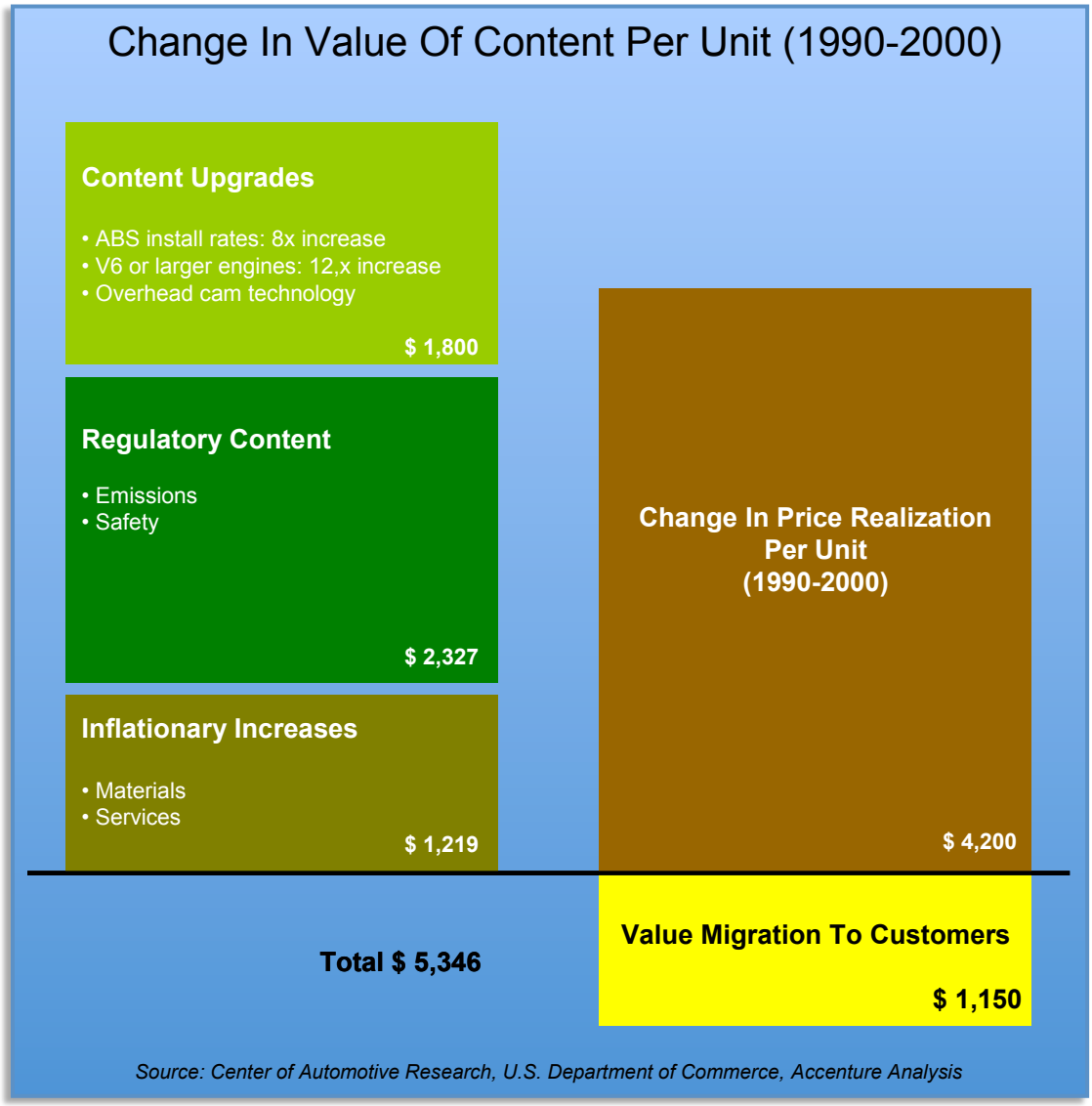


Figure 8: **Value migration per car in the US automotive industry according to ACCENTURE[16].**

1.2.4 The Automotive Suppliers' Marketing Mix

The unfavourable distribution of competitive forces within the automotive market combined with the value drain for commodities presents a very challenging situation for those suppliers who cannot differentiate themselves.

These kinds of automotive suppliers become trapped in a vicious circle, in which the low margins and high price pressure of the commodity market force them to focus

[16] Referring to ACCENTURE and Centre for Automotive Research (CAR) (2001)

mainly on further cost reductions, thereby limiting their capability to invest in the long-term development of other differentiators.

It becomes obvious when applying the classical marketing-mix-model depicted below, that the opportunities to escape the commodity trap are limited. The 4 P-Elements analyse what suppliers generally can do to improve their strategic position on the Targeted Market:

- Product: the centrepiece of the marketing mix, describes the physical part or service the supplier wants to market.
- Place: the point of sale or distribution channel of the product or service.
- Price: the monetary value of the product and services offered including payment terms and other commercial conditions such as givebacks, bonuses and rebates.
- Promotion: all the communication activities used to inform, support, convince etc. the customer to place an order with a supplier.

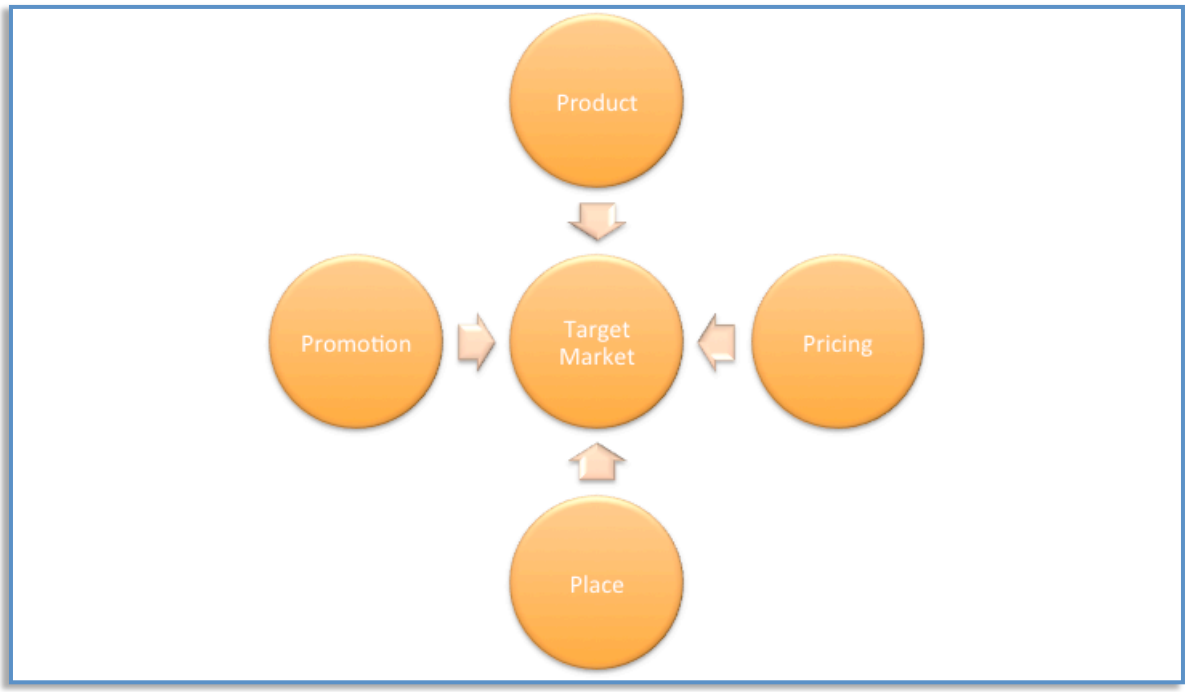
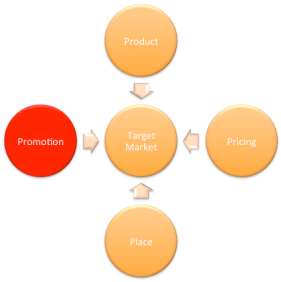


Figure 9: Marketing-Mix-Model (author's illustration).

Supplier's Target Market

The market for suppliers' products and services is almost solely comprised of the Automotive OEMs. For some suppliers, it is also possible to sell some of their products directly to the customer via the independent aftermarket and the accessories market places, but this is not feasible for all products. Additionally, most of the OEMs have created commercial and legal barriers to prevent their suppliers from selling directly in these markets, since they would then represent competition for the OEM's own aftermarket and accessories business.

The strategic choice for most suppliers is therefore limited to selecting the OEM(s) they want to serve, respectively the OEM's vehicle programs and the regions they want to target. Due to the buyer's strong power position, this is in most cases a process driven by the automotive OEMs since they pre-select the suppliers they consider strategic for their business and try to distribute the program orders in the different regions according to their own sourcing strategy. Most suppliers have to follow this direction and try to adapt to the OEMs' strategy instead of actively targeting a specific market.

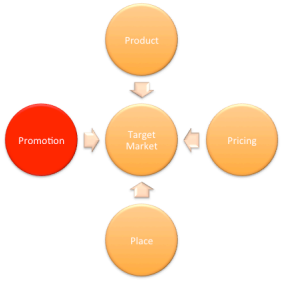


Product

The product of an automotive supplier is either a part of the OEM's vehicle or is a sub-module, sub-system or a component of another supplier's product. For this reason most automotive suppliers only have very limited, if any control at all, of the product's specification. In this case, product properties like physical structure (form/size/shape), features, performance quality, conformance quality, durability, reliability, reparability, style and design are usually determined or narrowly specified by the OEMs and can not be significantly altered by the supplier. Therefore most automotive suppliers produce and offer basically the same parts as their competitors do. They can differentiate themselves mainly by the way they create and produce the parts (production process) and by the service and support level they provide. This kind of differentiation must be perceptible to the buyer, meaning, it has to have a relevant commercial or technical effect.

Still there are some exceptions, whereby suppliers are able to offer products with unique functionality and/or value proposition, so that they maintain control of the product specification and configuration, giving them a stronger negotiating position with the OEMs. A critical prerequisite is to have a unique non-replicable advantage

that the supplier safeguards against competition. At the same time the suppliers' product's functionality must be of great importance for the OEM, meaning it has to help them differentiate their vehicles by either providing a cost advantage or offering unique customer relevant features.

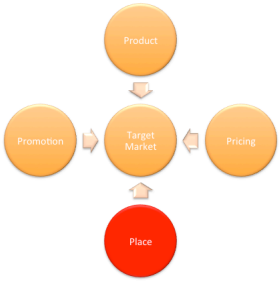


Promotion

Compared to other industries, the direct impact of the communication activities available to influence the market success of an automotive supplier is much less relevant. Typical promotion in the sense of advertising is therefore rare in the industry and is more commonly linked to communicating a general company or attracting talent than to supporting the sales process.

Some suppliers have started ingredient-branding strategies that target the end consumers, but so far nobody has reached a significant brand recognition level comparable to the computer industry's "Intel inside" phenomenon with very few exceptions e.g. some tire suppliers. Most supplier brands are very weak and almost unknown to the end-consumer.

However, the importance of direct, and in many cases, informal communication to the OEM must be emphasised. It is very important for the supplier to constantly stay in contact with the OEM to obtain information and keep the customer's technical and purchasing departments informed. For instance, many suppliers use specific promotion activities like technology-shows, aiming to present new products or general technological capabilities to a specific OEM.

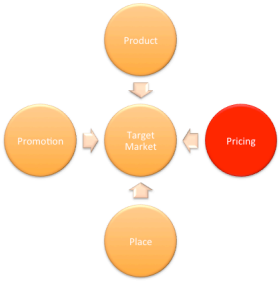


Place

Selling their products directly or indirectly, through a higher tier supplier, to the OEM's is practically the only channel through which automotive suppliers can market their products. Targeting the end-consumer through aftermarket or accessories channels is only suitable for a few suppliers, most of which act as niche players or do so only as an additional source of revenue to their core OEM supplying business.

The most effective practice within the industry is to use a key account management sales organization to target OEMs individually. Due to the growing technical and

product complexity of the business, leading suppliers additionally use a product oriented management organization as a complementary sales interface to their customers.



Pricing

This is the most important parameter in which the vast majority of the automotive suppliers focus their marketing activities. While all other marketing instruments do not provide a significant chance of differentiation, having a low price is in most cases the key competitive dimension among suppliers.

The “price per piece” is certainly one key aspect, of the supplier’s pricing approach, but by no means the only one. Of great importance are also all indirect costs, including development costs and investments, for instance for tooling and production facilities. Depending on the sourcing strategy of the OEM, the nature of the product and the supplier’s own strategy, these costs may be amortized through the piece price or paid as a lump sum in advance.

Also of high importance are other commercial agreements in particular the so-called givebacks and price reductions that have become industry standard for all sourcing activities of the OEMs. They require a binding commitment from the supplier to provide future price reductions according to a jointly agreed scheme, mostly by fixing a percentage price reduction per year assuming a learning curve effect on the supplier’s side. OEMs also request price reductions on the existing business of the supplier assuming additional scale effects and economies of scope with every additional business sourced to a supplier. The net effect for the supplier is that a very competitive price level will be further decreased during the lifetime of a product as can be seen in the following figure with an example of the trending price decrease of outside mirrors for a European Supplier.

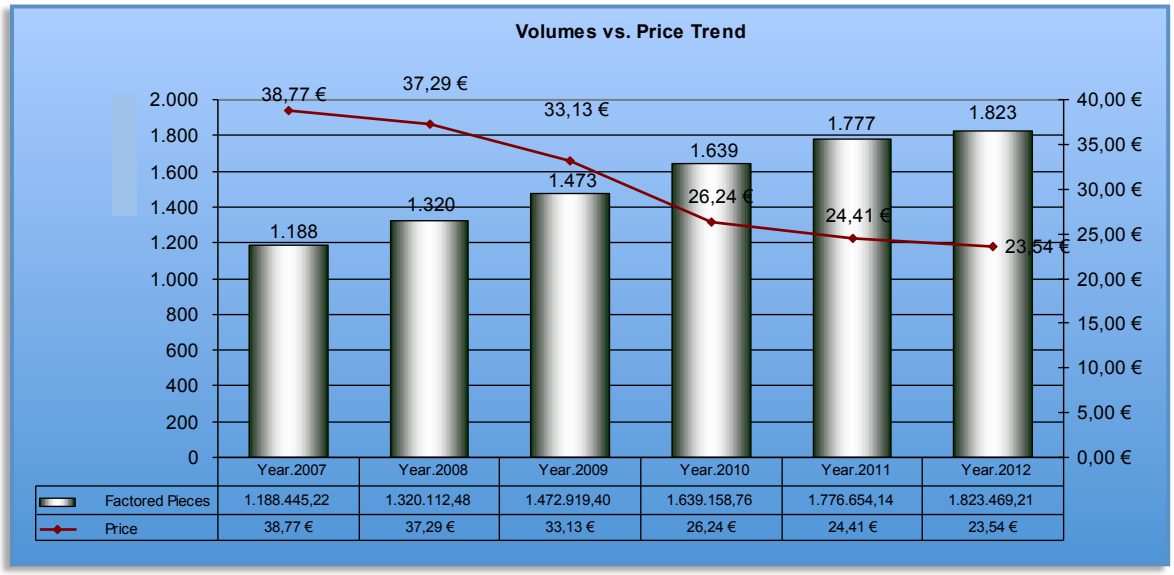


Figure 10: Characteristic price development curve for automotive suppliers' products (author's illustration)[17].

1.2.5 The Imperative Need for Innovation in the Western Automotive Supplier Industry

Following PORTER's argumentation[18], companies can choose to compete through overall cost leadership, differentiation or focus. The differentiation possibilities of a typical supplier in the automotive industry are, as described in the previous chapter, strongly limited. For this reason, most automotive suppliers try to establish a position of cost leadership. Due to a higher labour cost base than that of emerging markets, attaining this position is especially challenging for Western automotive suppliers. But even those suppliers that manage to obtain a relative cost advantage over their competitors have to deal with the drop in overall price levels and therefore with a shrinking total market and turnover for their commodities.

Creating a differentiation strategy, then, is essential to the survival of Western suppliers. Using the framework suggested by BARNEY[19] it can be stated, that to differentiate itself a firm must have resources that are valuable, rare, difficult to imitate and lack strategic equivalents or substitutes. The only long lasting way to obtain and maintain such resources is through innovation.

[17] Data Source: Magna Exteriors & Interiors Systems Marketing.

[18] Cf. PORTER , M. E. (1980), p. 35

[19] Cf. BARNEY, J. (1991), p. 99

According to a study conducted among ten recognized innovative companies by BERMAN and HAGAN[20] successful companies use innovations to:

- Change the basis for competition: Innovative companies differentiate themselves through a new dimension, which exploits an emerging or unarticulated market need.
- Break the rules of scale leveraging technology to deliver profit at a lower scale point or, conversely, achieving scale advantage where none previously existed.
- Implement alternative business models that have the ability to disrupt or undermine the incumbent industry business model.

To be valuable and unique, innovations in the automotive supplier industry have to support one of the two main competitive dimensions, reducing cost or helping to differentiate. For the latter case, they must be perceptible to the end costumer in a way that either influences their choice for a specific make or can be priced as an option.

The supplier must have enough resources, market and financial strength to be able to implement their inventions and bring it into the market, only then it becomes an innovation. To maintain a competitive advantage, the innovation must be difficult to imitate and ideally protected by unique know-how and/or patents.

Finally, the supplier's innovation must be compatible to the technical but also strategic specification of an OEM's vehicle. This may represent in many cases a fundamental hurdle for automotive suppliers since, as has been described in the previous section, their abilities to influence and change the product are often limited. This is the specific challenge of the automotive supplier industry, on the one hand of paramount importance to innovate in order to survive the extreme competition and on the other it's inherent very high innovation hurdles.

Companies like Bosch with its anti-lock braking system or Gentex with its electro-chromic auto dimming mirror technology are good examples of successful automotive suppliers innovators. But even for these successful companies the differentiating advantage didn't last indefinitely. The compound forces of competitors

[20] Cf. BERMAN, S. J.; HAGA, J. (2006) , pp. 29

and buyers managed to quickly erode their differentiating position. In the long run, only the capability to constantly produce and market relevant innovations will provide a lasting advantage.

Following a strategy of focus on specific customers or segments, for instance like some of the keiretsu Japanese suppliers, can be a valid alternative for small western suppliers, but will not be a realistic option due to the limited number of suitable customers and size of possible focus segments for most large Tier 1 suppliers.

1.3 Research Goals

As has been shown in this introductory section, the automotive supplier industry is of great macro-economic importance for the western European countries especially for Austria and Germany. This key industry is being dramatically challenged by the current global market situation and growing competition from low cost countries.

The specific characteristics of the industry limit the possibilities available to an average western automotive supplier to differentiate itself. Instead, suppliers are forced to compete on a cost base whereby foreign suppliers may be in a better long-term position, due to their lower salary costs. To be successful in the long term, western automotive suppliers have only one possible solution: they must become more innovative. However, this is more easily said than done. The specific state of this industry not only limits the marketing mix possibilities available for automotive suppliers, but it also requires them to very specifically tailor their innovation management approach.

Taking into consideration both the macro-economic importance of the automotive supplier industry and the increasing relevance of innovation management as a research topic, it is surprising to discover that only a small number of studies focused on both areas. Some innovation management research work has been done to analyse the automotive industry in general. However, there is a lack of research focusing solely on the specific situation of automotive suppliers.

The main goal of this work is based on the current nature of discussion in literature and empirical findings derived from a series of analysed case studies. It is to identify those key success factors in innovation management that are specific to western automotive suppliers.

Secondary goals are:

- To describe the effect on the innovation management approach for the different supplier-OEM relationship types.
- To design a model for successful innovation management.
- To make recommendations for implementation in practice.

1.4 Research Framework and Structure

Based on the Graz-Model for Industrial Management[21], where innovation management is defined as one functional module within the differentiation zone, this research work will first focus on identifying innovation barriers, deriving success factors to overcome these barriers and formulating a model for successful innovation management in the automotive supplier industry.

For this purpose this research work aims to answer the following questions:

- How can the existing innovation management concepts and models be appropriately adapted to better address the current specific state of the automotive supplier industry?
- What are the main barriers and hurdles for innovation management in the supplier industry and which specific innovation success factors can be identified to overcome them?
- What recommendations can be derived for implementing a successful innovation management for automotive suppliers?

Following the model developed by WOHINZ, this research work is structured, as depicted in the following figure, in six sections:

- The first chapter gives an introductory overview of the automotive supplier industry and the challenges faced by suppliers when they target innovations. It also describes the research goals and framework used for the research.
- The second section gives an overview of the state of the art in innovation research, describing the concept of innovation, innovation management and innovation barriers as presented in the relevant literature.
- In Chapter Three, the core model and framework of this research work are presented and described. The model is built upon the specific characteristics of the automotive supplier industry. Their impact on the innovation management of suppliers is described by comparing the situation of the automotive suppliers to the OEMs. Based on the specific barriers and hurdles that automotive suppliers face when pursuing innovation, success factors have been identified and combined in the presented management framework for automotive suppliers.

[21] WOHINZ, J. W. (2003) as cited WOHINZ, J. W. et al. (2007), pp. 27

- The Model and framework are validated in a series of case studies described in the fourth section of this dissertation. The case studies were based on top management expert interviews conducted by the author, and describe specific innovation projects of selected automotive suppliers.
- Chapter Five combines the results of the preceding chapters and formulates recommendations for implementations.
- The final chapter summarises the content of this research work and provides an outlook to future trends and research needs.
- In the appendix, a list of all tables, figures, abbreviations and referenced literature can be found.

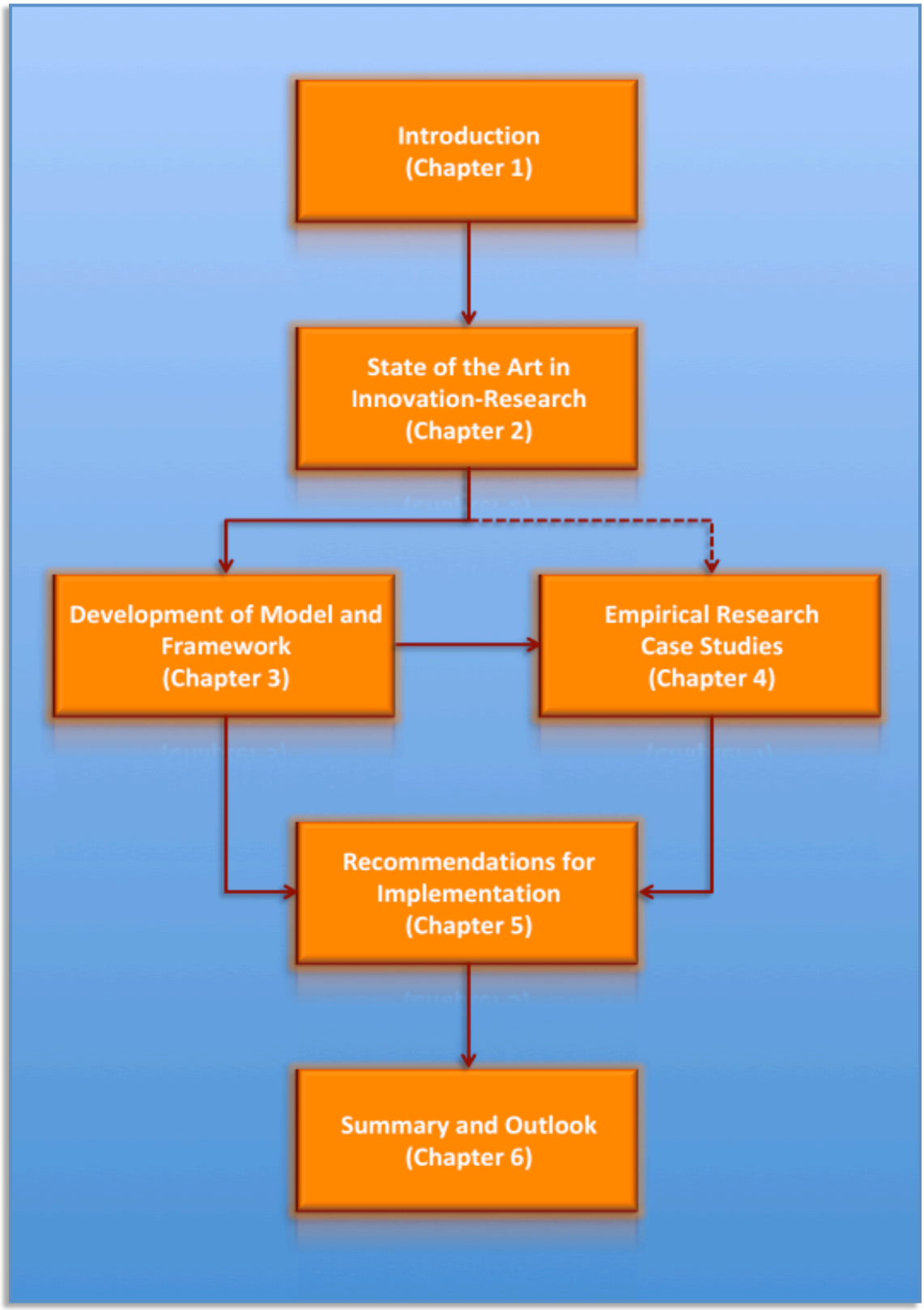


Figure 11: Structure of this thesis according to WOHINZ[22]

[22] WOHINZ, J.W. (2009), p.12

2 State of the Art in Innovation Research

The following chapter gives an overview of the innovation related literature relevant to the goals of this research work. The first section describes different definition approaches for the concept of innovation, the second section deals with the management of innovations and the final section defines and characterizes innovation hurdles.

2.1 The Concept of Innovation

Although the phenomena of invention and innovation are very old, there is a common understanding among most researchers, that SCHUMPETER's[23] ground-breaking work, originated the modern concept of innovation. McCRAW refers to him as the "Prophet of Innovation"[24], while for TIDD, BESSANT and PAVITT he is the "Godfather of Innovation Studies"[25].

SCHUMPETER uses the definition of production as "to combine materials and forces within our reach". Accordingly he defines innovation as "to produce other things, or the same things by a different method, means to combine these materials and forces differently"[26]. He identifies five innovation cases:

- "The introduction of a new good —that is one with which consumers are not yet familiar—or of a new quality of a good.
- The introduction of a new method of production, that is not yet tested by experience in the branch of manufacture concerned, which need by no means be founded upon a discovery scientifically new, and can also exist in a new way of handling a commodity commercially.
- The opening of a new market, that is a market into which the particular branch of manufacture of the country in question has not previously entered, whether or not this market has existed before.
- The conquest of a new source of supply of raw materials or half-manufactured goods, again irrespective of whether this source already exists or whether it has first to be created.

[23] SCHUMPETER, J. A. (1912)

[24] McCRAW, T. K. (2007)

[25] TIDD, J., BESSANT, J. PAVITT, K. (2005) p. 7

[26] SCHUMPETER, J. A. (1934), p. 65

- The carrying out of the new organization of any industry, like the creation of a monopoly position (for example through trustification) or the breaking up of a monopoly position"[27].

SCHUMPETER clearly differentiates between Innovation and invention: "Economic leadership must hence be distinguished from invention. As long as they are not put into practice, inventions are economically irrelevant. And to put any improvement into effect is a task entirely different from inventing it, and a task, moreover, requiring entirely different kinds of aptitudes"[28].

2.1.1 Later Definitions

The latest research work on innovation and innovation management has been focused on specifying and expanding Schumpeter's definition. For the scope of this research work, one crucial factor must be singled out when defining innovation, the difference between invention and innovation. FAGEBERG for instance defines invention, as "the first occurrence of an idea for a new product or process" while innovation for him is "the first attempt to carry it out in practice" [29]. Thompson accordingly, defines innovation as the "generation, acceptance, and implementation of new processes, products, or services within the organisational setting"[30]. Later in an often-quoted OECD study on technological innovations, FREEMAN defined innovation as "an iterative process initiated by the perception of a new market and/or new service opportunity for a technology-based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention"[31]. This definition addresses two important aspects of innovation, as observed by GARCIA and PALANTONE: first it includes two phases; I) the invention and II) the marketing of the innovation that leads to diffusion and adoption and second, it refers to innovation as an iterative process. Additionally it clearly links innovation to commercial success[32].

[27] SCHUMPETER, J. A. (1934), p. 65

[28] SCHUMPETER J. A. (1934), p. 88

[29] FAGEBERG J. (2005), p.4

[30] THOMPSON, V. A. (1967), p. 2

[31] FREEMAN, C. (1991), as cited in GARCIA, R. and CALANTONE, R. (2012), p. 112

[32] Cf. GARCIA, R. and CALANTONE, R. (2012), p. 12

SMITH and BARFIELD reinforce the importance of commercial success for innovation, stating: “The solution to a basic scientific puzzle or the invention of a new product only in a laboratory setting makes no direct economic contribution. Innovation includes not only basic and applied research but also product development, manufacturing, marketing, distribution, servicing, and later product adaptation and upgrading”[33].

This research paper uses the definition of SCHUMPETER quoted earlier as the economic application of an invention, and the definition suggested by AFUAH. In his definition, AFUAH refers to FREEMAN, who defines “innovation as invention plus commercialization”[34] and PORTER’s definition of “a new way of doing things (termed invention by some authors) that is commercialised”[35]. AFUAH defines innovation, as “the use of new technological and market knowledge to offer a new product or service that the customer will want. The product is new in that its cost is lower, its attributes are improved, it now has attributes it never had before, or that never existed in that market before. Often the new product itself is called an innovation, reflecting the fact that it is the creation of new technological or market knowledge, or of its new customers”[36]. It is therefore of key importance to point out that innovation is much more than invention, it requires acceptance and finally commercial success to be considered as such.

Further on AFUAH makes a distinction between technical and administrative innovations. For him “technical innovations are about new/improved products and services” whereas “administrative innovations affect organizational structure and administrative processes”[37]. Within the technical innovations he uses the definition of DAMANPOUR to distinguish among product innovations as ”new products or services introduced to meet an external market need”[38] and process innovations as “new elements introduced into an organization’s production or service operations-

[33] SMITH, B. and BARFIELD, C. (1996), p. 1 as cited in GARCIA, R. and CALANTONE, R. (2012), p. 112

[34] FREEMAN, C. (1982) p.6 as cited in AFUAH, A. (2003), p. 13

[35] PORTER, M. C. (1990), p. 780 as cited in AFUAH, A. (2003), p. 13

[36] AFUAH, A. (2003), p. 4

[37] AFUAH, A. (2003), p. 14

[38] DAMANPOUR, F. (1991) as cited in AFUA, A. (2003) p. 14

input materials, task specifications, work and information flow mechanisms, and equipment used to produce a product or render a service"[39].

Other researchers use similar definitions of innovation depending upon the area where an innovation can be found, for instance KNIGHT and THOM[40] distinguish between four different types of innovation; product or service innovations, production-process innovations, organizational-structural innovations and people/social innovations.

This research work is mainly focused on the market relevant side of innovation. Accordingly it's main focus lies on technical product/services and process innovations rather than in administrative or social innovations.

2.1.2 Advanced Innovation Concepts: Lead-User and Open Innovation

Lead-User Concept

HIPPEL introduced the idea of democratising innovation. When he speaks of innovation being democratised, he means that the users of products and services are increasingly able to innovate for themselves. He states that this is valid for both individual consumers and firms. In his opinion it is becoming easier for many users to get exactly what they want by designing it for themselves. According to his research work, this kind of user-centred innovation process offers great advantages over the manufacturer centric development systems. As the major drivers for this trend, he names the continuous advances in computers and communication technology, that have broken ground for users to access affordable design tools and the needed information, often through virtual user networks allowing them to design their own solutions.

HIPPEL sees a radical contrast between this kind of user-centred process and the traditional manufacturer-centred innovation process, where manufacturers develop products and services in an isolated manner and the user's only function is to have needs which are to be identified by the manufacturer.

[39] DAMANPOUR, F. (1991); UTTERBACK, J. M.; ABERNATHY, W. (1975) as cited in AFUAH, A. (2003), p.14

[40] KNIGHT, K. E. (1967), p. 482; cf. THOM, N. (1980), pp. 32

In this user centric innovation model from HIPPEL the “lead user” plays a key role. According to his definition a key user has two main characteristics “they are ahead of the majority of users in their populations with respect to an important market trend and they expect to gain relatively high benefits from a solution to the needs they have encountered there” [41].

As shown in a study by FRANKE and HIPPEL, individuals with a high amount of lead users characteristics are not only more likely to be innovators but there is also a positive correlation between the lead-user characteristics of an innovator and the commercial attractiveness of the innovations he or she develops[42]. As HIPPEL explains their findings using the following picture, users with higher values for lead user characteristics are linked to a higher number of innovations that at the same time are more commercially attractive (Innovation Attractiveness is measured as “the sum of the novelty of the innovation and expected future generality of market demand)”[43].

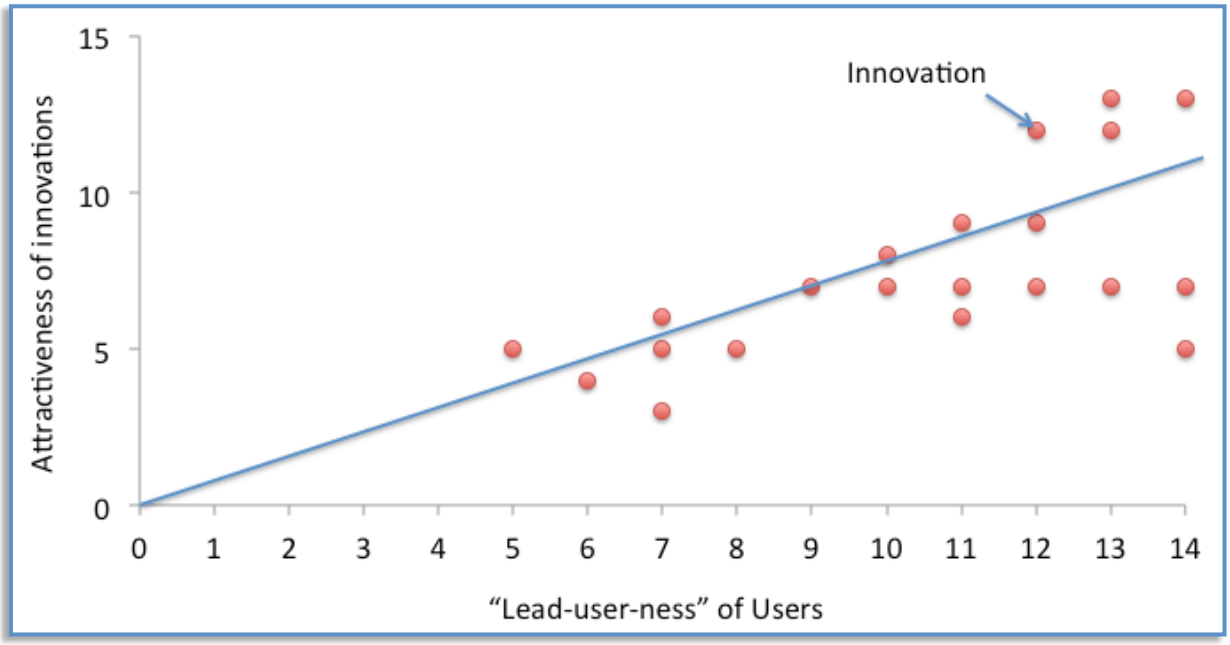


Figure 12: Correlation between stronger "lead user" characteristics and attractiveness[44] of their innovation from FRANKE and HIPPEL.[45].

[41] Cf. HIPPEL, E. v. (2005), Loc. 33-231

[42] Cf. FRANKE, N.; HIPPEL, E. v. (2003), p. 17

[43] Cf. HIPPEL, E. v. (2005), Loc. 80

[44] Measuring of “Lead-user-ness“:

“We experience new server security needs earlier than most other organizations” (7-point rating scale)

“Our organization has a high need for server security” (7-point rating scale)

In HIPPEL's opinion manufacturer-based design may not be able to survive the challenge presented by the lead-user innovation community. Manufacturers will have to adapt to user-centred innovation, whether they like it or not. For physical products, he suggests the three following alternatives for adapting their business model:

- Producing user-developed products.
- Supplying toolkits and / or platform products to users.
- Providing complementary products or services.[46].

Open Innovations

Taking a look at other industries with a higher degree of innovativeness, for example the software industry, high-tech electronics or internet-based companies, a new trend regarding the overall innovation approach has emerged in recent years, as CHESBROUGH has described in his research work. The days of the "Closed Innovation System", as he calls it, where heavy research and development (R&D) investments within the company were the main driver for technological advance and innovation seem to be over. He sites two main factors responsible for the diminishing success of closed systems; (1) the growing mobility of highly experienced and skilled people, who often take away a big portion of the knowledge to their new employer and (2) the growing presence of venture capital, which specialises in creating new firms that commercialize external research and then converting these firms into growing valuable companies[47].

"Our organization has benefited significantly by the early adoption and use of Apache security features (e.g. new modules)" (7-point rating scale)

"Our organization would benefit significantly from building new Apache security features (e.g. new modules)" (7-point rating scale)

Measuring of "attractiveness":

"newness" (7-point rating scale: 1 = small improvement to an existing product, 7 = completely new product)

"market potential" (number of potential users) (7-point rating scale: 1 = very small, 7 = very big)

FRANKE, N.; HIPPEL, E. v. (2003), p. 30

[45] HIPPEL, E. v. (2005), Loc. 80

[46] HIPPEL, E. v. (2005). Loc. 209

[47] Cf. CHESBROUGH, H. W. (2006) pp. xxii

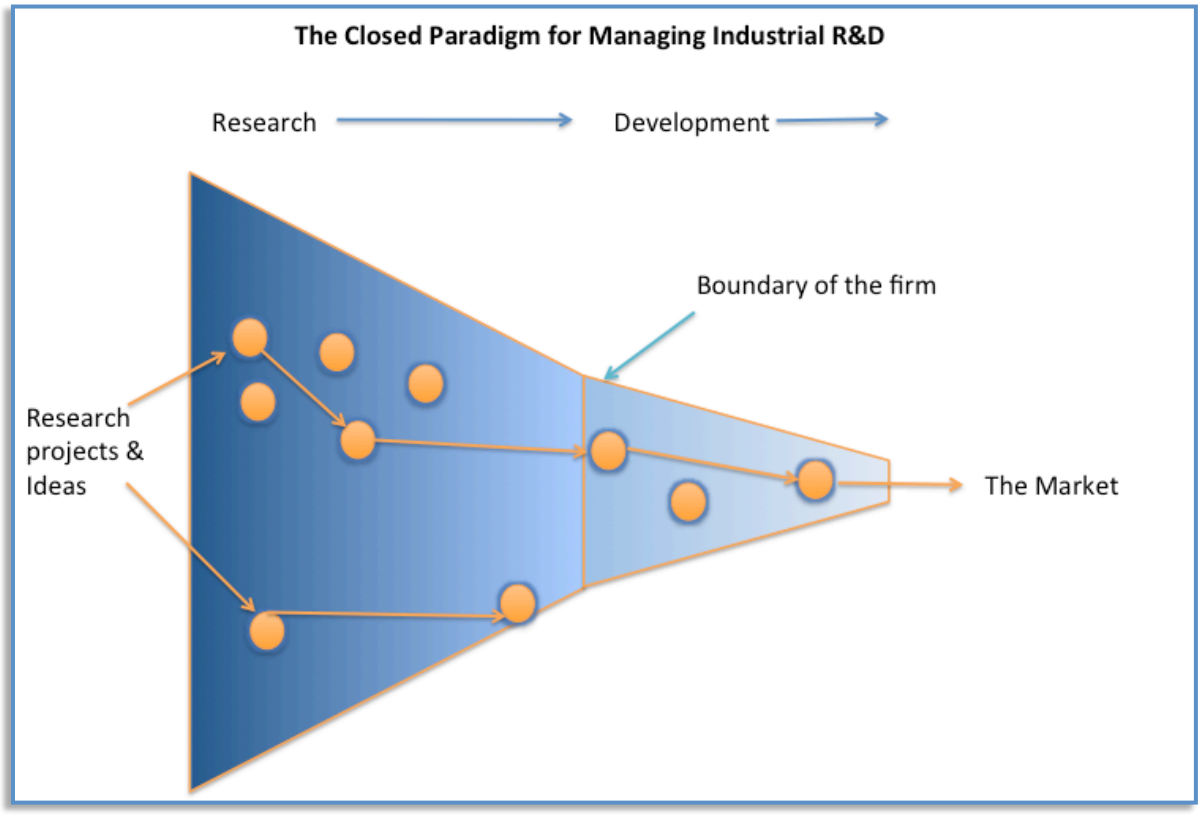


Figure 13: The Closed Innovation Paradigm from CHESBROUGH[48].

CHESBROUGH defines "Open Innovation as a new paradigm that combines external and internal ideas to create innovation. Open Innovation assumes that internal ideas can also be taken to market through external channels, outside the current business model". This approach not only "dramatically increases the knowledge base and creativity potential for new ideas and research projects, but also leverages the potential for commercial success through innovation"[49] as depicted in the following illustration.

[48] CHESBROUGH, H. W.(2006), p. xxii

[49] CHESBROUGH, H. W. (2006), pp. xxiv

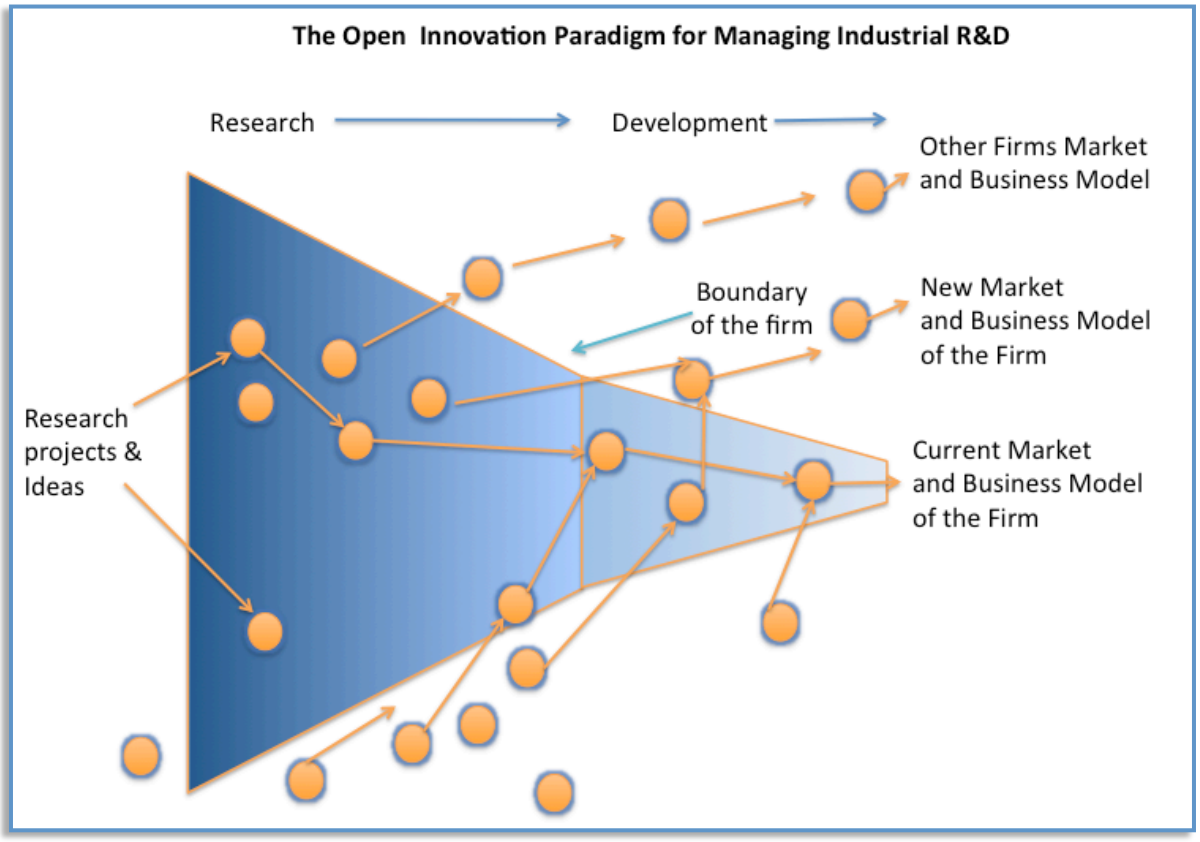


Figure 14: The Open Innovation Paradigm from CHESBROUGH[50].

Open Source Models

Open source development models promote free access to the end product's source materials and know how. In a purely open source model, basically everybody not only has access but is encouraged to participate in the product's further development and documentation, and its blueprint or source code is freely available and distributed for free. One of the most prominent examples of an open source product is the computer operating system Linux, originated through the work of Finnish software engineer Linus Torvals. It has become one of the leading operating systems for servers with an estimated market share between 20 and 30%. It is distributed for free and developed as an open source system by a developer's community, many of whom work on a voluntary basis.

Following this model allows for the development of more innovative solutions. The idea of giving a community the opportunity to co-develop the product can also facilitate the development of more customer-oriented solutions.

[50] CHESBROUGH, H. W. (2003), p. xxv

According to HIPPEL, open source is not really new, since the revelation of free product innovations began long before the open source software phenomenon[51]. He quotes, among other studies the work of ALLEN on the eighteenth-century iron industry[52] and the research of NUVOLARI on free revealing in the early history of mine pumping engines[53]

HIPPEL also remarks quoting FRANKE and SHAH that "innovation communities are not restricted to software or even information products, as they can play a major role in the development of physical products"[54].

Nevertheless as of today, the occurrence of open source models in the automotive industry is very limited, due to technological, legal, environmental and safety related barriers. Implementing this approach in the automotive supplier industry may provide a boost in innovation and help suppliers to come up with totally new solutions and business models. However, taking into consideration the very strict liability regulations in the automotive industry and the very complex and costly testing and homologation standards required, it is rather unlikely that this innovation approach will be adapted by automotive suppliers that deal with any safety relevant part in a short time perspective. For other areas, like infotainment functions however, this could already be a suitable model, and it could be expanded to other automotive parts later, in particular if the software content of cars continues to grow.

2.1.3 Innovativeness: Measuring the Degree of Innovation Newness

Another important aspect in the concept and definition of innovation is the degree of innovativeness of a specific innovation. According to DAMANPOUR the two terms, innovation and innovativeness are "either distinguished from each other or used interchangeably"[55]. However, according to SALAVOU, later research works make a clear distinction, whereby "innovativeness appears to embody some kind of measurement contingent upon an organization's proclivity toward innovation"[56].

[51] HIPPEL, E. v. (2005), Loc. 144

[52] ALLEN, R.C. (1983) as cited in HIPPEL, E. v. (2005), Loc. 144

[53] NUVOLARI, A. (2004) as cited in HIPPEL, E. v. (2005), Loc. 144

[54] FRANKE, N.; SHAH, S. (2003) as cited in HIPPEL, E. v. (2005), Loc. 144

[55] DAMANPOUR, F. (1991) as cited in SALAVOU, H. (2004), p. 33

[56] SALAVOU, H. (2004), p. 33

Accordingly, GARCIA and CALANTONE define innovativeness as a measure of the degree of 'newness' of an innovation. 'Highly innovative' products are seen as having a high degree of newness and 'low innovative' products sit at the opposite extreme of the continuum. Product innovativeness for them is a measure of the potential discontinuity a product (process or service) can generate in the marketing and/or technological process. They further consider in their definition of innovativeness the area where the discontinuity occurs; at a macro-level measuring how the characteristics of product innovation is new to the world, the market, or an industry; and on a micro-level where product innovativeness is identified as new to the firm or the customer. Following this concept, "radical innovations" are those that cause disruption in technology and marketing at both levels macro and micro. "Incremental innovations" cause either marketing or technical discontinuity and occur only on a micro level. The combinations of these two extremes are the "really new innovations"[57]. This system is depicted on the following table:

Type of Innovation	Macro Level New to the world / industry / market		Micro Level New to a firms / customer / organization		Examples
	Marketing Discontinuity	Technology Discontinuity	Marketing Discontinuity	Technology Discontinuity	
Radical	✔	✔	✔	✔	WWW
Really new		✔	✔	✔	Fax Machines
	✔		✔	✔	Walkman
	✔		✔		Commercial Jetliner
		✔		✔	Diesel Locomotive
Incremental			✔	✔	Super sonic transport
			✔		"Health" foods
				✔	Digital automotive control systems

Table 1: Typology for identifying innovations from GARCIA & CALANTONE[58].

[57] Cf. GARCIA, R.; CALANTONE, R. (2001), pp. 112

[58] Referring to GARCIA, R.; CALANTONE, R. (2002), p. 121

According to their definition, “radical” innovations always embody a new technology that creates a new market; they often do not address an existing demand but create new needs. For instance the www (world wide web) is not only a new technology but has created a multi-billion dollar industry with business models addressing needs that were not known a couple of years earlier. “Really new” innovations do not discontinue both market and technology but only one of them. They can evolve into new product lines, extend existing product lines with new technology, or develop new markets with existing technology. Finally, incremental innovations are defined as those which provide benefits, new features or improvements to existing products in existing markets.

For the goals of this research work, this definition may not be completely adequate since this research paper is focused on innovations made by automotive suppliers. Thus, by definition it mainly looks at innovations on a micro level. For this reason it will use innovativeness as a measure for newness of an innovation, but only general distinctions between radical, semi-radical and incremental innovation will be made, as first suggested by AFUAH, and later on in the innovation framework of DAVILA, EPSTEIN and SHELTON. According to AFUAH, an innovation is only radical “If it results in a product that is so superior (lower cost, better or new attributes) that existing products are rendered non-competitive. All other innovations are categorized as incremental”[59]. Additionally, considering not only product/ technology innovations but the complete business model of a firm or industry, DAVILA, EPSTEIN and SHELTON differentiate between two forms of semi-radical innovations as described in the following Innovativeness Matrix[60].

[59] AFUAH, A. (2003), p. 15

[60] Cf. DAVILA, T.; EPSTEIN, M. J.; SHELTON, R. (2006), p. 38

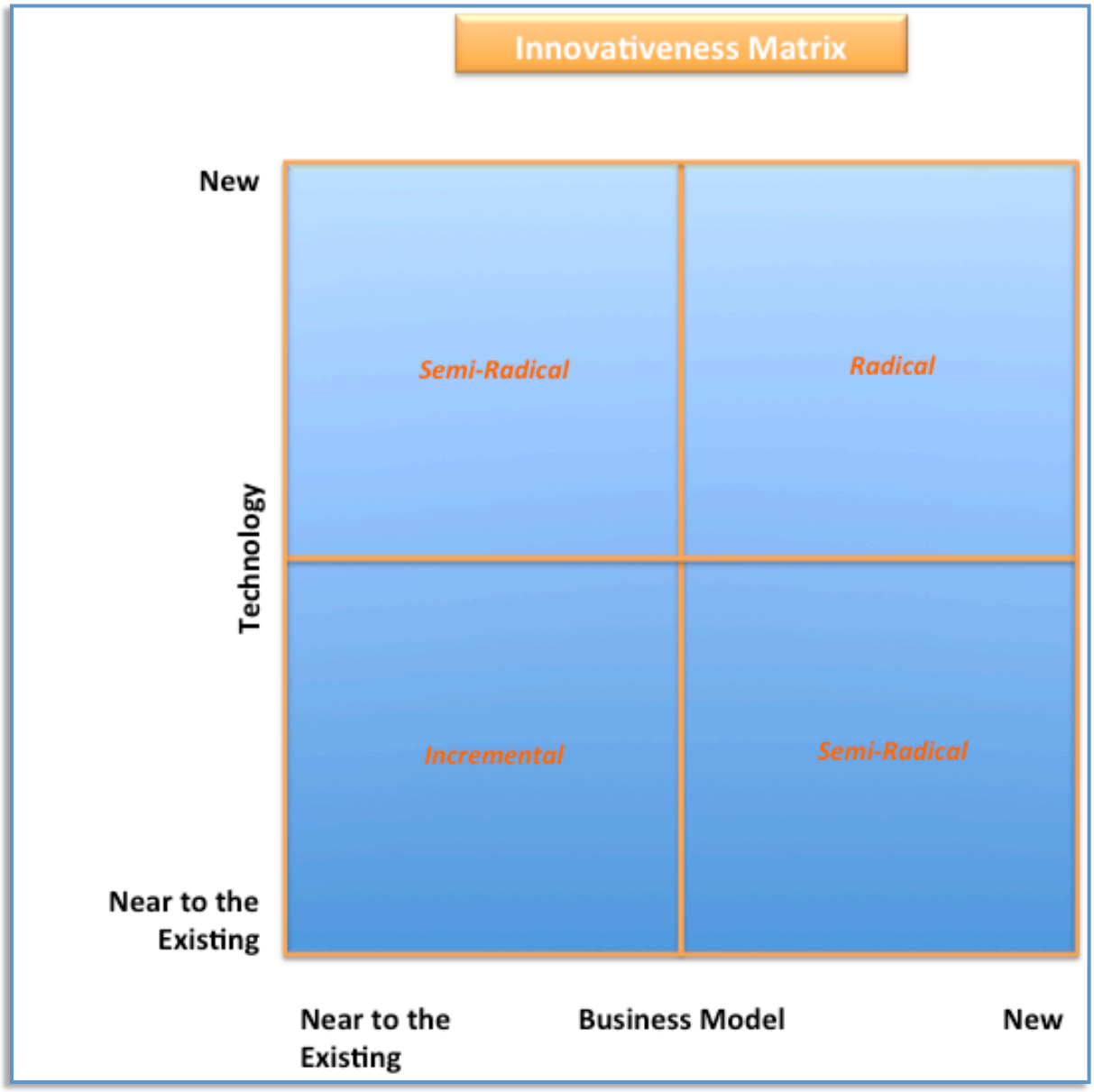


Figure 15: Innovativeness Matrix[61]

According to this definition radical innovations are those which are not only superior to all other products, but also affect technology and the existing business model of the product supplier. Those innovations with significant innovativeness but which only affect one of the two dimensions - technology or business model - are considered semi-radical. All other innovations with less innovativeness are incremental innovations.

[61] DAVILA, T.; EPSTEIN, M. J.; SHELTON, R. (2006), p. 39

2.2 Innovation Management

According to WOHINZ and WINKLER innovation management is a broad management task that considers strategic and operational aspects to systematically implement change processes. For their definition they consider three criteria as relevant:

- the change management activities through the leadership team,
- the systematic approach/process of the innovation
- and its integration in the corporate strategy system[62].

In a similar way, HAUSCHILDT and SALOMO define innovation management as the dispositive creation/organization of innovation processes, whereby they clearly differentiate innovation management from R&D and technology management, the latter being only subsets of innovation management[63].

The overall purpose of innovation management should be to create and sustain a competitive advantage. According to BARNEY, firms obtain sustainable competitive advantages by "implementing strategies that allow them to take advantage of external opportunities and exploit their internal strengths, while at the same time neutralising external threats and avoiding internal weaknesses"[64].

For AFUAH competences and assets are the underpinnings of profits. He defines capabilities as the ability to use assets to create value and profit, assets being tangible, intangible or human resources and competences the general ability to use them to create value[65].

Based upon these definitions this research work will consider innovation management to be the strategically based systematic management of capabilities to obtain and maintain competitive advantage through innovation.

Using the business architecture model developed by Andersen Consulting/Accenture adapted by the author of this research work, innovation management can be

[62] Cf. WOHINZ, J. W.; WINKLER, R. (2007), p. 6

[63] Cf. HAUSCHILDT, J; SALOMO, S. (2007), pp. 32

[64] BARNEY, J. (1991), p. 102

[65] Cf. AFUAH, A. 2003), p. 47

considered a complex system characterised by its strategy, culture, organisation, processes, capabilities, applications/tools/methods and performance management elements, as depicted in the following figure.

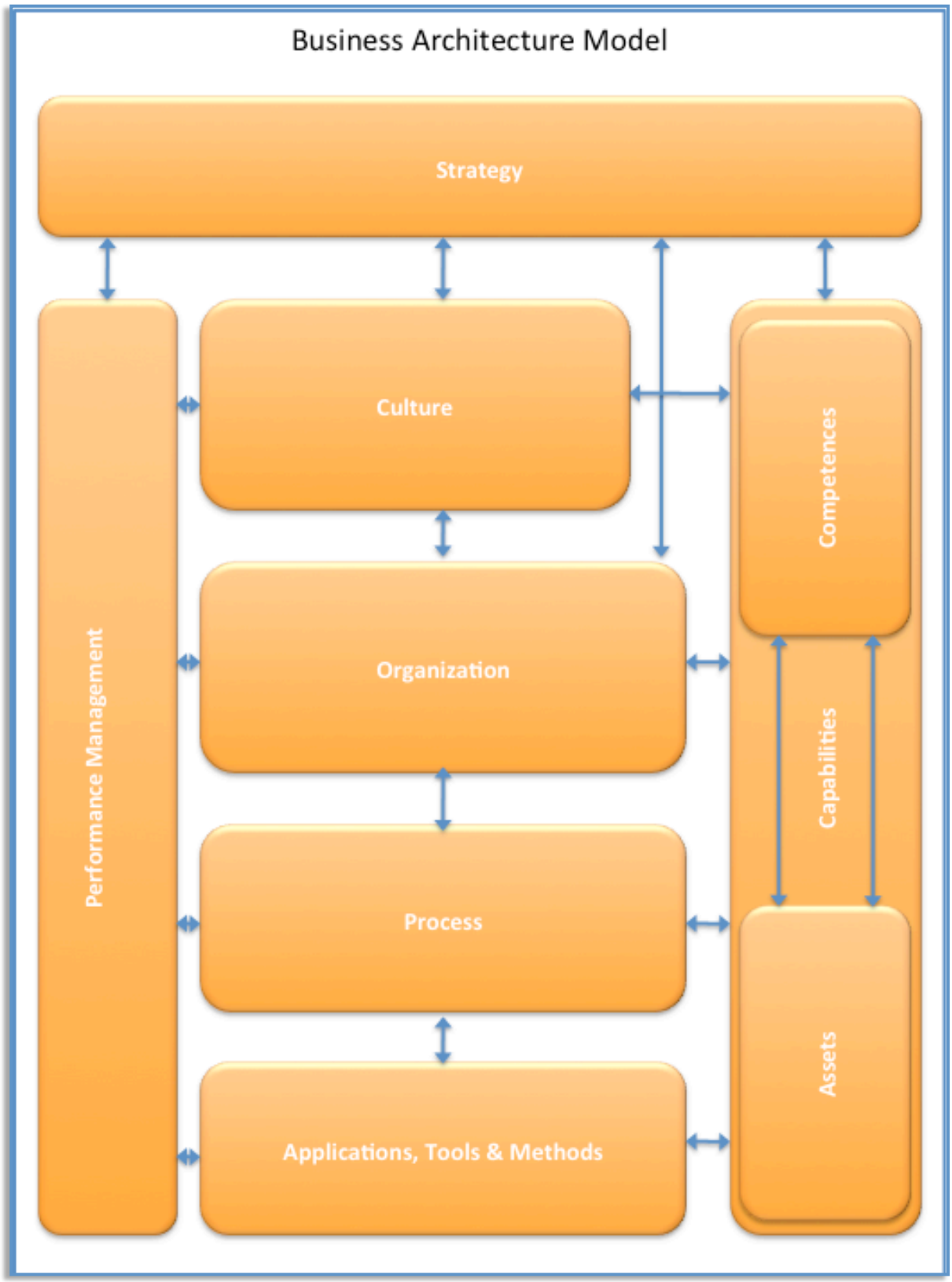


Figure 16: **Business Architecture Model according to ACCENTURE (author's illustration).**

Following the St. Gallen Management Model, which recognises three configuration forces: strategy, structures and culture (excluding the process dimension), as depicted in the illustration below, this research work will focus on analysing the elements of:

- innovation strategy,
- innovation process and
- innovation culture[66]

in the specific context of the automotive supplier industry.

This approach is very much aligned with the research work of COOPER. In his "Innovation Diamond" model, he identifies 4 points of performance as decisive for the "business's new product performance"[67].

[66] Universität St. Gallen (2013), access date 26.12.2013

[67] COOPER, R. G. (2004), pp. 48

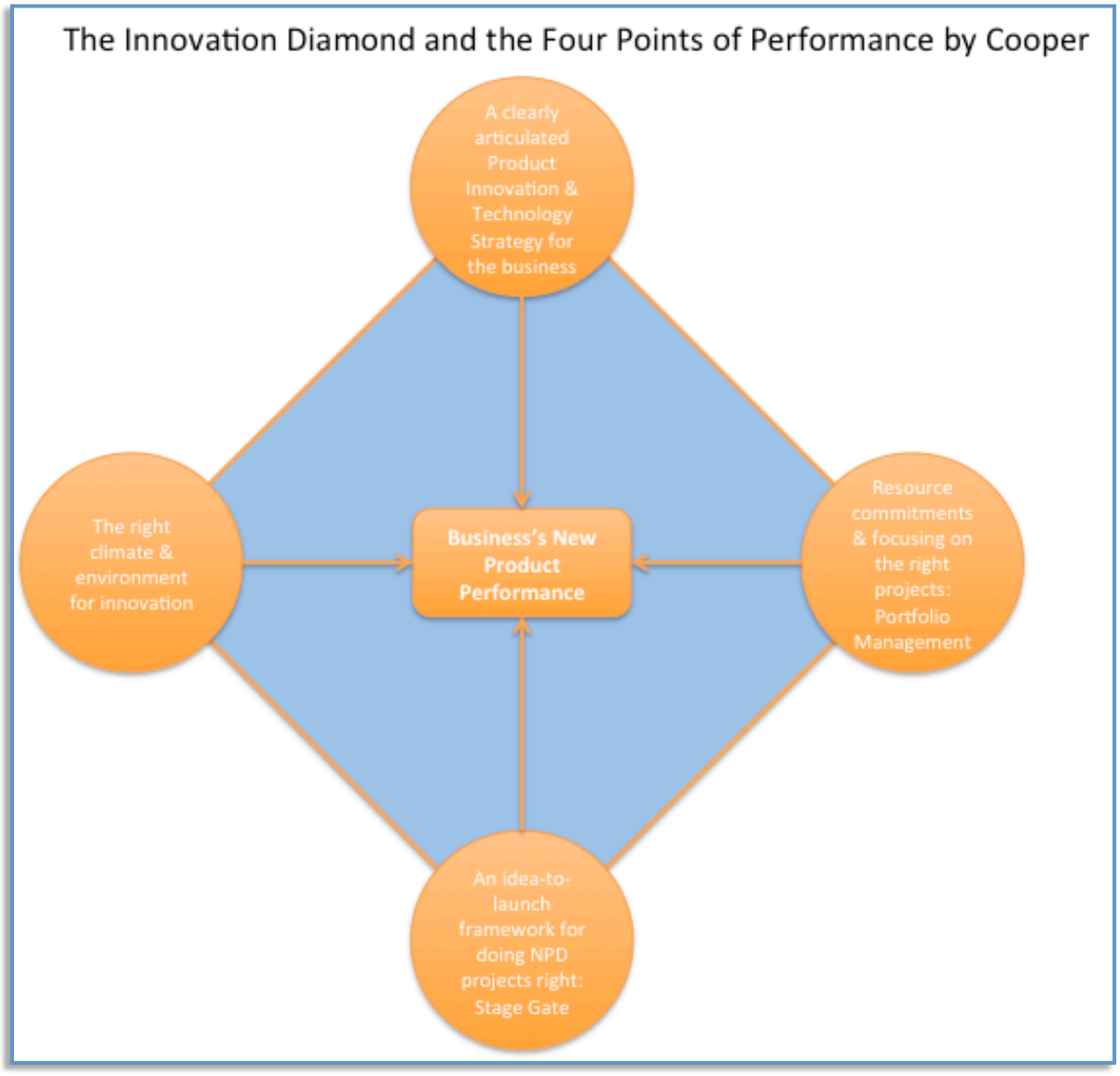


Figure 17: COOPER's Innovation Diamond and the Four Points of Performance[68].

The four points of performance in COOPER's model are:

- Product innovation and technology strategy (= innovation strategy)
- New product framework (= innovation process)
- Right climate & environment (= innovation culture)
- Resource commitment & focusing on the right projects: Portfolio management

[68] COOPER, R. G (2004), p. 48

The only factor of the “Four Points of Performance”, not explicitly addressed in the framework of this research work, is portfolio management, although having the right resources focused on the right projects is certainly a very important factor for suppliers. The key question regarding an automotive supplier’s portfolio management concerns the balance between innovations project that are initiated by the suppliers themselves and those that are started based on an OEM request. This research work focuses on analysing that aspect of portfolio management.

2.2.1 Innovation Strategy

Definition of Strategy

WOHINZ and WINKLER define strategy as “ways and means to reach corporate goals”[69]. According to another definition commonly used by the leading global consulting firms, a strategy is defined, based on the purpose of an organization (i.e. its vision and mission statement), by what value the business wants to create, which customers it wants to attract and how this is intended to happen.

On a more specific level, PORTER defines competitive strategy as “taking offensive or defensive actions to create a defendable position in an industry, to cope successfully with the five competitive forces and thereby yield a superior return on investment for the firm”[70].

[69] WOHINZ, J. W.; WINKLER, R. (2007), p. 8

[70] PORTER, M. E. (1980), p. 34

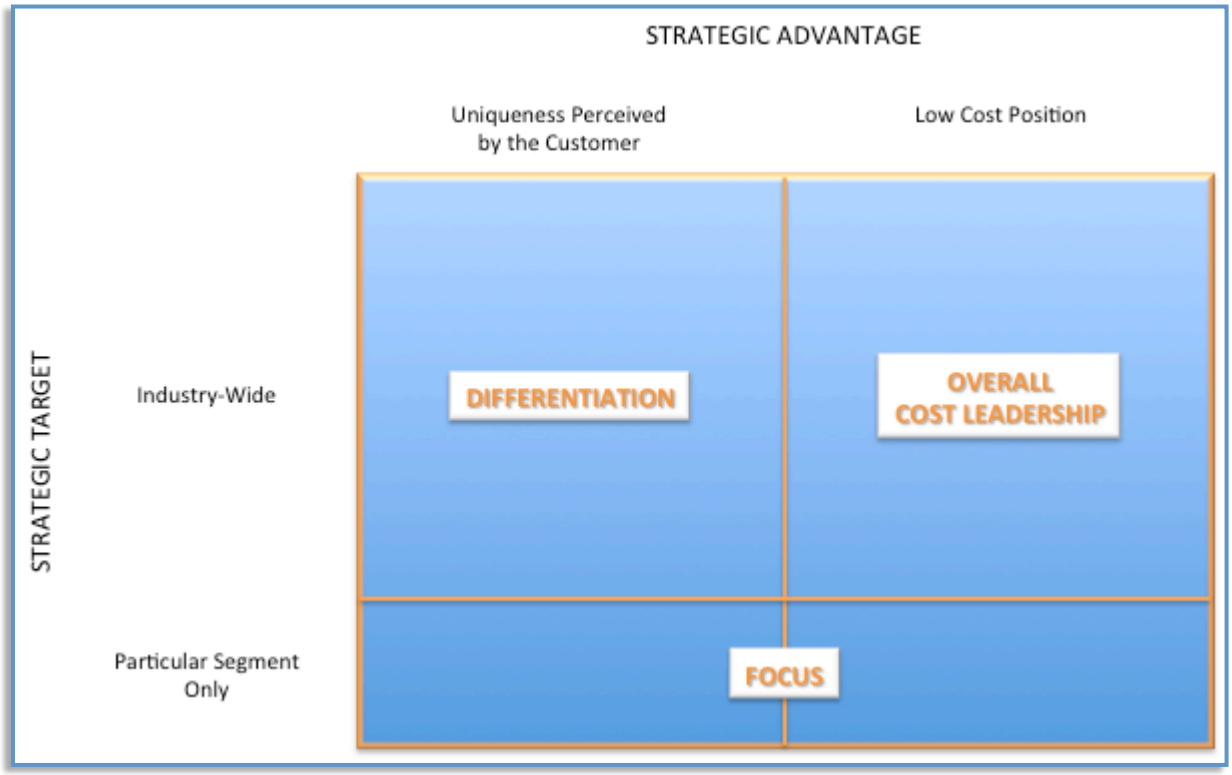


Figure 18: PORTER's Three Generic Strategies[71].

As depicted in the preceding figure, PORTER identifies three successful generic strategic approaches to outperforming competitors:

- Overall cost leadership: achieving cost and consequently price advantages in an industry through a set of functional policies, e.g., leveraging economies of scale, scope or experience curve effects.
- Differentiation: providing something that is perceived as unique to command a premium price.
- Focus: concentrating on and specialising in the specific needs and demands of a particular buyer group, segment, product line or geographic market.

Furthermore PORTER clearly states the need to link the innovation management activities of a firm to its general strategic approach: "a firm profits from innovation by using new knowledge to offer products at a lower cost than its competitors or products that are differentiated enough to command a premium price, which more than compensates for the extra costs of differentiation"[72].

[71] PORTER, M. E. (1980), p. 39

[72] PORTER, M. E. (1991) as cited by AFUAH, A. (2003) p. 47

According to the model developed by the firm Andersen Consulting - today rebranded as Accenture - a firm should define its lower level strategies to support the primary strategy and market approach. The innovation strategy is one of these key functional supportive strategies.

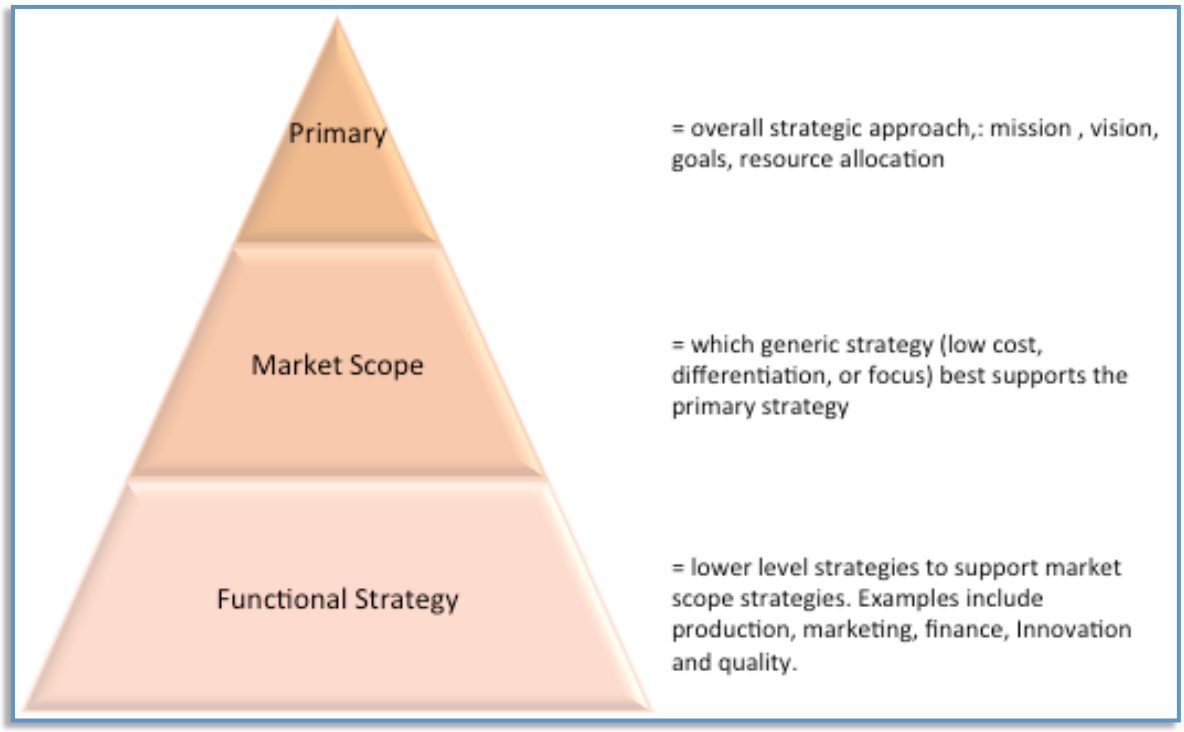


Figure 19: ACCENTURE's model for levels of strategy.

When determining the right innovation strategy it is key to have a clear picture of the expected level of customer value. However as ANDERSON, NARUS and VAN ROSSUM remark, "Customer value proposition" has become one of the most widely used terms in business markets in recent years. Yet their research reveals that there is no agreement as to what constitutes a customer value proposition—or what makes one persuasive.[73]

Innovation Strategies

An innovation strategy defines the approach a company intends to follow to best support its' corporate strategy through its' innovation management activities.

[73] ANDERSON, J.C.; NARUS, J. A., VAN ROSSUM W. (2006), p. 1

It is an obvious fact that a firm's innovation strategy should not only be derived from the overall corporate strategy but also be fully aligned to the company's strategic and market approach in order to be successful.

DAVILA, EPSTEIN and SHELTON define two classes of innovation strategies, depending on the basic strategic intention of the innovation strategy[74]:

- Play to win: an aggressive market-leading strategy that aims at producing significant competitive advantage. This class of strategy requires higher investments in innovation and implies a higher level of risk. Extreme examples for companies following this strategy can often be found among high-tech start-ups.
- Play to not lose: a defensive innovation strategy, where companies try to reduce the cost and risk of innovation by aiming for incremental innovations rather than radical ones.

WOHINZ and WINKLER refer to the work of ANSOFF[75] and the definition used by various consulting companies to define three different strategic approaches for innovation strategies regarding the timing for market entry:

- First to market: the pioneer strategy for early introduction of innovations into the market.
- Follow the leader: fast / early follower strategies.
- Me too: avoiding most innovation related early risks by entering the market at a relatively late phase.

AFUAH quotes FREEMAN to suggest the definition of six different basic innovation strategies:

- Offensive: the firm aims to be first to introduce new products by investing in innovation and building up the capabilities to do so.
- Defensive: waiting for a competitor with an offensive strategy to introduce a product first and resolve some of the innovations uncertainties, then introducing its own improved product avoiding the pioneers' mistakes, not as an imitation but rather as a differentiated product with better features or lower cost.

[74] Cf. DAVILA, T.; EPSTEIN, M. J.; SHELTON, R. (2006), pp. 60

[75] ANSOFF, I.H. (1965) as cited in WOHINZ, J. W.; WINKLER, R. (2007), p. 14

- Imitate: while a defensive company aims to differentiate it's products, a company with an imitate strategy will only copy the innovation.
- Dependent: a company follows the primary strategy of a stronger firm, innovating or imitating only on request.
- Traditional: striving to maintain the status quo mainly by focusing on low erring costs
- Opportunistic: focusing only on the specific needs of market niches[76].

This research work uses the differentiation between the "play to win" and "play to not lose" approaches to describe the basic innovation strategic intention of a supplier and the above quoted framework suggested by ANSOFF when analysing the timing dimension of an innovation.

Other Strategies: Production Strategy & Sourcing

To be successful, innovation strategy is not the only strategic element to be considered by automotive suppliers. They have to contemplate other important strategic factors as well, for instance, defining appropriate production and sourcing strategies that need to be well-aligned to their overall strategy and accordingly to their strategic innovation approach.

Correspondingly RAMSAUER states in his research work that a company's "production strategy must be developed hand in hand with its overall business strategy. The key question that a production strategy must answer is: "Where and how do we compete to win the customer's order?" According to him, companies can base their competitiveness in various production-related factors, such as:

- outstanding products or process technologies;
- product variety, quality, reliability and durability;
- response time to changes in demand delivery time; and
- the availability of the product on the market."

RAMSAUER further states that those companies that cannot compete in these areas must offer "low-cost production in order to compete on costs by optimizing two main cost categories:

[76] FREEMAN, C. (1982) as cited in AFUAH, A. (2003) pp.29

- the overall equipment efficiency measuring the utilisation of all input factors,
- and the optimization of transactional or landed costs"[77].

This strategy approach from RAMSAUER is summarised in the following picture.

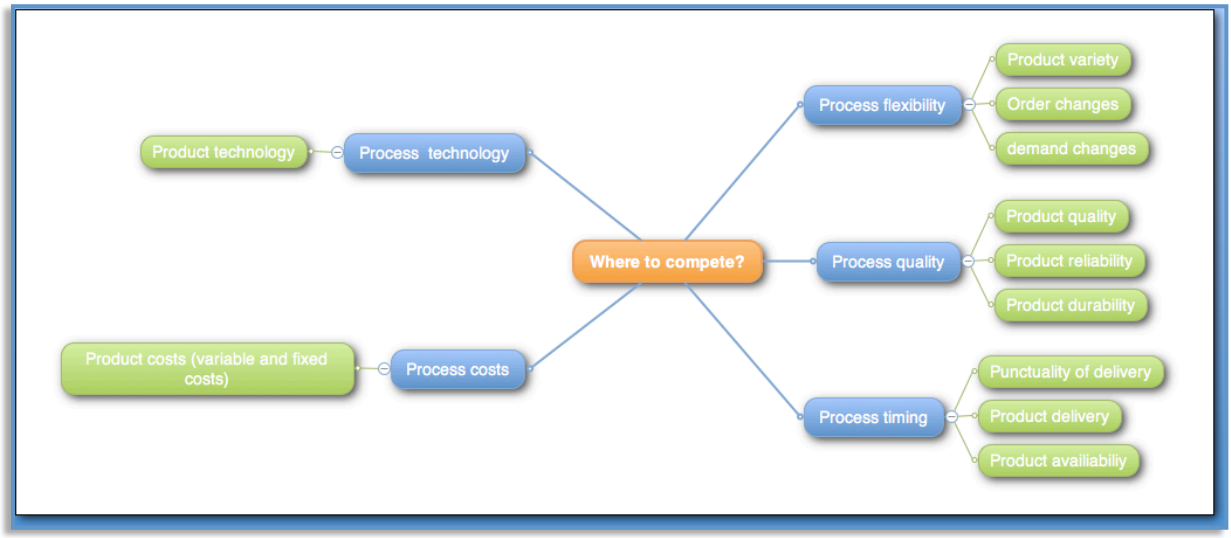


Figure 20: RAMSAUER's production strategy approach[78].

Due to the general complexity of automotive products, most automotive suppliers will have to source sub-systems, sub-Modules or other components from other suppliers to complete their own products. According to RAMSAUER, there are three common reasons for sourcing products from lower tier suppliers:

- lack of competence to produce the product
- operational advantages of the lower tier suppliers (cost, delivery times, capacity, etc.)
- technical edge of the lower tier suppliers.

From a strategic point of view RAMSAUER states "a company should produce in-house those components that are either key to the product's performance that entail a vital competitive edge due to manufacturing capabilities or that are prominently visible to the customer and contribute to differentiation on the market."[79]

[77] RAMSAUER, C. (2009) p. 49

[78] RAMSAUER, C. (2009) p. 50

[79] RAMSAUER, C. (2009), pp. 87

He also identifies two basic dependencies on suppliers:

- dependence on capacity
- dependence on knowledge.

2.2.2 Innovation Process

According to PORTER, the main corporate targets are managing change or managing innovation[80]. Following his argument the innovation process should be one of the few core and most important corporate processes of any company. However, this is often not the case. On the one hand the "importance of innovation management and new product process development is firmly recognised, and there is significant interest as to how this process might be most efficiently and effectively managed" as recognized by BARCLAY, HOLROYD and POOLTON[81]. On the other hand they remark using the results of HOPKINS that "there is evidence suggesting that despite decades of research and experience, little has changed in terms of innovation introduction and product development success rates, with failure rates being consistent at about 35% for all new products developed"[82]. For them one of the main reasons for this failure rate lies in the contradictory requirements for an optimal innovation management process. It must be one that is well structured and manageable by an organisation but at the same time it must grant sufficient freedom and flexibility to allow innovation to flourish[83].

For PAVIT, the problem is, that there is no widely accepted theory for the innovation process at firm-level that satisfactorily integrates the cognitive, organisational, and economic dimensions of the innovation process. For him, the innovation processes should involve the exploration and exploitation of opportunities for new and improved products/services based on either an advance in technical practice ("know-how"), a change in market demand or a combination of the two[84]. He suggests a three-step innovation management process model as depicted in the following illustration.

---

[80] PORTER, M. E. (1990) as cited in in BARCLAY, I.; HOLROYD, P.; POOLTON, J. (1994), p.35

[81] ROBERTS, R. B.; MEYER M.H. as cited in BARCLAY, I.; HOLROYD, P.; POOLTON, J. (1994), p.33

[82] HOPKINS, D. (1981) as cited in BARCLAY, I.; HOLROYD, P.; POOLTON, J. (1994), p.33

[83] BARCLAY, I; HOLROYD, P: POOLTON, J. (1994), p. 33

[84] PAVIT, K. (2005), pp. 87

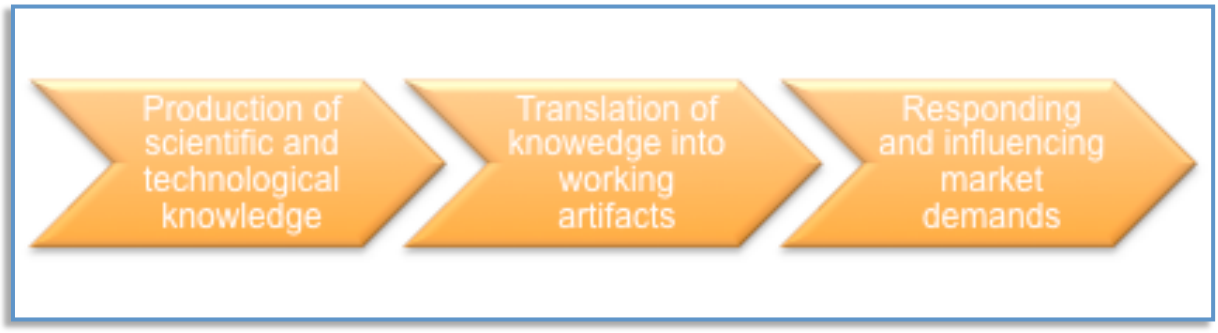


Figure 21: Innovation management process according to PAVIT (author's illustration)[85].

This model is closely related to the innovation management process of WOHINZ and WINKLER based on the work of THOM[86], which also consists of three main phases:

- Generation / production of ideas
- Acceptance of (decision for) ideas
- Realisation of ideas [87]

The single phases can be broken down in further sub-phases as illustrated in the following model:

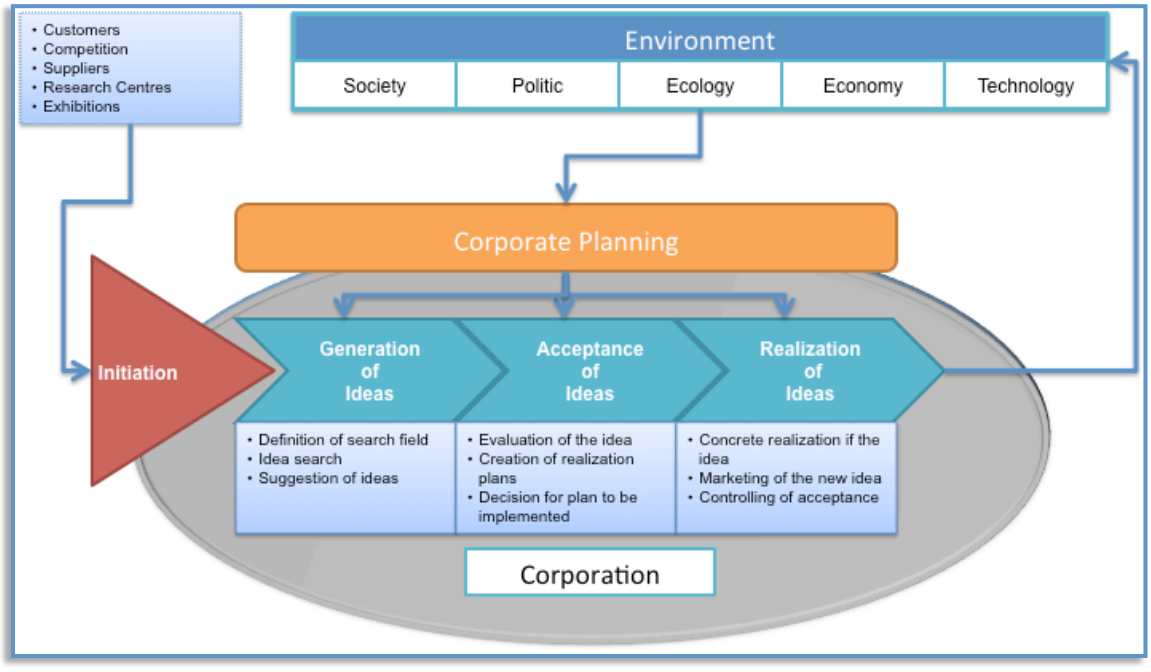


Figure 22: Innovation process of WOHINZ and WINKLER referring to THOM[88].

[85] Referring to PAVIT, K. (2005), p. 88

[86] THOM, N. (1980) p. 53

[87] WOHINZ, J. W.; WINKLER, R. (2007), p. 23

There are other authors who have taken a completely different approach to defining the innovation process, for instance ZHUANG, WILLIAMSON and CARTER[89] based on the work by MAJARO who define it as a problem-solving process as illustrated below.

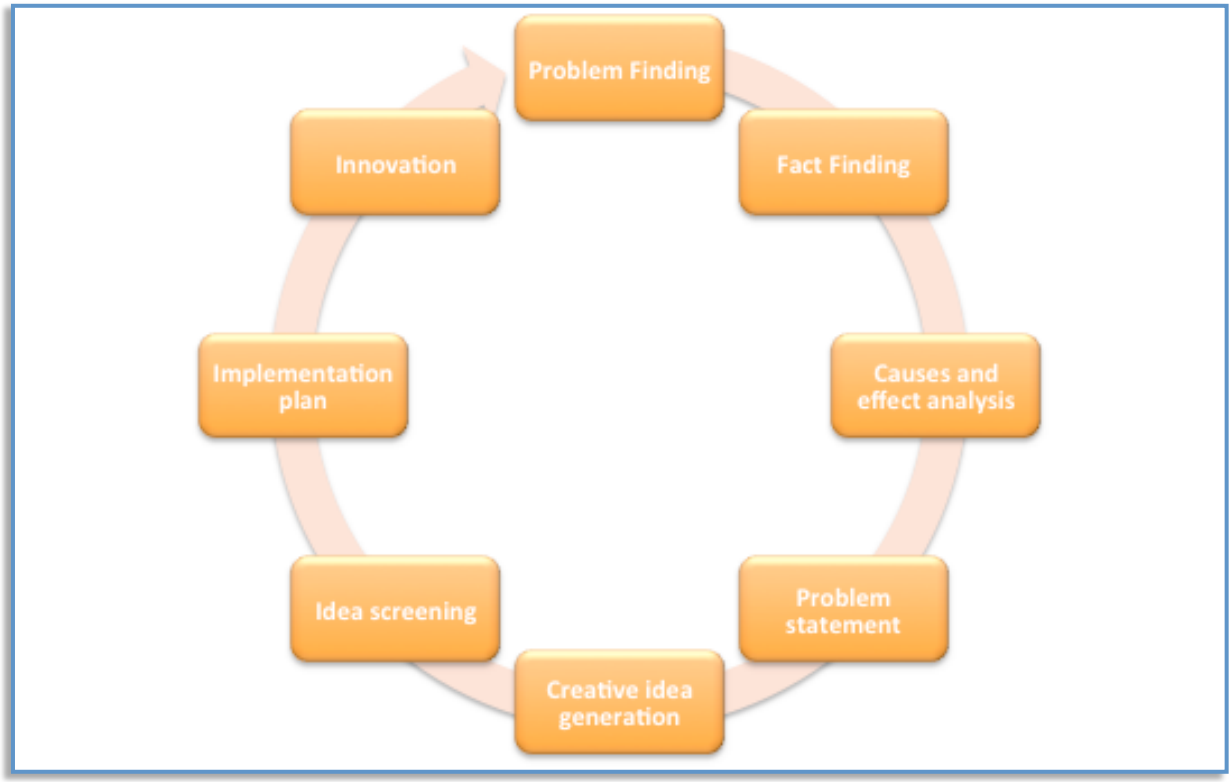


Figure 23: ZHUANG et al.'s Innovation process as problem solving process[90].

However this kind of approach is rather uncommon, in the industrial praxis many automotive suppliers use an innovation process that is based on the Stage-Gate model by COOPER[91]. His Stage-Gate process breaks the new product/ innovation process into six stages. The key stages are the following:

- Discovery: pre-work designed to discover new opportunities and generate ideas.
- Scoping: a quick, preliminary investigation of the project.

[88] WOHINZ, J. W.; WINKLER, R. (2007), p. 23 referring to Thom, N. (1980) p. 53

[89] ZHUANG, L.; WILLIAMSON, D., CARTER, M. (1997), p.58

[90] ZHUANG, L.; WILLIAMSON, D., CARTER, M. (1997), p.55 refering to MAJARO, S. (1992), pp. 126

[91] COOPER,R. G. (2001), pp. 322

- Building the Business Case: a more detailed investigation leading to a business case.
- Development: the actual design and development.
- Testing and Validation: tests or trials to verify and validate the innovation.
- Launch: commercialisation.

Preceding each stage are gate or go/kill decision points. They serve as quality-control checkpoints, prioritization points, and as points at which the path forward to the next stage of the process is to be decided.

The following picture displays the structure of the gates that consists of the following elements:

- A set of deliverables.
- Criteria against which the project is judged. These include “must-meet“ and “should-meet“ questions.
- Defined outputs, including a decision and an action plan for the next stage, and a list of deliverables for the next gate.

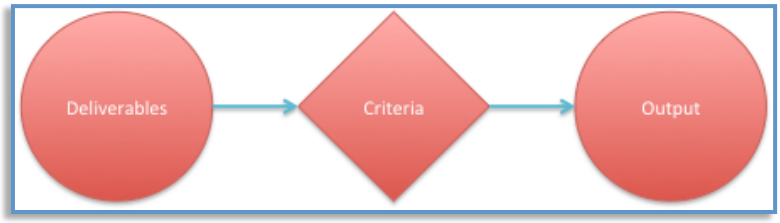


Figure 24: COOPER’s Gate Structure[92].

COOPER’s stage-gate process works as a funnel aiming to kill at the earliest possible stage all those projects that presumably will not succeed in meeting their targeted goals. The overall approach of this very systematic process is described in the next picture.

[92] COOPER, R. G. (2004), p. 214

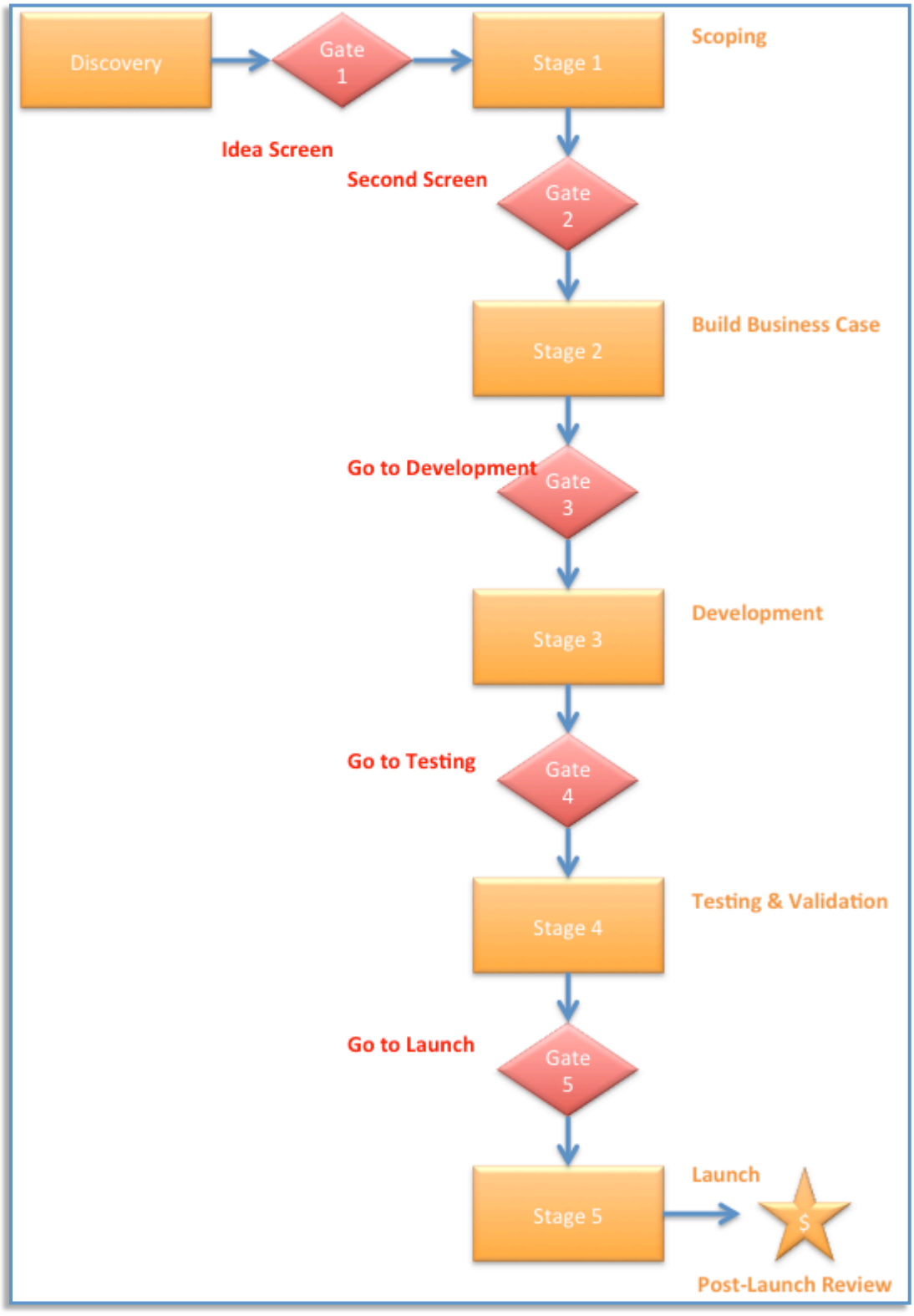


Figure 25: COOPER's Stage-Gate Model[93].

[93] COOPER, R. G. (2004), p. 211

This research work will use a three-phased innovation management process model based on the above-described process by THOM. The three phases of the model are:

- ideation,
- acceptance and
- realization & commercialization.

These three phased process model can easily be distilled from the COOPER's Stage-Gate Model; whereby the "ideation" phase includes COOPER's first and second stages (idea screen and second screen), the "acceptance" phase is equal to stage 3 of building a business and the "realization & commercialization" phase is directly linked to the stages 3 to 5 (development, testing & validation and launch).

In the last stage there is a modification to reflect the fact, that due to their dependence on the OEMs, the realization & commercialization phases of a supplier's innovation process have a special level of relevance and complexity. The model will be further expanded and adapted to better reflect the specific situation of the automotive suppliers as described in the following chapters.

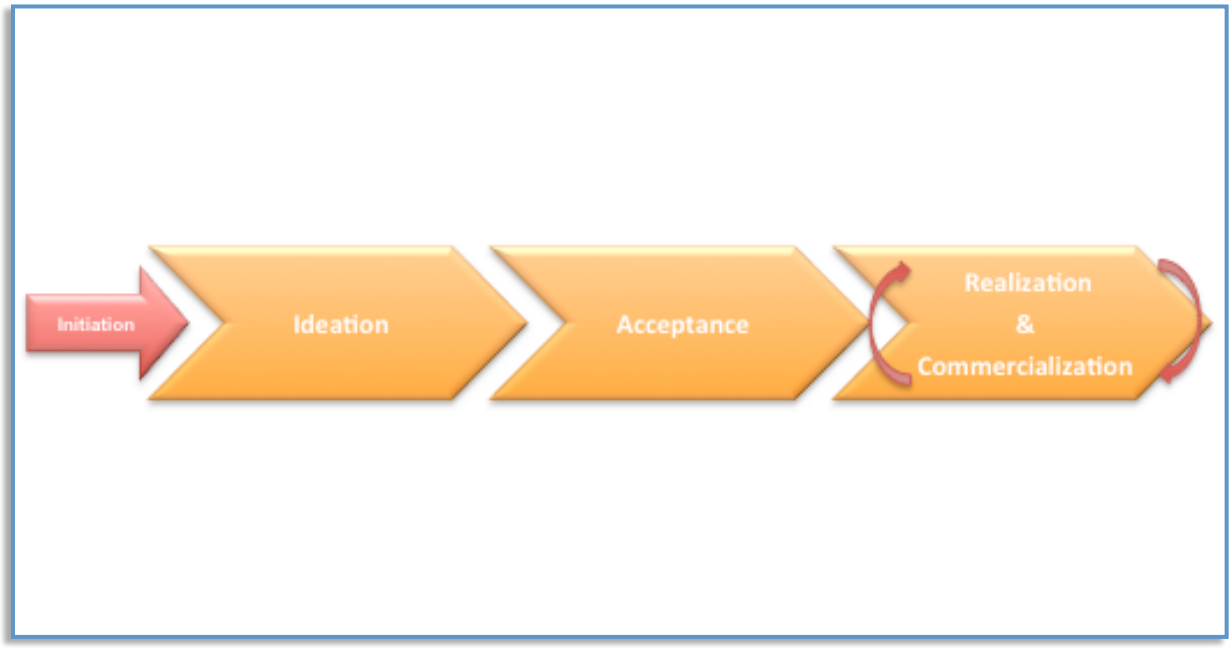


Figure 30: Innovation process model used by this research work (author's illustration).

2.2.3 Innovation Culture

The Concept of Corporate Culture

DEAL and KENNEDY use two definitions in their work about corporate culture, one formal one defining culture as “the integrated pattern of human behaviour that includes thought, speech, action and artifacts and depends on man’s capacity for learning and transmitting knowledge to succeeding generations” and the other, quoting BROWER’s work, defining corporate culture as “the way things get done around here“[94]; as they state “culture describes the values, beliefs, attitudes and experiences of a corporation”[95].

SCHEIN defines corporate culture starting from a commonly used definition of culture as “the climate and practices that organisations develop around their handling of people, or the espoused values and credo of an organisation”[96]. Furthermore, as “a pattern of shared basic assumptions that was learned by a group as it solved its problems of external adaption and internal integration, which has worked well enough to be considered valid and therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems"[97]. In his opinion, culture can be analysed on several different levels, which are defined by the degree to which a cultural phenomenon is visible to the observer, accordingly he defines three different levels of culture; the first and most visible level is the level of “artifacts” including the organizational structures and processes of a firm. The second level of “exposed beliefs and values” reflects the level of culture that most people mean when they talk of culture. It contains the formulated strategies, goals, and cultural values that a company has formulated and “officially” decided to follow. The third and most difficult to see is the level of “underlying assumptions”, the basic assumptions that have been taken for granted in a social unit, the ultimate source of values and actions and therefore extremely hard to change[98].

The interesting aspect of this model is, that the higher the levels are, the more visible and easy to influence they are, but they also have the least effect. It is relatively easy to change an organisational structure and influence new processes. But if it is not

[94] BOWER, M. (1967) as cited in DEAL, T. E.; KENNEDY, A. A. (1982) , p. 4

[95] DEAL, T. E.; KENNEDY, A. A. (1982), p. 4

[96] SCHEIN, E. H. (2004), p. 7

[97] SCHEIN, E. H. (2004), p. 17

[98] Cf. SCHEIN, E. H. (2004), pp.25

congruent with the underlying assumptions of the organisation there will not be a real change in culture.

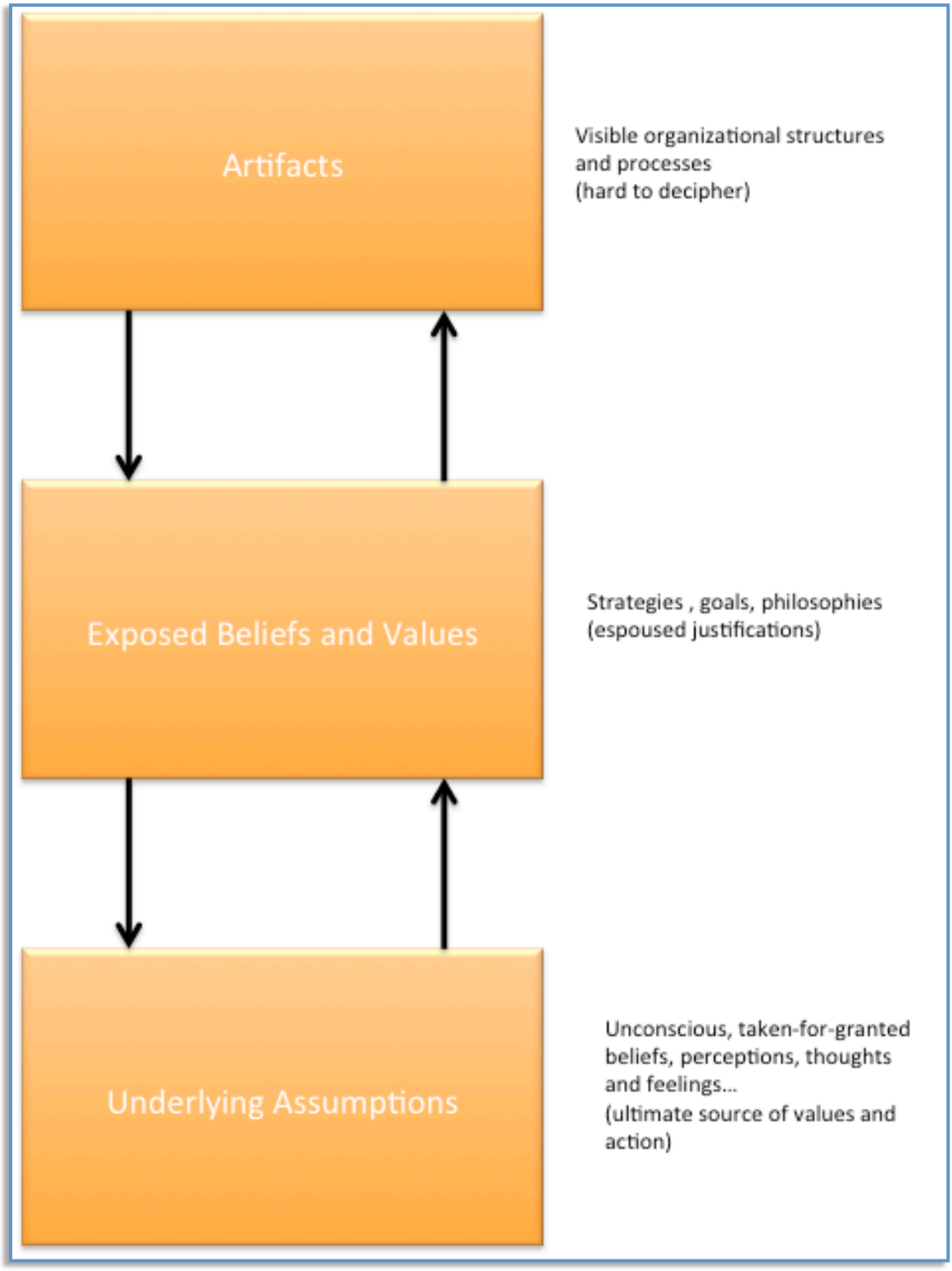


Figure 26: SCHEIN's levels of culture.[99]

[99] SCHEIN, E. H. (2004), p. 26

Innovation Culture

Although the concept of corporate culture, as a typical soft factor, is very hard to measure and characterise in practice, there is no doubt among most experts that it plays a key role in determining the success rate of innovation within any given enterprise. PETERS and WATERMAN found out that successful companies have simultaneous loose-tight properties with empowered product development teams at the lowest level but guided with very strong centralistic core values [100], BARCLAY, HOLROYD and POOLTON use these findings to postulate that a culture that provides balance between the opposing concepts of control and freedom is essential, in order for a new product to achieve commercial success[101].

A key factor when evaluating the influence of corporate culture on innovation management is the attitude of a firm toward failure. For instance SUTTON recommends rewarding success & failure and punishing inaction as one of the main success factors for implementing the right cultural environment for innovation. In his opinion, the key to more efficient innovation is failing faster, not less often[102].

According to a survey made by COOPER having a climate and culture that supports entrepreneurship and innovation is one of the strongest common denominators of top-performing businesses. He suggests various actions to improve the innovation culture, for instance:

- Avoid being overly risk-averse.
- Allow time off or scouting time for innovative projects (“Friday Projects”).
- Place major projects outside of the company (“skunk works”)
- Reward project champions & provide support for creative employees and their projects.
- Foster open communication[103].

[100] Cf. PETERS, T. J.; WATERMANN, R. H. (2003), p. 15

[101] Cf. BARCLAY, I.; HOLROYD, P.; POOLTON, J. (1994), p.35

[102] Cf. SUTTON, R. i. (2002), pp. 94

[103] Cf. COOPER, R. G. (2004), pp. 249

Managing Culture

Of high importance for the goals of this research work is the question of how culture can be influenced by the management. According to SCHEIN leaders of a company, in particular the founders of a company play a key role and have very high influence on the culture of a company. He identifies two mechanisms through which leaders influence the culture of an organization:

- Primary embedding mechanisms: these are the major tools for leaders to create and influence the culture of an organisation; leaders can use them to embed their own assumptions into the DNA of an organization. SCHEIN names six primary mechanisms:
    - what leaders pay attention to, measure, and control on a regular basis,
    - how leaders react to critical incidents and organizational crises,
    - how leaders allocate resources,
    - deliberate role modelling, teaching and coaching,
    - how leaders allocate rewards and status,
    - how leaders recruit, select, promote and excommunicate.
- Secondary articulation and reinforcement mechanisms: these are only culture reinforcer not creators, they only work if they are consistent with the primary mechanisms. According to SCHEIN they are:
    - organisation design and structure,
    - organisational systems and procedures,
    - rites and rituals of the organisation,
    - design of physical space, facades and buildings,
    - stories about important events and people,
    - formal statements of organisational philosophy, creeds and charters[104].

SCHEIN also analysed the mechanisms of cultural change, as described in the following table. He suggests ten different approaches to changing the culture of an organisation depending on their lifecycle stage.

[104] SCHEIN, E. H. (2004) p. 246

Organizational Stage	Change Mechanism
Founding and early growth	1. Incremental change through general and specific evolution
	2. Insight
	3. Promotion of hybrids within the culture
Midlife	4. Systematic production from selected subcultures
	5. Technological seduction
	6. Infusion of outsiders
Maturity and decline	7. Scandal and explosion of myths
	8. Turnarounds
	9. Mergers and acquisitions
	10. Destruction and rebirth

Figure 27: SCHEIN's culture change mechanisms[105].

[105] SCHEIN, E. H. (2004) p. 292

2.3 Innovation Barriers and Hurdles

The concept of innovation barriers or hurdles is almost as old as the definition of innovation itself, SCHUMPETER wrote about them as “the reaction of the social environment against one who wishes to do something new. This reaction may manifest itself first of all in the existence of legal or political impediments […] In matters economic this resistance manifests itself first of all in the groups threatened by the innovation, then in the difficulty in finding necessary cooperation, finally in the difficulty in finding and winning over consumers”[106]. HAUSCHILDT & SALOMO also quote SCHUMPETER’S work stating that even the most modern enterprises have a persistent resistance to changes[107]. They themselves describe the history of innovations as the history of never ending resistance against them[108].

Some authors like MARKHAM, GREEN and BASU, define hurdles as all those factors that have a negative effect on innovations[109]. On the other hand, MIROW[110] argues, that hurdles can have a positive effect on innovations, acting as a filter, in a form similar to the gates in the Stage-Gate process previously described.

An often-quoted definition of barriers is the one by WITTE. To him, innovation barriers are obstacles rather than barriers, hindering or hampering an innovation but able to be overcome[111]. Following this definition, this research work will use the term “hurdles” instead of “barriers”.

2.3.1 Categories of Innovation Hurdles

There has been a significant amount of research and studies conducted to identify, analyse and categorise common hurdles in innovation management. There are also a significant number of different categorization approaches.

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[106] SCHUMPETER. J. A. (1934), pp. 86

[107] “Die modernste Unternehmung hat einen Beharrungswiderstand gegen Veränderungen“ SCHUMPETER, J. A. (1912), as cited in: HAUSCHILDT, J.; SALOMO, S. (2007), p. 178

[108] HAUSCHILDT, J.; SALOMO, S. (2007), p. 178

[109] MARKHAM, S.K; GREEN, S. G., BASU R. (1991) , pp.217

[110] MIRROW, C. (2010), p. 7

[111] "es darf mit der Barriere keine feststehende Schranke assoziert werden, die entweder geöffnet oder geschlossen ist, übersprüngen oder nicht übersprüngen wird. Wir meinen einen graduellen Wiederstand, der auch graduell überwunden werden kann”: WITTE, E. (1973), p. 6

Based on WITTE's definition of hurdles, HAUSSCHILDT and SALOMO distinguish two main categories for individual innovation hurdles:

- Hurdles due to not knowing / ignorance.
- Hurdles due to not wanting / unwillingness[112].

Additionally they suggest four categories of arguments against innovations:

- Technological.
- Marketing.
- Financial.
- Ecological[113].

WOHINZ and MOOR, in their research work, identify five different areas for causes of innovation hurdles:

- Technical.
- Economic.
- Legal.
- Organisational.
- Socio-psychological[114].

This non-comprehensive overview of classification approaches gives an idea of the various possibilities there are to classify innovation hurdles depending on the perspective of the corresponding research. It is interesting to point out that none of the presented models explicitly mentions the lack of resources (material, financial, intellectual and personal) as a hurdle, which according to industry experts represents in reality one of the most common hurdles.

[112] HAUSCHILDT, J.; SALOMO, S. (2007), pp. 190

[113] HAUSCHILDT, J.; SALOMO, S. (2007), pp. 183

[114] WOHINZ, J. W.; MOOR, M. (1989), pp. 199

2.3.2 Success Factors of Innovation Management

The goal of this research is to identify and analyse success factors of innovation management for automotive suppliers. For this purpose success factors are defined as those manifestations of the innovation management business architecture that help the supplier to overcome innovation hurdles or to diminish their negative effects.

In the following figures, an overview of innovation hurdles studies is given and matched with the success factors according to the classification suggested within this research work.

AFUAH considers that the key innovation hurdles are related mainly to strategy as shown in the following illustration[115].

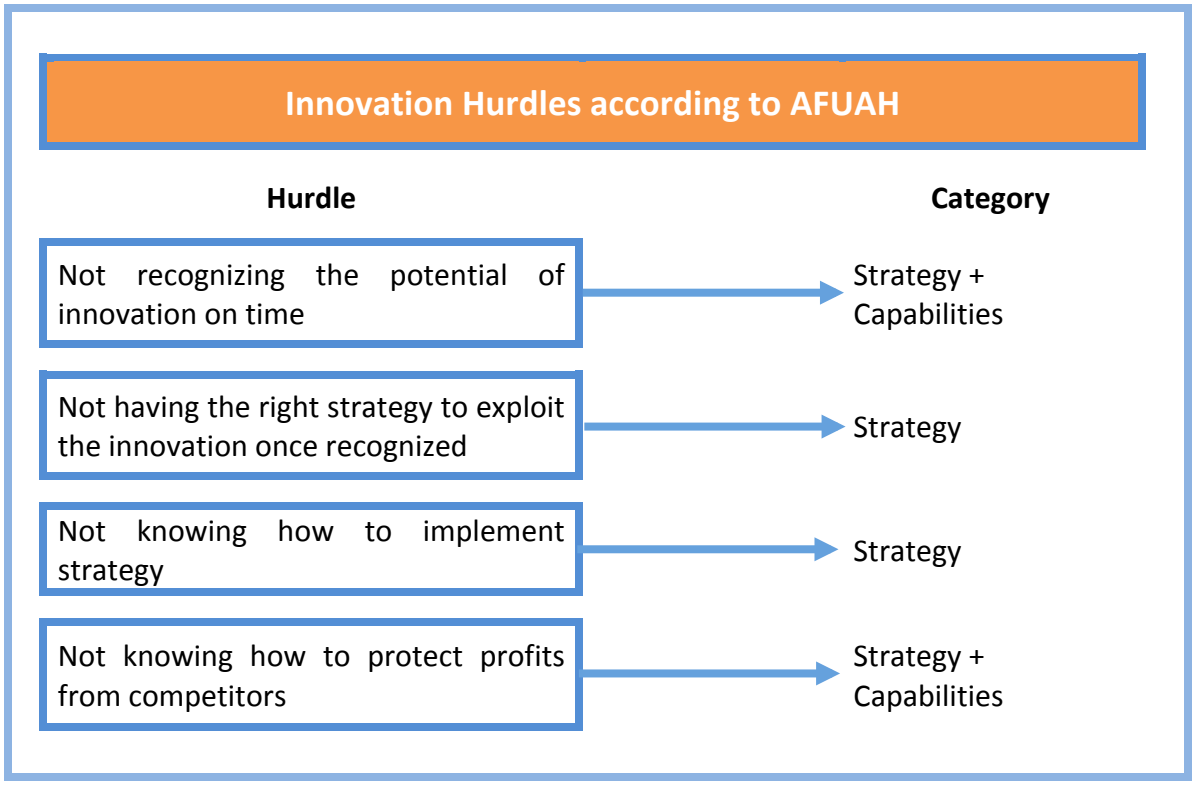


Figure 28: Innovation hurdles according to AFUAH[116].

Other authors like HERSTAAT and SANDAU or CHRISTENSEN, KAUFMANN and SHIH have focused their research work on other barriers.

[115] Cf. AFUAH, A. (2003), p. 1

[116] Referring to AFUAH, A. (2003), p. 1

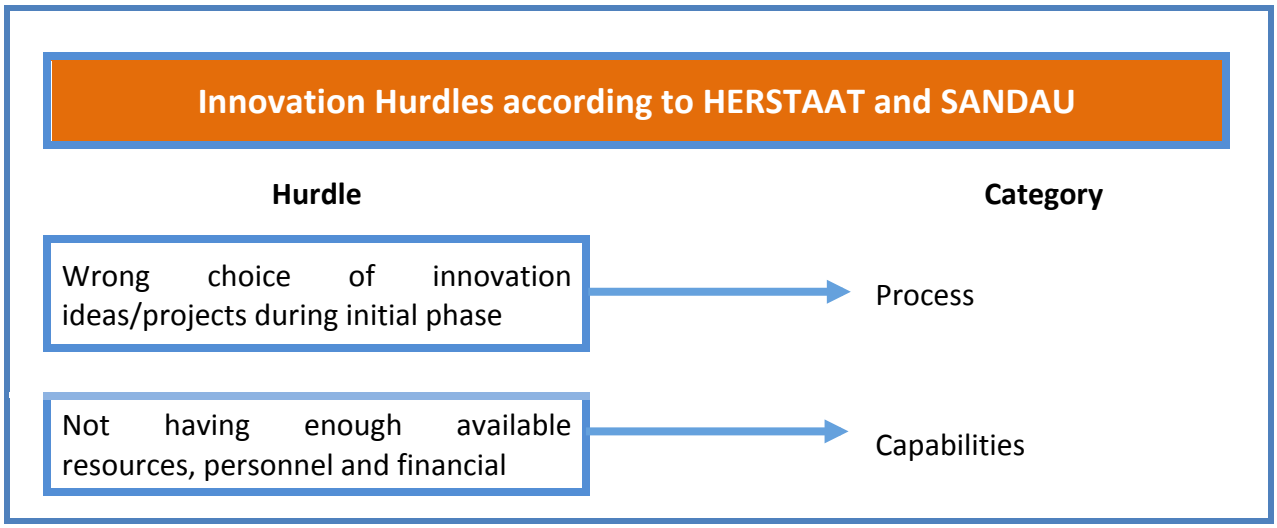


Figure 29: Innovation hurdles according to HERSTAAT and SANDAU[117].

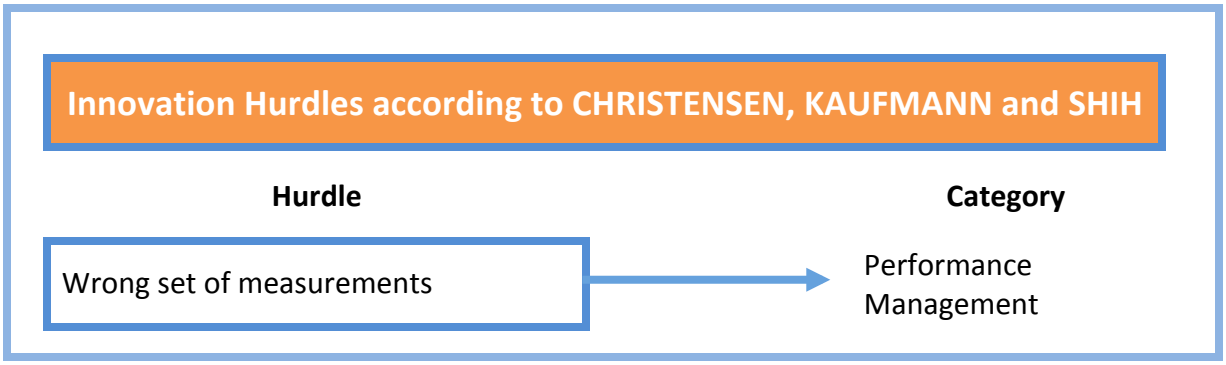


Figure 30: Innovation hurdles according to CHRISTENSEN, KAUFMANN and SHIH[118].

Besides these examples from scientific literature, various management-consulting companies have conducted a number of surveys and studies analysing innovation management hurdles during the last years. The following tables give a representative overview of their findings

[117] Referring to HERSTAAT, C.; SANDAU, J (2006), p. 10

[118] Referring to CHRISTENSEN, C. M.; KAUFMANN, S. P.; SHIH, W.C. (2008), pp. 1

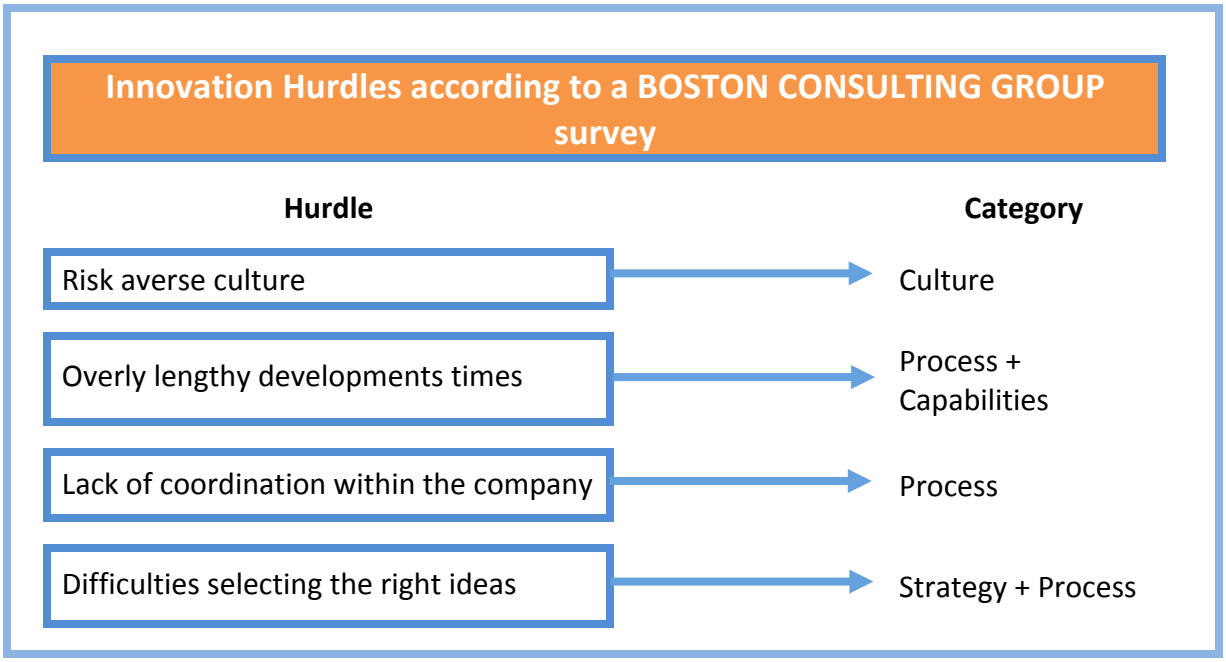


Figure 31: Innovation hurdles according to a study by BOSTON CONSULTING GROUP[119].

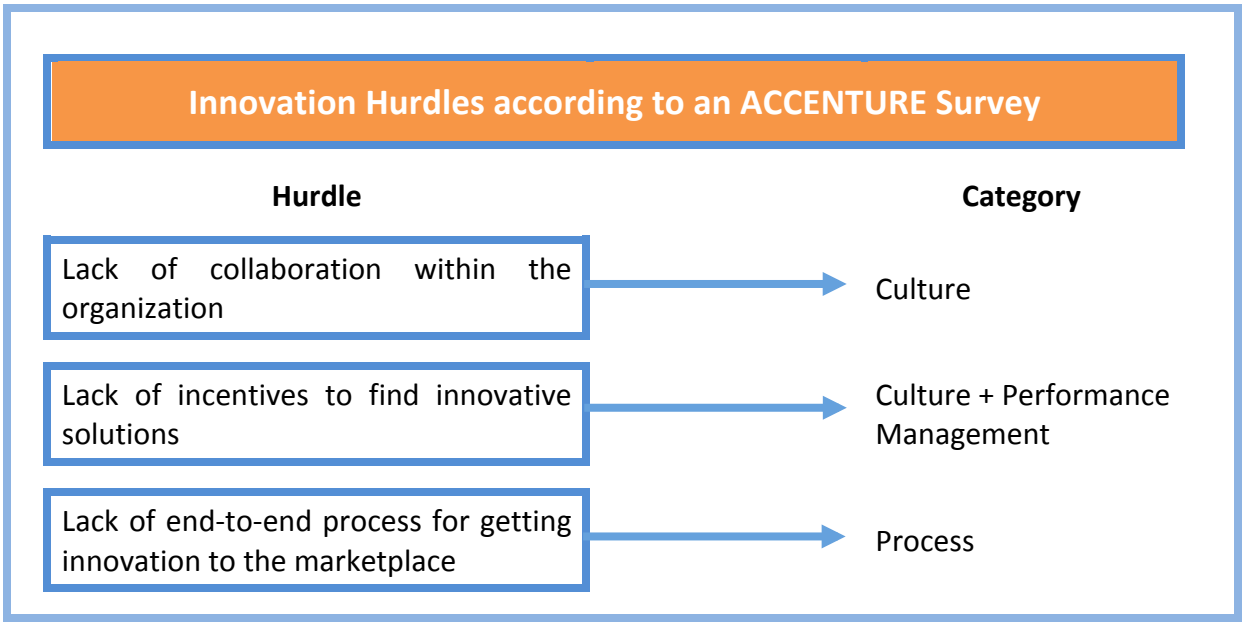


Figure 32: Innovation hurdles according to study by ACCENTURE[120].

[119] Referring to BOSTON CONSULTING GROUP (2007)

[120] A Referring to ACCENTURE (2006)

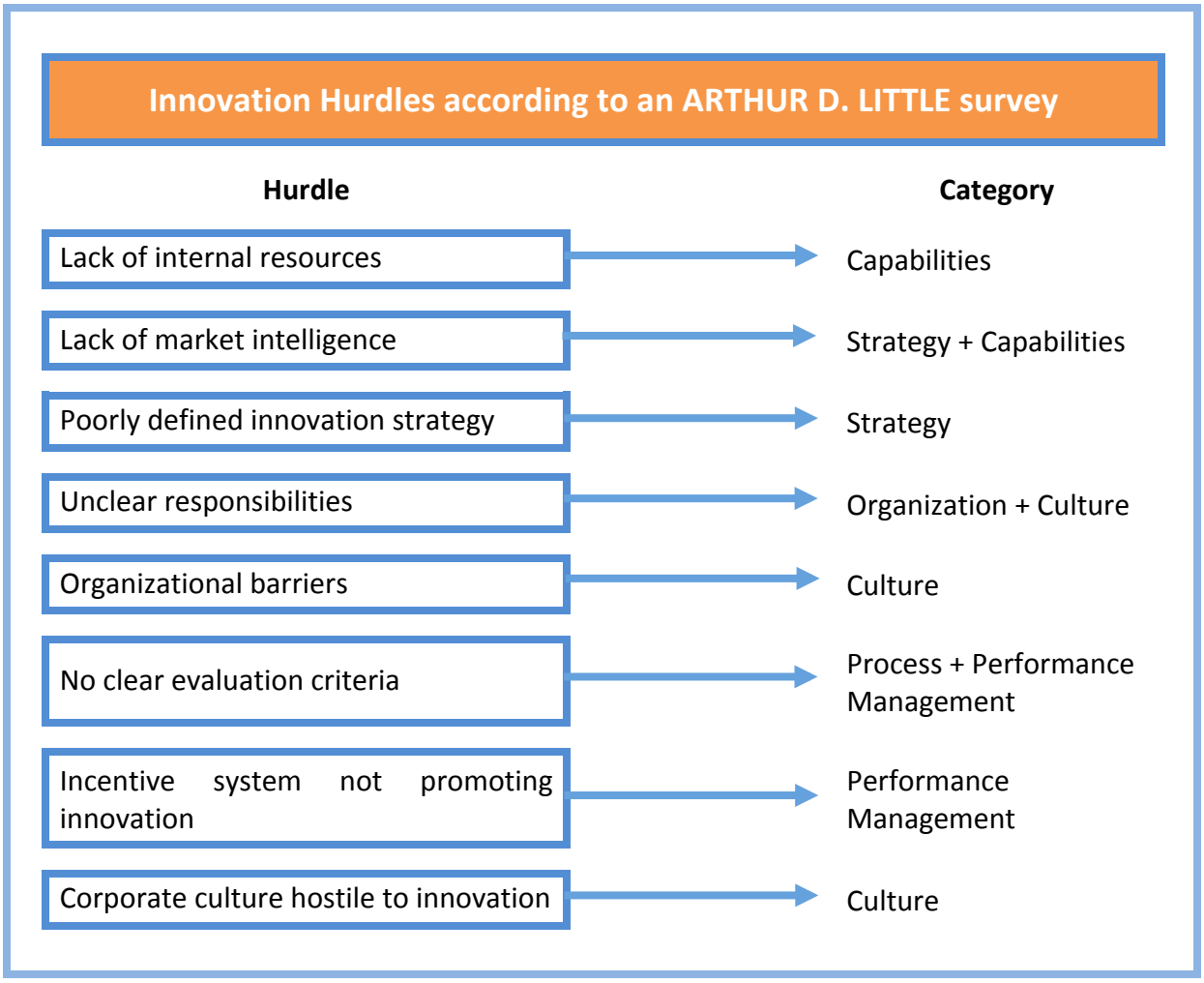


Figure 33: Innovation hurdles according to a study by ARTHUR D. LITTLE[121].

Other authors have formulated success factors directly without first deriving them from the innovation hurdles. Since their results are very consistent with the hurdles research, it is possible that the authors followed the same logic of identifying the obstacles for innovation first and then deriving the success factors, but chose to focus just on the results alone, as can be seen in the following tables.

[121] Referring to ARTHUR D. LITTLE (2005)

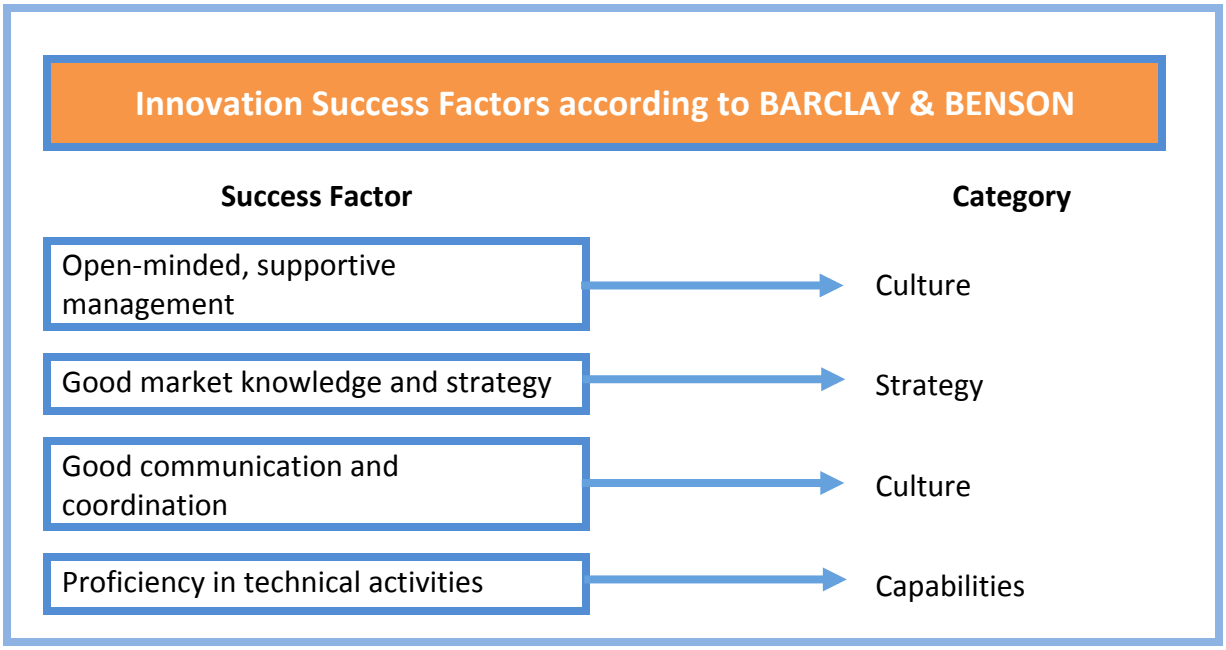


Figure 34: Innovation success factors according to BARCLAY and BENSON[122].

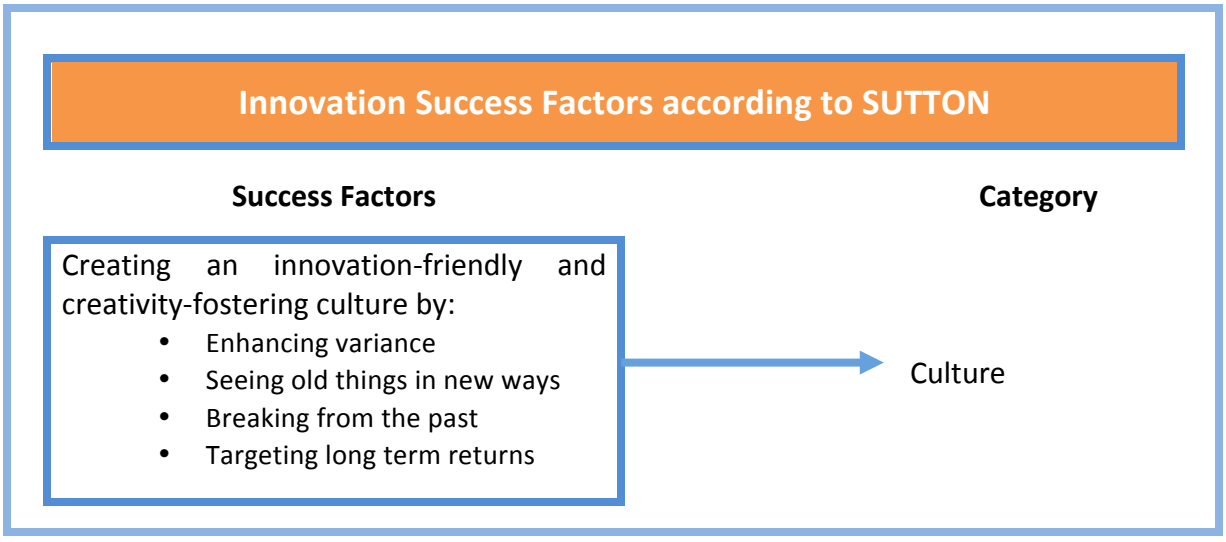


Figure 35: Innovation success factors according to SUTTON[123].

[122] Referring to BARCLAY, I.; BENSON, M.H. (1990) as cited in BARCLAY, I. ; HOLROYD, P., POOLTON, J. (1994), p. 34

[123] Referring to SUTTON, R. I. (2002), p.3

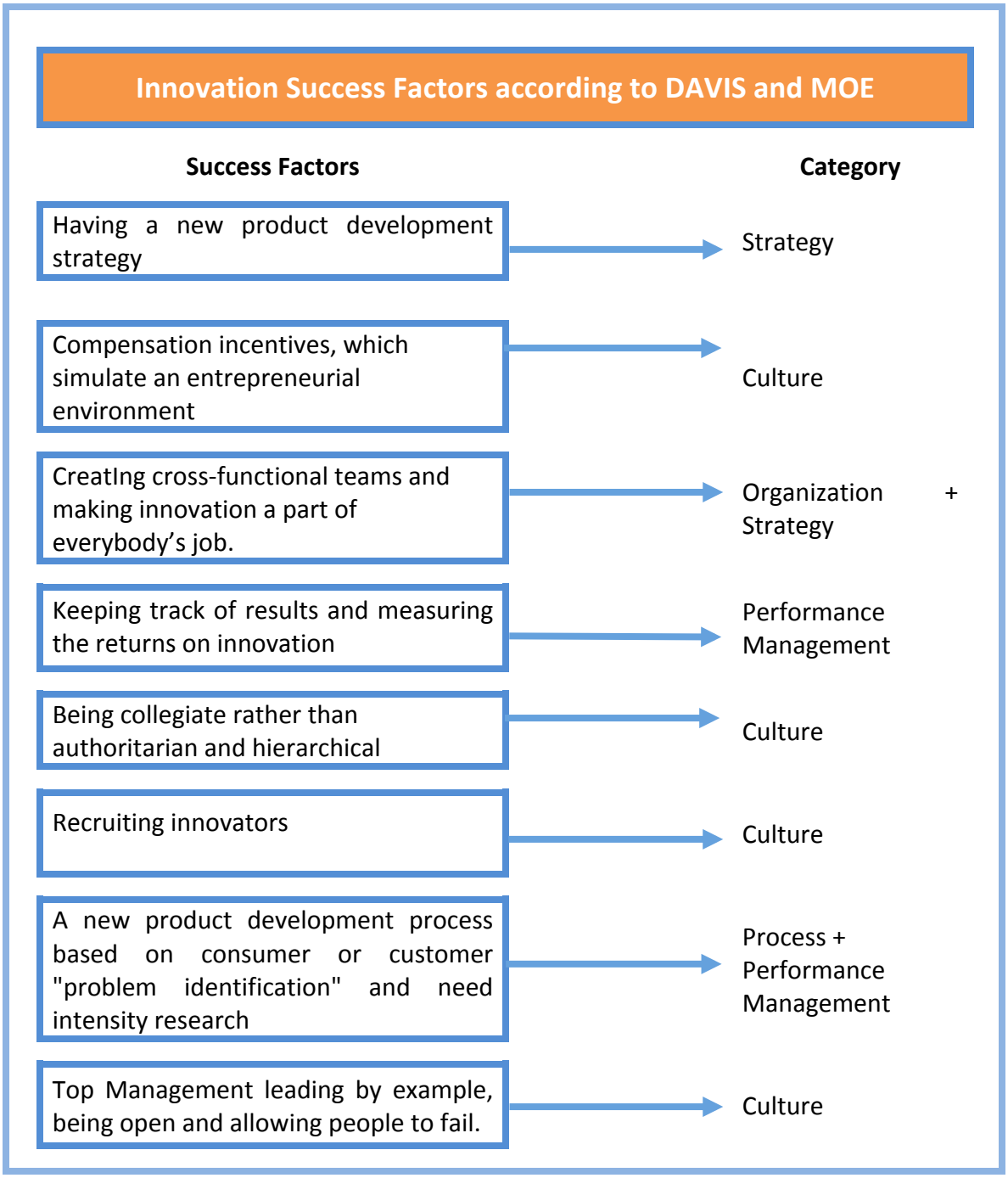


Figure 36: Innovation success factors according to DAVIS and MOE[124].

These results reinforce the findings postulated at the beginning of this chapter. Therefore it can be stated that the innovation management business architecture elements of strategy, process and culture have a high influence in determining the success or failure rate of a specific innovation project or the complete innovation management of any organisation and eventually lead innovations to success.

[124] Referring to DAVIS, S. M.; MOE, K. (1997), pp. 360

The other elements of the business architecture, for instance organization, capabilities and performance management, are also without a doubt very important in determining the success of an innovation. This research work will mainly focus on the three factors of innovation-strategy, -process and -culture. Unlike other industries, the specific situation of the automotive industry requires a unique approach for automotive suppliers that has not yet been fully analysed.

For instance, in one of the very few supplier specific studies (albeit not limited to automotive suppliers) WALTER, RITTER and RIESENHUBER found out that a suppliers' innovation-development function offers a differentiation potential against competitors and is related to higher shares of customers' business; but only when the customers are willing and able to align and make use of the suppliers' innovation-development function. They follow that innovating for non-innovative customers is only a waste of resources and recommend simply that innovative suppliers focus mainly on innovative customers[125]. This and similar specific aspects of the automotive supplier industry will be explored in the following chapters.

[125] WALTER, A.; RITTER, T.; RIESENHUBER, F. (2007), p.14

3 Development of Model and Framework

In order to develop a suitable innovation management framework for automotive suppliers this section of the research work follows a structured five-step approach as shown in the following picture:

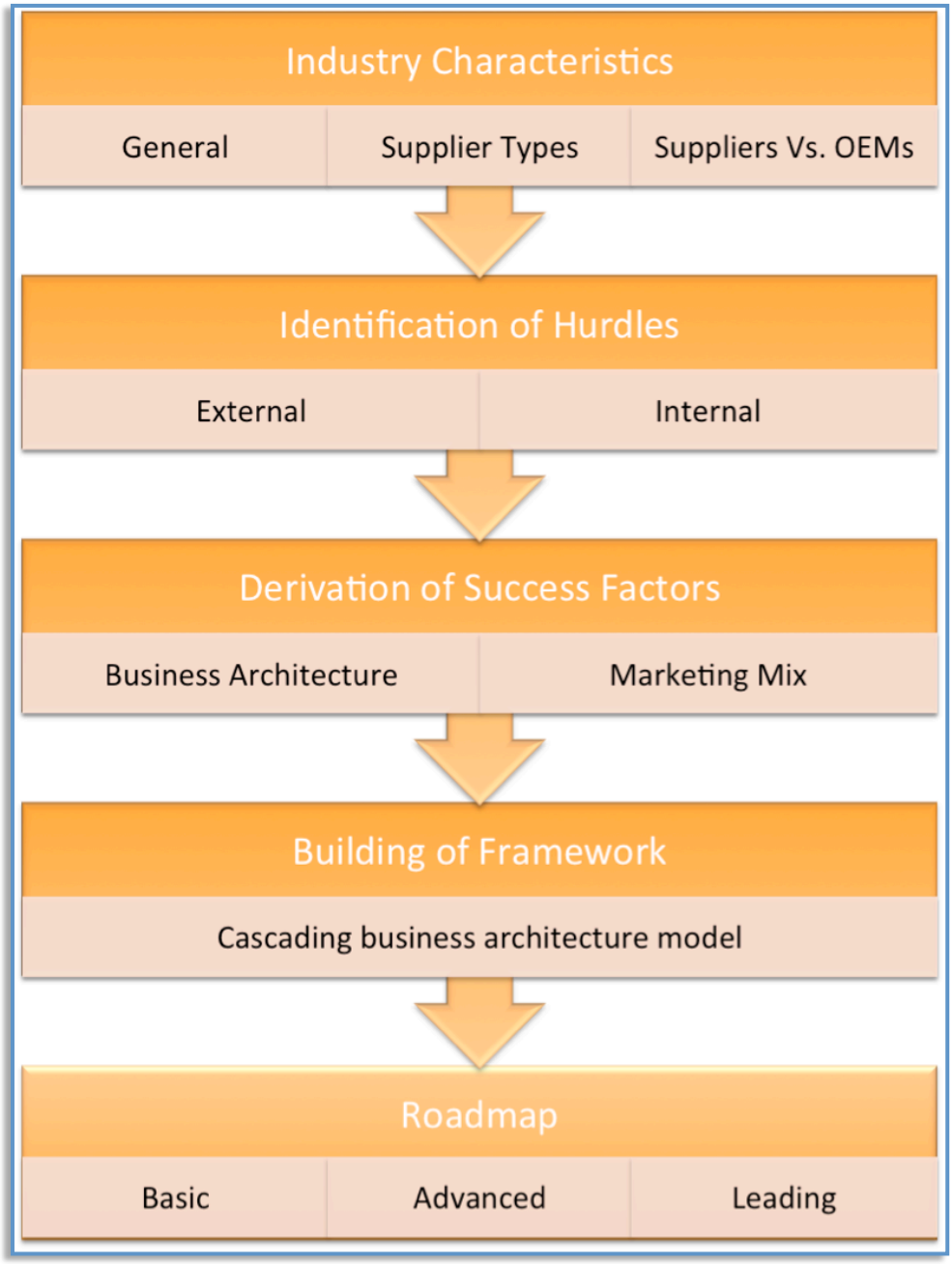


Figure 37: Five steps used to develop the Innovation Management Framework (author's illustration)

1st Step: Innovation Management Characteristics of the Automotive Supplier Industry

Starting with the general analysis of the automotive supplying industry, a set of relevant characteristics has been identified and their relationship to the different supplier types evaluated. Finally, the effect of these characteristics upon the innovation management of automotive suppliers was analysed by comparing their situation with the innovation management of the automotive OEMs. The comparison has been done for the three key areas of the innovation management business architecture and the single elements of the marketing mix model.

2nd Step: Innovation Hurdles for Automotive Suppliers

The characteristics of the industry are used to identify specific innovation hurdles for automotive suppliers. They are grouped in to external and internal hurdles.

3rd Step: Success Factors of Automotive Suppliers Innovation Management

Success factors are derived from the defined hurdles. A success factor is defined as one of the innovation management elements that automotive suppliers can use to overcome/reduce the impact of barriers to becoming successful innovators. The findings are used to formulate a series of hypotheses for successful innovation management of automotive suppliers.

4th Step: Automotive Supplier Innovation Management Framework

The single elements of the previous steps are put into relationship to each other, building a framework for automotive suppliers to become successful innovators. It is a cascading model that starting with the innovation strategy combines the key elements of the innovation management business architecture and the marketing mix elements needed for the realization of innovations.

5th Step: Roadmap for Implementation

An innovation management implementation roadmap is formulated, consisting of three different innovators stages: basic, advanced and leading innovators.

3.1 Innovation Management Characteristics of the Automotive Supplier Industry

As already outlined in the first chapter of this research work, the automotive industry has some specific characteristics that make the situation of automotive supplying companies very special, with regard to their activities and approaches toward innovation management. These main characteristics are:

- It is a B2B market with very few customers.
- The bargaining power is clearly on the side of the buying automotive OEMs.
- Suppliers have only limited or no access to the end users/consumers of their products.
- Supplier products are built into an OEM car, or another supplier's product (cascading tier structure).
- The design/specification of the supplier product is dictated or at least has to be approved by the car manufacturers.
- Most supplier products are developed for one specific car or platform. It is often not possible or only with significant additional investment to transfer the product to another OEMs vehicle.
- Many suppliers offer products that are pure commodities, easy to be replaced and not perceptible by car drivers.
- Rather than through the product they deliver, suppliers often can only differentiate themselves by the quality of the processes to engineer, produce and deliver parts to the OEMs.
- With very few exceptions, the industry standard is imposed by the OEMs to calculate piece prices on a cost plus basis, providing detailed cost break-downs to justify them.
- The development of a new product is linked to significant costs and investments that have to be paid upfront, often a couple of years before the start of production of the vehicle. Suppliers have the options of financing these costs upfront themselves and then having them amortized through the piece price or having them funded by the OEMs. In the first case, they have to carry all the risks without having the possibility to directly influence the commercial success of the car, and therefore can only indirectly influence the success of their own product. In the second case they have less financial risk, but are

very likely to lose their intellectual property to, or have their use limited by the OEM, either completely or at least for a fixed time period.

- The window of opportunity for introducing a new product is limited by the OEMs cycle plans. It is very unusual and most of the times not feasible to introduce an innovation into a car that is already in series production.

These industry characteristics of the automotive supplier industry make this market very special. The influence they have upon the innovation management approach is significant, as the next chapters will show in detail.

3.1.1 Supplier Types

There are many possible ways of categorising the different types of suppliers. For instance it can be done by technology or by size. To analyse their situation regarding innovation management the most appropriate categorisation is to use their relative position in the value chain to the OEMs. For this purpose this research work has adapted the model of SCHÖNSLEBEN[126], wherein the supplier structure always follows the product structure as shown in the following picture.

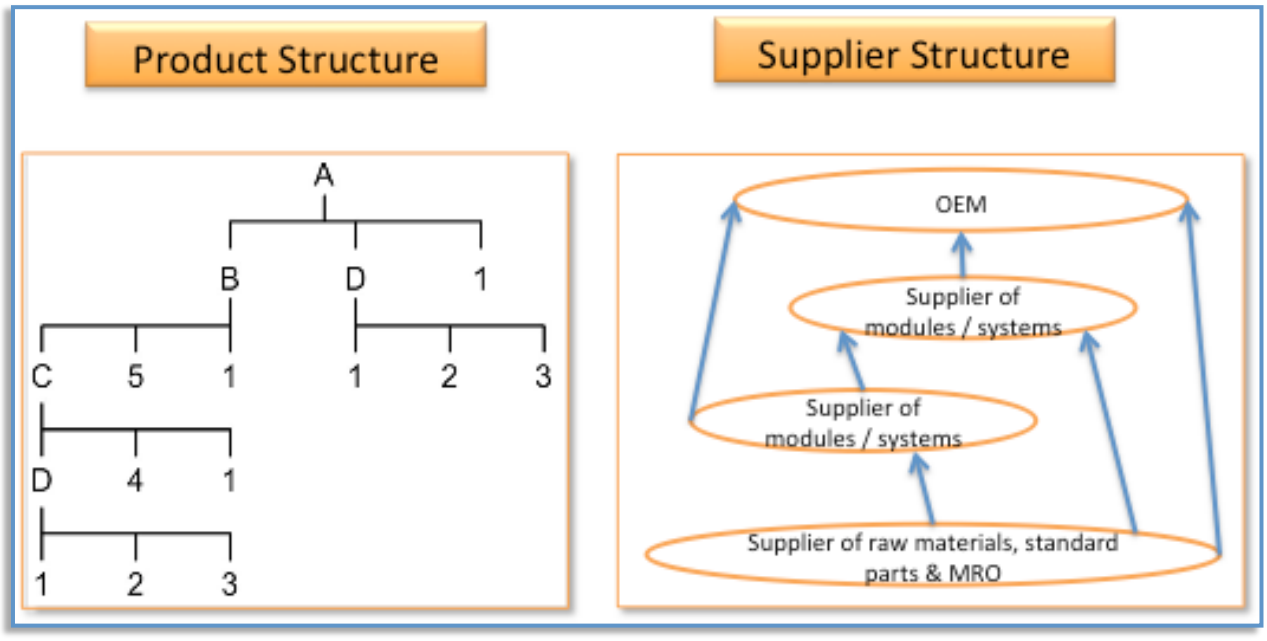


Figure 38: SCHÖNSLEBEN's product and supplier structure model[127].

[126] SCHÖNSLEBEN, P. (2007), p. 77

[127] SCHÖNSLEBEN, P. (2007), p. 77

The products of automotive suppliers can be categorized into:

- Modules: physically cohesive integration of sub-modules to a unit. They are ready to be built in a vehicle. Modules are defined by the assembly logic of a vehicle. Examples: front-end modules, cockpit modules.
- Systems: functional integration of sub-systems. They are not ready to be assembled but instead distributed among various modules. Systems provide a specific function of the car.
  Examples: safety systems, infotainment systems.
- Sub-modules: physically cohesive integration of components and parts.
  Examples: overhead consoles, middle consoles.
- Sub-systems: functional integration of components and parts.
  Examples: restraint-systems, interior lighting systems.
- Components: complex units consisting of different parts.
  Examples: headlamps, airbags.
- Parts: simple, often standardised, elements used to build components.
  Examples: screws, ball-bearings.
- Raw materials: basic materials for production.
  Examples: paint, steel, resin.
- MRO: indirect goods for Maintenance, Repair and Operations

The position of a supplier within the value chain is denominated using a tier system, whereby the first tier suppliers are those that deliver directly to the OEMs, second tier suppliers supply to the first tier and so on.

Tier 1 suppliers are typically module or system suppliers, Tier 2 suppliers produce sub-modules, sub-system and/or components, the tiers with a higher number consist of parts, raw materials and MRO goods suppliers as depicted in the following figure.

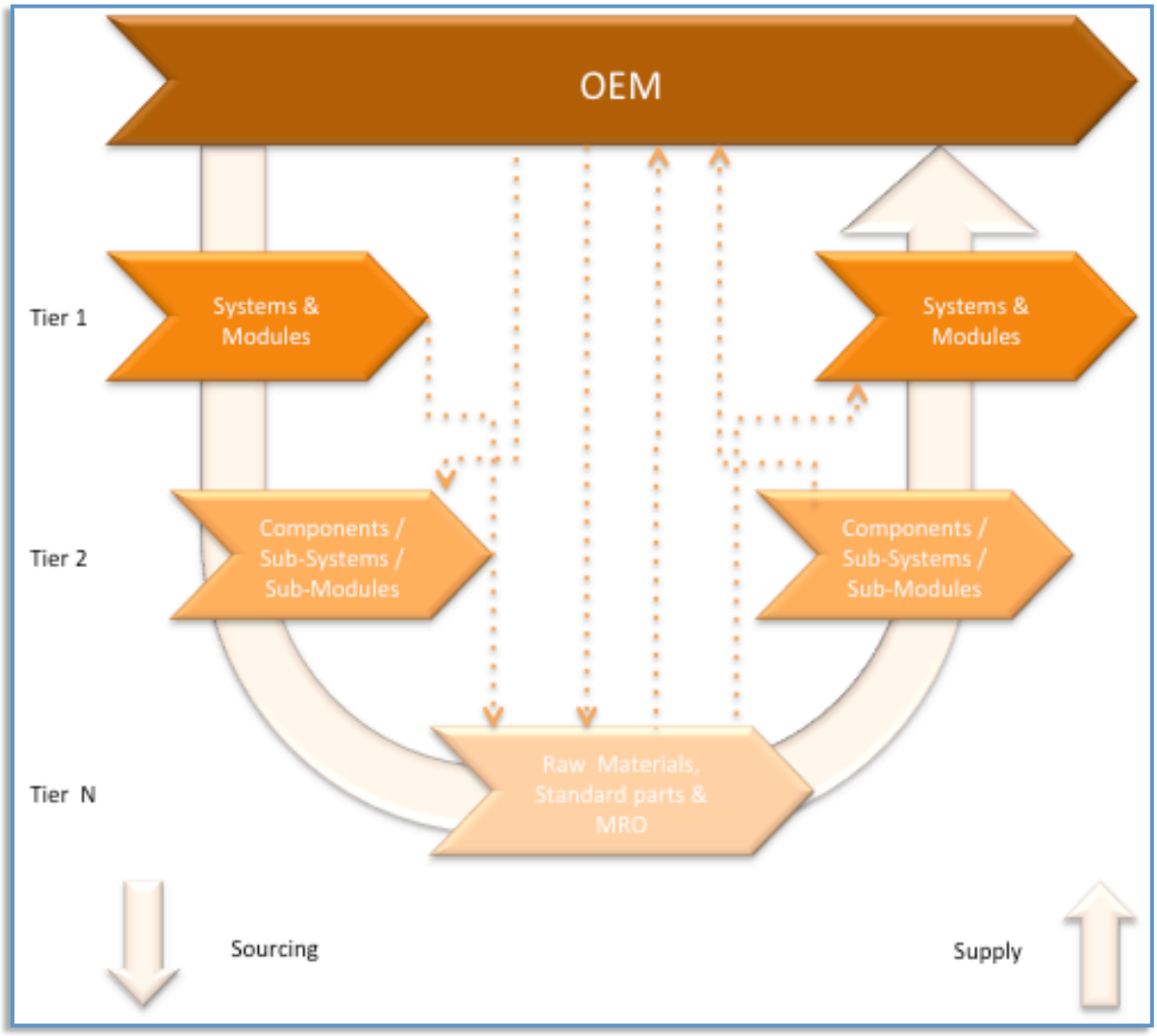


Figure 39: Different types of suppliers (author's illustration).

In reality, the supply relationship is obviously more complex since not all the material flow follows this strict cascading system. For example, OEMs buy parts and raw materials directly from higher tier suppliers, which are still not considered as tier one.

From the specific point of view of innovation management as analysed in this research work, the most interesting suppliers are the first tier suppliers. All the particular characteristics and complexity of the industry apply to then. The further away in the supply chain a supplier is from the OEMs the less affected they are by the OEM extreme buying power. For example raw material suppliers at the beginning of the supply chain have in many cases, a very diversified customer portfolio in which the automotive customers are only one of many. They don't face most of the specific

barriers described in this framework. Additionally, products offered by the tier 1+n suppliers are usually much simpler than those of the first tier suppliers.

Special cases are not explicitly considered in this model, like complete vehicle assemblers like Magna Steyr (who used to call themselves a “tier 0.5 supplier”) or pure service providers without any physical production. Most of these findings research findings are valid for them but would go exceed the scope of this work to analyse their specific characteristics in detail.

Another special case involves the suppliers in supplier parks. Supplier parks are the settlement of various suppliers in an industrial area close to the production site of an OEM[128]. In most cases, the suppliers in a park only supply a single OEM. A supplier park can create significant synergies, especially in the area of logistics. Accordingly, the influence of supplier parks is primarily focused in logistics, whereby new ways of direct cooperation can be explored that can lead to new ideas for improvement, especially at the interfaces between OEMs and the various tier suppliers. A good example of this is the very innovative concept of the supplier park that was created for supplying the SMART in Hambach, France, where seven suppliers on site not only manufacture modules but also install them into the car themselves. This innovative logistic approach helps to save time, increase flexibility and minimize stock and delivery periods. According to Daimler experts, this has had a massive impact on logistics costs and allowed them to build a “Smart fortwo” in less than five hours.

As this example shows, supplier parks create a tighter form of cooperation and integration among suppliers and the OEMs. This tighter link is helpful for reducing barriers at the interface, since both sides have a better understanding of their corresponding strategies, goals and resources and there is a higher willingness to work together to overcome all hurdles. On the other hand, the reason why supplier parks do not produce as many product related innovations as could be expected is the fact that in most of the cases, the parks consist of pure operational satellites, where almost no developmental work is done and no important product related decisions are made.

[128] VAHRENKAMP, R. (2007), p. 406

3.1.2 Automotive OEMs vs. Automotive Suppliers

By comparing the specific circumstances of automotive suppliers to the automotive OEMs it becomes clear that, although they cohabit the same industry, the challenges they face regarding innovation management are completely different. In this section, a detailed analysis of the difference between the automotive OEMs' and automotive suppliers environment will be made and the implications for their innovation management business architecture will be derived for the following factors:

- their targeted market and corresponding marketing mix
- their overall strategic approach and specific innovation strategy
- specific aspects regarding the different phases of their innovation processes.

Targeted Market - Customers[129]

OEMs

The automotive OEMs aim to sell cars to the end consumers. Theirs is basically a business to consumer (B2C) market, although there is also a significant B2B segment, for instance the fleet business. In any case, the automotive OEMs have a large customer base; the individual needs of their customers are not always easy to recognize for them, they use segmentation and CRM tools to gather information about their products' users and to help them understand their needs.

Suppliers

It is a B2B market. The automotive suppliers sell their products to automotive OEMs, a few suppliers have significant aftermarket business, but for the majority, selling to the few existing OEMs is their core automotive business.

Impact on Innovation

When thinking about innovations and new products for their core customers, automotive OEMs have the challenge of coping with a very large number of mostly anonymous consumers. Suppliers, on the other hand, have to focus only on very few customers, but their innovation management activities have to be totally aligned to those of the OEMs they are targeting.

[129] This research work is focused on the passenger cars market and does not consider for instance the heavy trucks sector, since its' characteristics, both on the OEM side as well as the supplier side, can greatly differ.

Targeted Market – Competitive forces

OEMs

The internal rivalry among OEMs has traditionally been the main driving force in this market. New entrants from other regions (China and India) and maybe in the future also from other industries (e-mobility) are becoming an important force. Due to increasing discussions about environmental concerns, limited natural resources and the dearth of parking space in big cities, the threat of substitution by other mobility systems is expected to increase in the future.

Suppliers

The main competitive force in the suppliers market is the buyer bargaining power that constantly drives prices down and has put a lot of suppliers in a very critical financial position. New entrants from other regions and industries are increasing their competitive power as well.

Impact on Innovation Management

OEMs use innovation to differentiate themselves from each other. Suppliers' innovations are very dependent upon the OEM buyers. Their innovations are almost the only chance for suppliers to get a higher price from the OEM.

Targeted Market – Main dimensions of competition

OEMs

The product itself plays a mayor role. Consumers are very much influenced by the price and/or the performance and features of a car. Additional factors like brand image and services (e.g. financing) can also play an important role. Innovations that provide features perceptible to the customer or that have a significant impact on the efficiency/safety of a car are major differentiators.

Suppliers

To a large scale, their product will be designed and/or specified by an OEM. The overall dominating competitive factor is the price. Other important aspects, such as logistics, quality and engineering capabilities are considered as hygiene-factors, they are precondition "sine qua non" but are not sufficient differentiators by themselves. Single innovations can be an important source of differentiation but need to have the right "fit" to the targeted OEM.

Impact on Innovation Management

For both parties, OEMs and suppliers, innovations can be a key competitive factor in the market. The importance as a differentiator will most of the time be of higher relevance to the OEMs than to the suppliers. In other words, two comparable innovations of the same level of innovativeness, one coming from a supplier and one from an OEM, will have more beneficial impact for the OEM than for the supplier in their corresponding markets. The OEMs have a higher degree of control and power to influence their customers, while suppliers are more dependent upon the OEMs as their buyers.

Marketing Mix – Product

OEMs

Generally OEMs design and manufacture entire vehicles to sell them under their own brand to the end consumer. OEMs also provide added services and spare parts around the car. Excepting legal requirements, OEMs have a high level of freedom to design their products.

Suppliers

With very few exceptions, automotive suppliers design and develop products according to the specification and requirements of an automotive OEM. Products from an automotive supplier can be a simple part or component, a (sub-/) module or (sub-/) system or even the complete design and assembly of a car for an OEM. Due to the increasing technical complexity and pressure to reduce costs in the automotive industry system module suppliers are gaining higher levels of freedom and responsibility from the OEMs to design their products.

Impact on Innovation Management

Suppliers are more limited than OEMs when designing their products. A stand–alone supplier product does not, in most cases, have any use at all. In the same way any supplier-developed innovation has to be integrated into a vehicle. Although their level of influence on the product design has been increasing, a successful realisation and commercialisation is still fully dependent upon, first, the technical fit to the car, and then upon the commercial success of the complete vehicle program. A successful technical invention in a vehicle that is not commercially successful will not benefit the supplier.

Marketing Mix – Place

OEMs

OEMs use a dealer network to sell to the end-consumer. In their core European markets, most of them strive to (own and) control the dealerships and wholesalers. Due to actual EU legislation, independent cross-brand dealerships are possible and play an important role, especially in markets where the OEMs are not well established. Still, OEMs have a strong level of influence when it comes to setting standards for offerings and product presentation at the point of sale.

Suppliers

Automotive suppliers don't have their own sales channel to access the end-consumer, the only exception is, as previously mentioned, the independent aftermarket, which is not relevant for most suppliers. Suppliers market their products through their own sales organisation, which interacts directly with the purchasing and engineering departments of the OEMs. Internet based platforms, which were extensively discussed at the beginning of this decade, play only a niche role and are used mainly as an additional tool by the OEMs to lower prices. A global key account management approach is nowadays considered to be the best practice in the industry.

Impact on Innovation Management

OEMs are the only channel for suppliers to place their innovations into the market. With the very few exceptions of those products that can be retrofitted into a car as an accessory or spare part (e.g. tires or parking heating systems), an automotive supplier cannot market its innovations to the end-consumer without the support of at least one OEM. Regardless of how appealing the innovation could be for end-consumers, without the OEM sales channel, the suppliers have no access to the end-users of their products. This fact not only limits their sales possibilities, but it also significantly restricts their access to relevant market information regarding end-user preferences and trends, which is normally an important source of ideas for innovations.

Marketing Mix – Promotion

OEMs

Promotion plays a very important role in the marketing mix of OEMs, since brand and image are very important competitive factors among them. The fact that they are

targeting large audiences of existing and potential customers requires their large need for extensive advertisement and other communication activities.

Suppliers

A possible strategy for suppliers could be to try to communicate directly to end-consumers in order to influence their buying, i.e. to make them buy cars with a higher content of their products. There are examples of other industries where such an ingredient branding strategy has worked, the “Intel-inside” effect being the most famous case for instance. As of today, with the few exceptions of suppliers active in other industries like consumer goods, for instance Harman-Becker or Bosch, and some of the tyre suppliers, the brands of the vast majority of suppliers are too weak; most consumers know more than one or two supplier brands. Almost nobody knows who the supplier of any component in their cars is, not to mention the fact that almost nobody currently bases their car purchase on the supplier of its components. This fact may change. However, it can only work for suppliers that have products which are perceptible to the end-costumer, meaning that they must have a significant influence upon the styling, performance, comfort or safety of a car so that the end-customer notices it. Actually most suppliers have limited promotion activities targeting the OEMs only, their impact on the overall commercial results is very limited.

Impact on Innovation Management

In promoting the commercial success of an innovation in the market, suppliers must rely on the promotion activities of the OEMs. Nevertheless, within the given constraints, there are some areas where supplier promotion activities can contribute to the success of a single innovation. Good examples of effective supplier promotion activities are for instance actions to inform key persons and decisions makers on the OEM side of new developments. In certain cases it can make sense to run campaigns at the point of sale to try to increase the customer take-rate for certain vehicle options with a higher content of a supplier’s products. There are also successful examples of supplier lobbying activities to influence legal regulations to improve market conditions for a specific new technology or product.

Marketing Mix – Pricing

OEMs

The pricing system of the OEMs is not at all transparent. The same car can be priced at totally different levels in different markets, depending on the market image and market share it has. OEMs have a huge range of mechanisms to influence the

customers, for example providing extra features, building packages or offering attractive financing conditions or higher prices for used cars taken as a down-payment from their customers. When introducing new features to the market, OEMs are often able to follow a skimming pricing strategy and obtain premium prices for the extra from their customers, this is especially the case in the higher value segments.

Suppliers

The pricing of suppliers, at least for the standard products, is very transparent to the OEMs. Most of the times they demand so called “open books” calculations where all the relevant cost factors have to be specifically laid out and explained by the supplier. It is a common practice, for example, that OEMs request quotations for various components from different suppliers and then “cherry pick” by selecting the most competitive price of every category and asking their supplier of choice to meet these targets for all components. Additionally, OEMs have strict, and in most cases non-negotiable, commercial conditions regulating all other relevant factors, like payment terms, investments or development costs payments.

Impact on Innovation Management

Innovations provide one of the few chances that suppliers have to obtain higher prices from the OEMs; however this is only possible if the innovation is protected through a special know-how and technology or through patents. OEMs will otherwise not pay a premium but try to apply their usual pricing schemes regardless of the innovativeness of the products. For this reason, process innovations often bring higher returns to suppliers than product innovations since they are not easily imitated and their value structure is not as transparent to the OEMs.

Strategy and Innovation Strategy

OEMs

To realise their primary strategy, OEMs are free to pick the strategic market approach and derived innovation strategy that best fits their purposes, market requirements and their own strategic resources.

Suppliers

When formulating their market approach and innovation strategy, automotive suppliers need to consider the strategies of their targeted OEMs or risk being unsuccessful.

Impact on Innovation Management

Suppliers are very dependent upon the innovation strategy of the OEMs they work for or target. For example, a very innovative supplier can be forced to follow a rather defensive follower strategy since his customers will not accept any innovation that has not been already proven by someone else.

Innovation Process – Initiation and ideation

OEMs

OEMs are free to start an innovation process whenever they want. It can be based on a costumer demand, internal ideas or external input, for instance an idea coming from a supplier.

Suppliers

The majority of the supplier innovation processes is triggered by a demand derived from a specific OEM's request or needs. To start an innovation process that is based on one's own ideas without the explicit support of an OEM bears a high risk that the invention may not be commercialized.

Impact on Innovation Management

Suppliers have the choice between two basic types of innovation processes, those that are triggered by an OEM (market pull) and those that are based on their own initiative. OEM triggered projects are less risky, since there is a higher probability that the OEM that started the project will support the supplier in commercialising the innovation. The downside of this kind of project is that OEMs will demand a high level of influence, even exclusivity for the delivered innovation, limiting the potential of returns to the suppliers. On the other hand, supplier triggered innovations can provide higher revenues for the supplier, but without the support of an OEM the risk of a failure is also much higher.

Innovation process – Acceptance

OEMs

OEMs decide on the acceptance of an innovation based on their own processes and criteria.

Suppliers

In addition to their own internal acceptance process, suppliers also have to involve at least one OEM and obtain its acceptance in order to successfully realise and commercialise any innovation.

Impact on Innovation Management

When implementing an innovation, suppliers have to carefully balance between the grade of dependence upon an OEM and the level of risk, otherwise they will not be able to realise and commercialise an innovation at all. Depending on their decision, they will either follow only OEM triggered innovations, involve the OEMs early in the development of their own innovations or present innovations at an advanced development stage to obtain maximum returns.

Innovation Process – Realisation and Commercialization

OEMs

Normally OEMs have all the means and resources needed to realize and commercialize their own innovations by themselves. They are only dependent on the amount of resources available.

Often they decide to delegate the realization to their suppliers but maintain the full control over the commercialization.

Suppliers

Suppliers need access to an OEM vehicle in order to realise their innovation and due to the lack of alternative channels; suppliers can only commercialise their innovation in most cases through the OEMs.

Impact on Innovation Management

The overall success of supplier's innovations is heavily dependent on the OEMs. They are often in control of the realization and commercialisation of the suppliers' innovation and in many cases take advantage of this fact.

Innovation Culture

OEMs

Most OEMs have very large organizations that tend to be very bureaucratic, which may limit the impact of a single innovative individual. OEMs are used to cooperate with suppliers and integrate their innovations into their products.

Suppliers

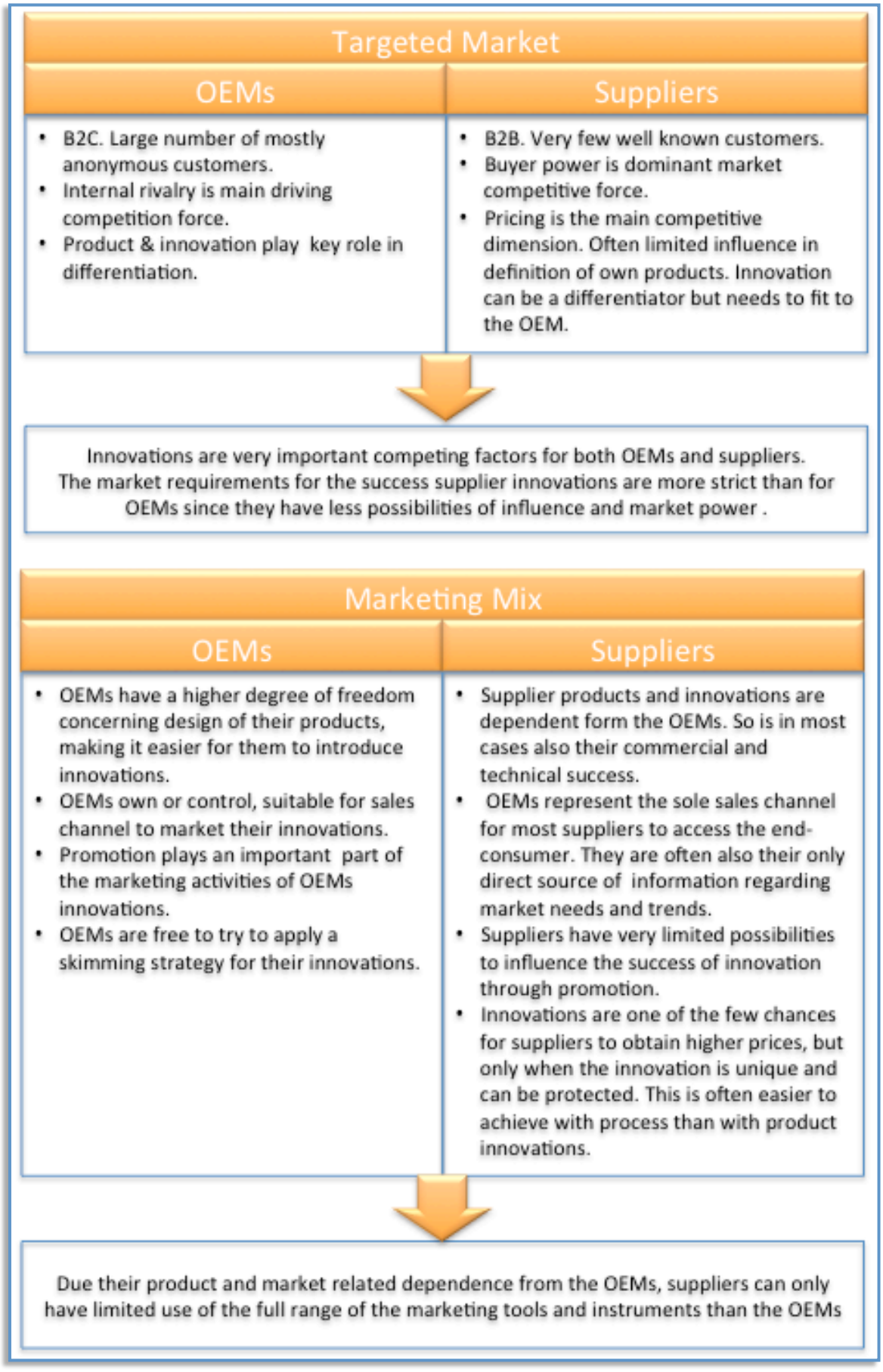
Most of the time, supplier organisations are smaller, and the influence of single individuals is therefore greater. A very innovative founder/top manager can have major influence in contributing to an innovation friendly environment. Suppliers are less used to working with other/lower tier suppliers and integrating their ideas and technical solutions into their own.

Impact on innovation Management

Due to their size and structure, OEMs organisations are prone to become very bureaucratic, creating many internal innovation barriers. Supplier organisations, led by innovation friendly management, especially if the founder or the chief executive officer (CEO) is a supporter of innovation, can develop a very innovative environment. This helps offset many of the supplier-typical barriers and become very innovative organisations.

On the other hand, suppliers are less accustomed to working with external partners to develop their products, and are therefore more prone to face cultural barriers due to a “not invented here”-mentality.

Considering these facts as summarized in the next tables, it is easy to understand why automotive suppliers face a very challenging situation when trying to successfully create and commercialize innovations and new products in general.


Targeted Market
OEMs
B2C. Large number of mostly anonymous customers.
Internal rivalry is main driving competition force.
Product & innovation play key role in differentiation.
Suppliers
B2B. Very few well known customers.
Buyer power is dominant market competitive force.
Pricing is the main competitive dimension. Often limited influence in definition of own products. Innovation can be a differentiator but needs to fit to the OEM.
Innovations are very important competing factors for both OEMs and suppliers. The market requirements for the success supplier innovations are more strict than for OEMs since they have less possibilities of influence and market power .
Marketing Mix
OEMs
OEMs have a higher degree of freedom concerning design of their products, making it easier for them to introduce innovations.
OEMs own or control, suitable for sales channel to market their innovations.
Promotion plays an important part of the marketing activities of OEMs innovations.
OEMs are free to try to apply a skimming strategy for their innovations.
Suppliers
Supplier products and innovations are dependent form the OEMs. So is in most cases also their commercial and technical success.
OEMs represent the sole sales channel for most suppliers to access the end-consumer. They are often also their only direct source of information regarding market needs and trends.
Suppliers have very limited possibilities to influence the success of innovation through promotion.
Innovations are one of the few chances for suppliers to obtain higher prices, but only when the innovation is unique and can be protected. This is often easier to achieve with process than with product innovations.
Due their product and market related dependence from the OEMs, suppliers can only have limited use of the full range of the marketing tools and instruments than the OEMs

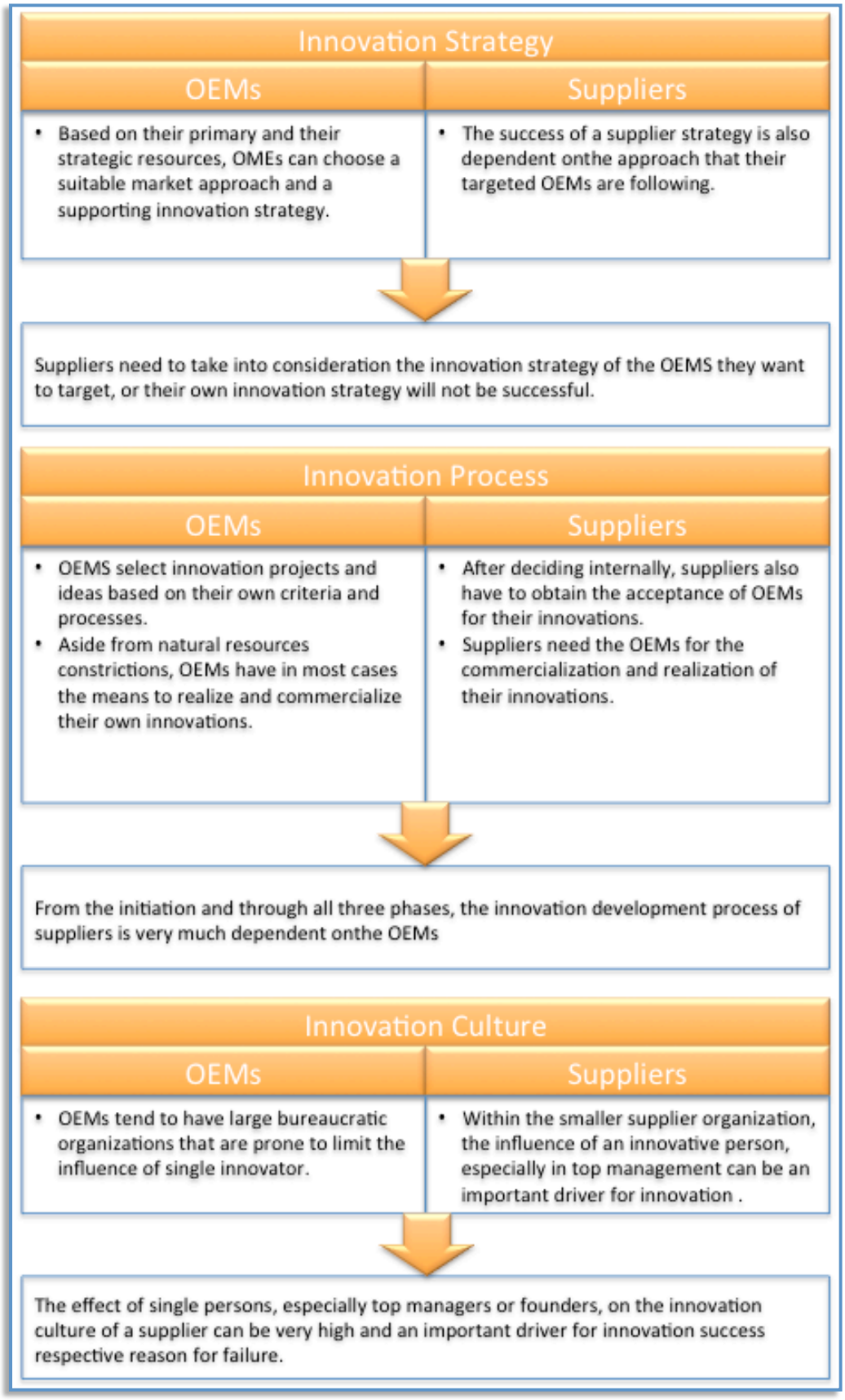


Table 2: Overview of innovation management characteristics of automotive OEMs vs. suppliers (author's illustration).

As can be clearly observed in this overview, the main challenges for supplier innovation management originate in their direct dependency upon the OEMs due to the hierarchical tier structure and unbalanced power distribution of the industry. This dependency is particularly high regarding the design, specification and commercialization of the suppliers' products, because any innovation has to be implemented into and sold through an OEMs' vehicle. This fact not only limits the number of possible innovation ideas but also creates additional hurdles for their acceptance and realisation. Additionally, the reliance upon OEMs as a single sales channel limits their commercial possibilities and dilutes the total revenues of most suppliers' innovations.

Finally, in an industry characterized by extreme competition and the need for high investment to implement new products, the influence of financial elements upon the success factors of any automotive innovation project is also highly significant. Regarding this aspect, automotive suppliers find themselves again in an unfavourable situation compared to the OEMs. Car manufacturers can use their suppliers to co-finance their own innovations and minimize their own risks and financial exposure. The compensation that suppliers are being offered for this additional financial burden and risk is limited and reflects the imbalance of power within the industry.

These characteristics create very specific innovation hurdles for automotive suppliers that will be further analysed in the following section.

3.2 Innovation Hurdles for Automotive Suppliers

There are many innovation barriers in the automotive industry, for instance, according to RUBENSTEIN and ETTLIE, governmental regulations and laws concerning safety, environment and energy consumption represent one of the biggest hurdles for innovations in the industry[130]. This hurdle affects both manufacturers and suppliers. This research work focuses primarily on those hurdles which are specific to suppliers only.

The innovation hurdles that suppliers face due to the specific situation of the market in which they are competing can be categorised into external and internal hurdles, internal hurdles being those that originate within the supplier's organisation and external ones those that have their origin outside of it.

3.2.1 External Innovation Hurdles

Ideation Phase

Due to their lack of direct interaction with the auto drivers, the end consumers of their products, most automotive suppliers receive only indirect or no feedback at all regarding their product's acceptance and perceived performance. This leads to a poor understanding of the end users' needs, general market demands and trends. And, strongly challenges the capability of suppliers to identify concrete opportunities and needs for innovations, increasing their dependence on the OEMs as their main, and, in some cases only, source for market information.

Acceptance phase

Automotive suppliers are limited to the development of products according to an OEM-given design and specification; their innovation has to fit into the general concept and architecture of a specific vehicle according to the plans of the corresponding OEM.

Realisation & Commercialisation

External barriers limit suppliers not only in the conception of innovations, but also during the phases of realisation and commercialization. Their dependence on the OEMs as a sole market channel is enhanced by the fact that the more advanced the

[130] Cf. RUBENSTEIN, A. H.; ETTLIE, J. E. (1979), p. 65

development phase of an innovation is, the higher the level of customisation for a specific OEM or even a single vehicle/platform it will have, making it very difficult to sell it to another potential customer. In other words, the dependence on a single OEM tends to grow constantly during the realization phase of an innovation. As soon as the innovation hits the market, it can be easier for the supplier to use it as a reference, but it can also be the case that the first OEMs demand some sort of exclusivity or other OEMs don't want to adopt the innovation, in order to avoid being perceived as imitators.

Finally, it is not uncommon that, even after a successful innovation, the supplier cannot harvest the full market potential of its work. Using their bargaining power, OEMs try to avoid any type of product/technology monopolies, often forcing the innovator to share their intellectual property among competitors or support rivals, in order to develop similar products or technologies. For instance, it is common practice that most OEMs include in their general purchasing conditions a clause to make sure that all intellectual property rights related to the goods and service provided by the suppliers shall be fully assigned to the OEM without any further conditions and limits regarding use, extension and publication. Suppliers are often forced to accept second sources.

Accordingly, RUBENSTEIN and ETTLIE identify the automotive manufacturer's decisions to accept, encourage development of, or adopt innovations as the key influencing success factor for innovative automotive suppliers[131].

3.2.2 Internal Innovation Hurdles

Besides these restricting environmental challenges, there are also various internal automotive suppliers' barriers to innovation. The first and probably most important hurdle is the lack of focus on innovations. Due to the missing link to and feedback from the end customers, suppliers tend to focus too much on addressing the constant cost reduction demands from the purchasing departments of their direct customers. Reflecting this fact only very few suppliers have a clearly formulated innovation strategy.

Taking a look at a more operational level, most automotive suppliers lack an effective innovation management framework. Indeed, larger suppliers have some kind of more

[131] Cf. (RUBENSTEIN, A. H.; ETTLIE, J. E. (1979), pp. 65

or less formalized innovation process defined. In reality, however, it is often limited to the collection of a random number of ideas that are filtered through various milestones, leading to only very few products/offerings being developed and even less being successfully marketed. Additional key elements which would support the process, such as the systematic definition and use of supporting tools, innovation performance management or the right set of skills and capabilities are rare exceptions in most automotive supplier firms.

For instance, a major deficit in these processes is the selection of innovation opportunities and the evaluation of their potential. Most suppliers lack adequate methods and capabilities for performing systematic opportunity assessments, not so much in the technical and cost area, but very much so when it comes to evaluating the market/revenue-potential of innovations. In general, the criteria utilised for innovation potential evaluation are mostly based on subjective factors or are one-sided, e.g., focusing only on the cost side.

In addition, there are several internal “soft factors”, due to an inappropriate mind-set and a corporate culture that further limit the innovation capabilities of automotive supplying companies. In a cross-industry study performed by ZGUANG, WILLIAMSON and CARTER they found that, while there is a growing awareness of the competitive necessity for innovation among most organisations, most companies don’t have a clear policy in place to ensure that innovation is firmly embedded in their corporate culture[132]. They also discovered a surprisingly low level of understanding of the most commonly known innovations techniques among responsible management. These general findings are characteristic for the automotive supplier industry and represent a significant innovation hurdle. Typical examples are the inability to cope with failures, mostly present among European suppliers, and the lack of willingness to implement processes that support creativity, allowing for a wider range of results. In the automotive industry it is almost natural to mainly implement processes that limit variation and make outcomes fully predictable.

[132] Cf. ZHUANG, WILLIAMSON and CARTER (1997), pp. 57

3.3 Success Factors of Automotive Suppliers Innovation Management

This research work defines an innovation management success factor as all those elements of the innovation management business architecture, or the marketing mix model that help suppliers overcome innovative hurdles or mitigate the effects of those hurdles allowing or easing the successful realisation and commercialisation of an innovation.

In the preceding step, external and internal hurdles have been identified and described. To cope with them, this research work recommends that automotive suppliers should use an innovation management approach consisting of the three main elements of innovation management business architecture suggested in the preceding chapters: innovation strategy, innovation process and innovation culture. In addition, automotive suppliers must adapt their marketing mix approach in order to be more successful in the commercialisation of their innovations as will be described in the following.

3.3.1 Strategy

As described before, based on their primary strategy, their existing capabilities and resources, automotive OEMs are able to choose an appropriate market scope to define how they want to strategically compete in the market and decide which innovation strategy is the most appropriate to support their objectives. They will only accept and buy those innovations that are aligned with their strategy and will help them reach their strategic goals.

Having the wrong strategic alignment to a targeted OEM is a significant innovation hurdle. To successfully overcome it, automotive suppliers must consider the overall strategy and derived innovation strategies of their customers when defining their own market strategy. This is true for both strategic levels: the strategic market approach and the innovation strategy. The challenge for the suppliers is not only establishing the right strategic alignment but also finding out and understanding the strategic direction of the targeted OEMs, since in many cases the OEM strategies are not explicitly formulated and accessible to all suppliers.

Market Scope Strategy

Automotive suppliers have to consider the strategic market scope of their customers, the OEMs, whenever defining how they themselves want to compete in the market space. It is not necessary that they always choose the same strategic market approach as the targeted OEMs, but, on a long-term basis, it would be very difficult to remain successful with any given customer if the suppliers' strategy is contrary to the one being followed by the OEM. For instance, while an OEM pursuing a differentiation strategy will not have many issues collaborating with a supplier having a cost leadership strategy, in the opposite case a supplier with a function & feature based differentiation strategy will most probably have strong difficulties in obtaining the desired premium for its' products from an OEM customer following a cost leadership strategy. The following table gives an overview of the possible strategic matches between supplier and OEM.

Supplier \ OEM	Overall Cost Leadership	Differentiation	Focus
Overall Cost Leadership	Good Fit	Neutral	Case by Case
Differentiation	Bad Fit	Good Fit	Case by Case
Focus	Case by Case	Case by Case	Case by Case

Table 3: OEM/Supplier strategic market focus matrix (author's illustration).

Following a game theory optimisation approach, if the supplier doesn't know the strategy of an OEM or simultaneously targets OEMs with different market scope strategies, one could argue that a cost-leadership approach provides the best chances for success, since it provides a good match with an OEM cost leadership and is neutral to an OEM differentiation strategy. This is true if the supplier is following a defensive strategy hoping just not to lose the innovation game, but if a supplier is playing to win with innovations, then they should consider following a differentiation strategy. From an innovation perspective, the most productive

combinations result when both supplier and OEM are following a differentiation strategy. The combination of both players following a cost leadership strategy provides a good strategic fit, but normally, innovations aiming at mere cost reduction tend to be of a lower level of innovativeness than those aiming at differentiation.

In the case of the focus strategy, both on the OEMs' side as well as that of the suppliers, it depends on the compatibility of the segments both are focusing upon, which is why a generic evaluation cannot be made and a case-by-case evaluation is needed.

Hypothesis 1- Market Scope Strategy

To be successful innovators, automotive suppliers must first understand the market scope strategy of their customers, the automotive manufacturers, and make sure that their own strategic market approach supports them.

Innovation Strategy

When choosing an appropriate innovation strategy, automotive suppliers must make sure that their approach is aligned as closely as possible to the targeted OEMs' innovation approach. Suppliers that pursue a higher rate of innovativeness than those of their OEM customers will be less successful than those with synchronised customer strategic innovativeness levels. On the other hand, side suppliers with a considerable lesser innovative rate than their targeted customers will struggle to fulfil all their demands and will have to compensate by offering their products at a lower cost than a well-synchronized and more innovative competitor.

For example, some of the smaller Japanese OEMs have a strategy of never being first in introducing a new technology to the market. They prefer to wait until some of the other OEMs, ideally Toyota, establishes the technology in the market. Suppliers targeting these OEMs shouldn't follow a very aggressive innovation approach here or else most of their investments in developing innovations will not pay off.

Supplier \ OEM	Play to win	Play not to lose
Play to win	Good Fit	Bad Fit: OEMs will not honour the new products. All costs related to their development will have a negative impact on the suppliers competitiveness
Play not to lose	Bad Fit: OEM's expectations will remain unfulfilled, Supplier will have to compensate by offering products at lower costs than innovative competitors	Good Fit

Table 4: OEM/Supplier innovation strategy matrix (author's illustration).

This does not mean that suppliers always have to follow a dependent strategy, whereby they only innovate or imitate on OEM requests, as many Japanese Keiretzu automotive suppliers do. Quite to the contrary, in the western world, offensive innovative OEMs expect that their suppliers follow an independent and proactive innovation approach. The key for success is having the right level of strategic alignment.

Hypothesis 2 – Innovation Strategy

To be successful innovators, automotive suppliers need to synchronize their innovation strategy to the OEM's approach, avoiding being substantially more innovative or too far behind their customers' innovation level.

3.3.2 Innovation Process

According to MARTIN there is a distinction between technology-push and market-pull. Technology push implies that a new invention is initiated by a firm and pushed into the market. On the other hand, a market pull innovation is developed in response to an identified market need or request[133].

For the automotive supplier industry these definitions can be adapted based on the distinction of whether the OEM or the supplier is responsible for the initiation of the innovation management process:

- Market-Pull: an OEM has a specific need or idea and initiates an innovation process by a supplier.
- Technology-Push: a supplier ideates an innovation and independently begins an innovation process.

Market-Pull Innovation Process

An innovation process initiated by an OEM is the most common process in the automotive industry. Due to the different forms of suppliers' dependence upon the OEMs it is only natural that suppliers tend to follow the OEM initiated innovations.

When an OEM starts an innovation process there are very often parts of the innovation, and in some cases the complete development that the OEM doesn't want or can't develop by himself. In this case the OEM innovation process will cascade down the tier structure and trigger one or more supplier innovation processes as described in the following illustration.

[133] Cf. MARTIN, M. C. J. (1994), pp. 43

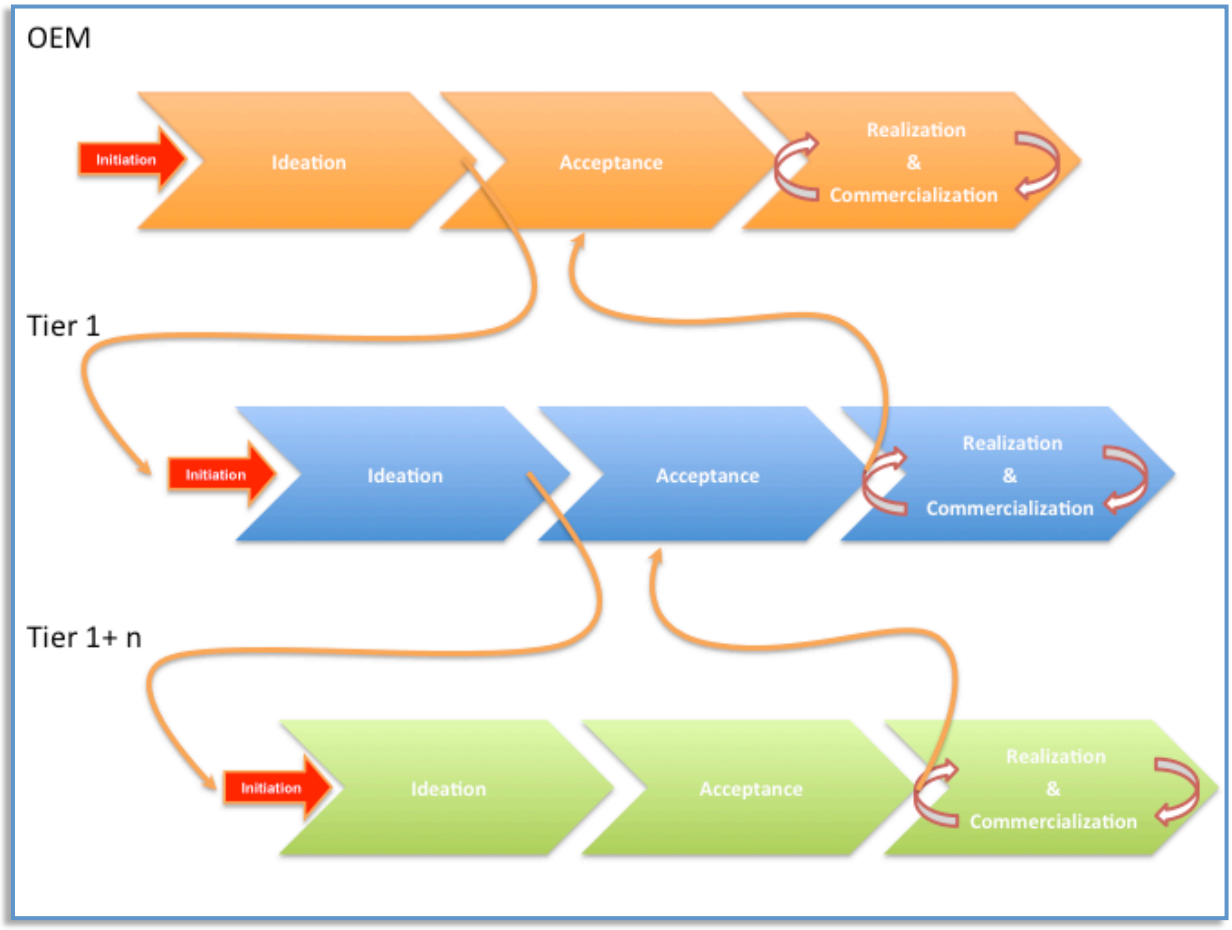


Figure 40: OEM triggered cascading innovation process (author's illustration).

Market-pull processes bear less risk for the automotive suppliers; there is an OEM that wants the innovation, hence the probability of a successful realisation and commercialisation is higher. The supplier starts the process with a notion of what the OEM really wants. In some cases, a specification is provided. Additionally, it has the opportunity to obtain feedback during the development. Regarding the acceptance of the innovation by the OEM, the suppliers are normally only responsible for the development of their own part, not having to convince the OEM organisation of the innovation as such.

However, the downside of market-pull innovations is the fact that the OEM will control the final resulting innovation. This can seriously limit the potential revenues that the supplier is able to earn from the innovation. OEMs may for instance prohibit or limit the commercialisation of the supplier's innovation to other OEMs. The fact that OEMs are involved in the development process can also be detrimental for the suppliers financial returns, since the OEMs will not pay a premium for the innovation and will try to pay only for the pure development costs or even consider those to be

included in the price of the parts they source. Finally the market risks may be less, but the very complex cascading structure, especially when two or more suppliers are involved, may create additional coordination and technical challenges that can jeopardize the success of the innovation.

Suppliers that follow an OEM triggered market-pull innovation process must take care that their process is very well-synchronised with the OEM's process, meaning that they have to have a great understanding of what the OEM wants and how the OEM process works. Open communication and trust between the OEM and the supplier are also key success factors for this kind of innovation process.

Hypothesis 3 – Market-Pull Innovation Process

To be successful innovators following a market-pull innovation process, automotive suppliers must align and synchronize their innovation process to the OEMs'. This cascading process system requires a high level of understanding of the customers' goals and procedures as well as a very effective communication and coordination between them and the suppliers.

Technology-Push Innovation Process

Automotive suppliers initiate technology-push innovation processes to develop new products/technologies and market them to an OEM without their explicit request. When the innovation is finally developed or has reached a sufficient stage of ripeness, the supplier will address the targeted OEM to market the innovation. If the innovation is successful, in many cases, the OEM will have to start its own process to include the innovation into one of his vehicles or platforms. This can in many cases be comparable to a new innovation process on the OEM level as suggested by the following figure.

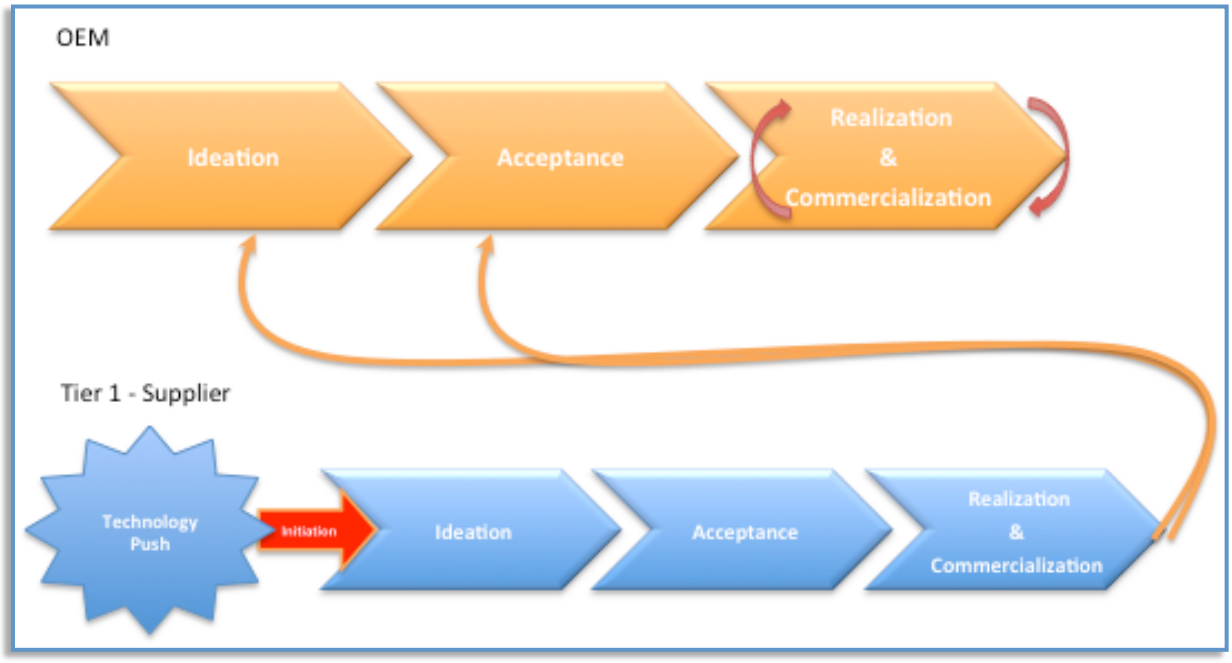


Figure 41: Supplier triggered technology-push innovation process (author's illustration).

It is clear to see that a technology-push innovation process creates various additional challenges for the supplier. The innovator has to realise and finance the full innovation, or at least a ripe proof of concept, and dock-in at the beginning of the OEM's process. Thus trying to influence the ideation process step of its customer, in order to later obtain the acceptance and finally realisation & commercialisation of their innovation. There is a considerable higher risk of failure, and the required investment is much higher than in a market-pull process.

Although the risk is higher, the potential revenue of market-push innovations is also higher making technology-push innovations the ultimate and most challenging form of supplier's innovation. No automotive supplier is considered really innovative if he doesn't pursue any technology-push innovations.

To lower the acceptance barriers and to increase the success probability, a technology-push innovation should ideally be conducted based on a very efficient advanced marketing approach. Advanced marketing means that suppliers must address the targeted OEMs in an early phase and present the idea to obtain basic information and start generating interest and awareness on the OEM side. Before they can successfully market their innovations, suppliers have to make sure that key persons at the targeted OEM are aware of the innovation in development and understand its goals and potential benefits. It is also crucial for the supplier to obtain

early feedback and information regarding expectations and potential pitfalls from the OEM regarding the innovation in process. All this information should be included as early as possible in the supplier's development process. This is one of the key success factors of technology-push innovation processes, finding the right timing for involving the OEM; on the one side an early OEM involvement reduces the risk of non-acceptance and allows the supplier to create an innovation that better fits the OEM, on the other side, if the OEM is contacted in a very early development phase, the developed idea may not be ripe enough to convince the OEM and it may be rejected right away. Additionally, premature involvement of an OEM may run the risk of alerting potential competitors, who could start similar developments.

Hypothesis 4 – Technology Push Innovation Process

To be considered innovative, automotive suppliers must pursue technology-push innovations by pushing their new ideas / technology into the OEMs innovation pipeline. To be successful with technology-push innovation processes, suppliers must embed their own innovation into the OEMs' innovation process. To do this, they must find the right timing and make sure that their process is endorsed by very efficient advanced marketing activities.

Finally, it is very important that throughout the whole process, suppliers take care to safe guard their innovation, either through patents or by developing unique capabilities. Otherwise the OEMs will use their strong bargaining position to force the supplier to share their innovation with other competitors diluting the competitive advantages and diminishing the revenues of the innovator.

Innovation Process Portfolio Management

As already mentioned in the previous chapter, COOPER suggests in his innovation diamond that portfolio management, along with strategy, process and culture, is one key success factor for innovation management[134]. Without doubt, managing scarce resources to make sure that they are assigned to those innovation projects that have the biggest potential for success is crucial for automotive suppliers. Due to their circumstances they need to follow a more specific approach by balancing their resources among the high potential high risk technology-push with the safer bet represented by the OEM initiated market-pull innovation projects. In the model presented in this research work, this supplier specific dimension is combined with an

[134]Cf. COOPER, R.G. (2001),pp. 238

innovativeness matrix in a two-step approach recommended for suppliers to manage their innovation portfolio as shown in the picture below.

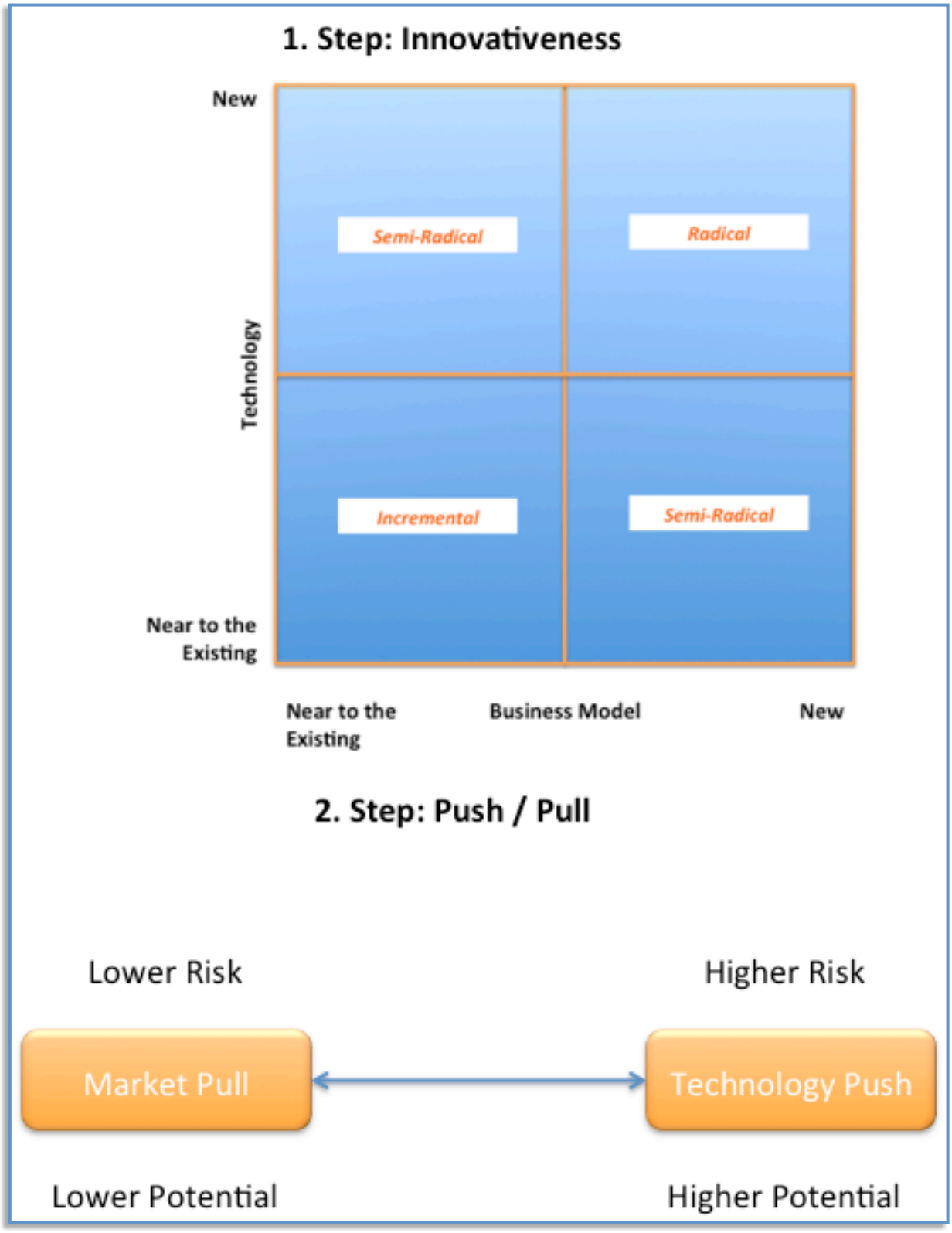


Figure 42: Two-step innovation portfolio management approach (author's illustration).

In the first step, the innovation processes are evaluated according to their innovativeness as “incremental”, “semi-radical” and “radical” using the matrix according to DAVILA, EPSTEIN and SHELTON as described in the precedent section[135].

In the second step, the innovativeness dimension of the supplier’s innovations process is placed in relation to the new dimension describing whether it is a push or a pull project, thus creating a matrix as depicted in the following illustration.

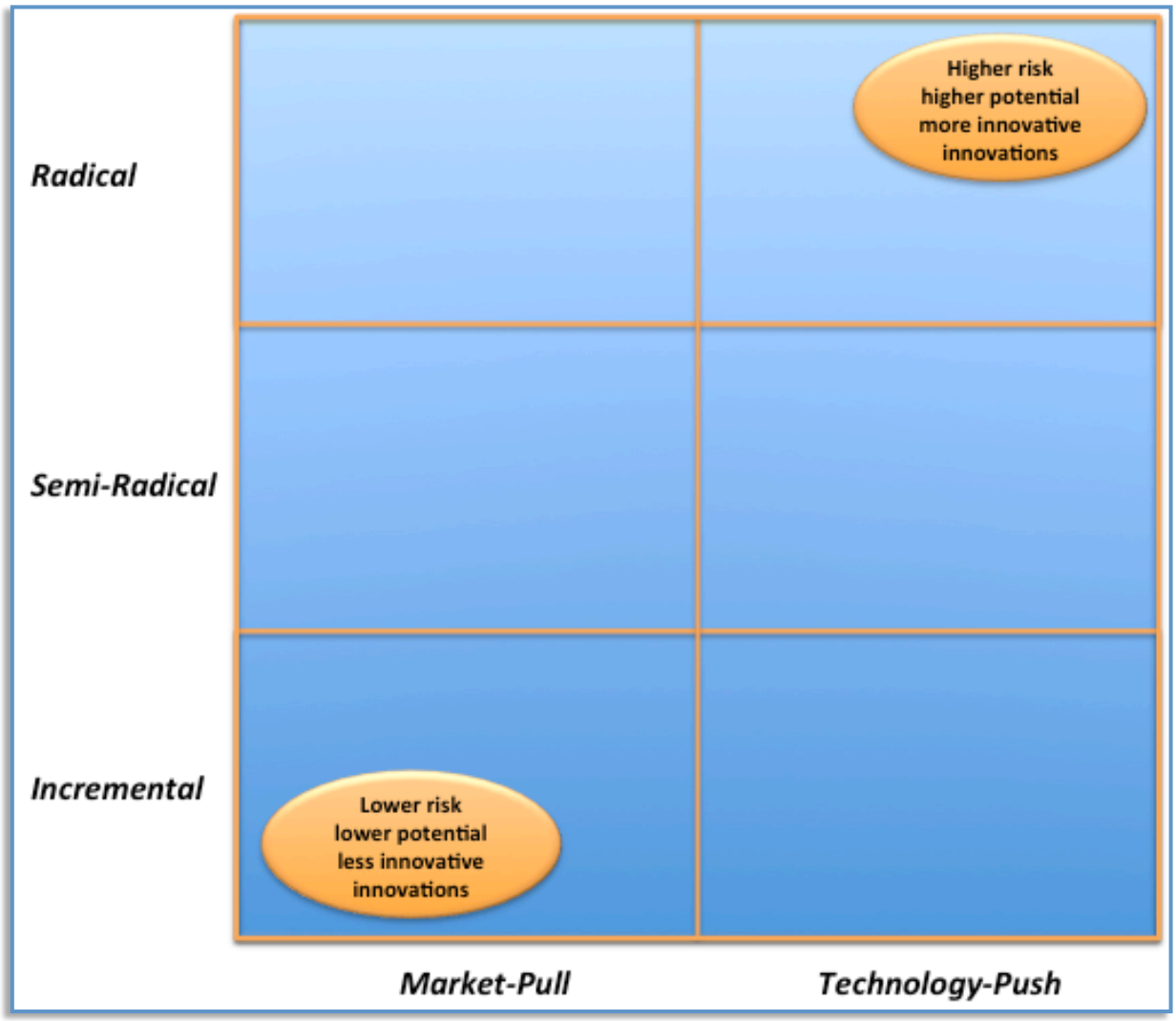


Figure 43: Matrix for supplier innovation portfolio management (author's illustration)

[135]Cf. DAVILA,T.; EPSTEIN, M. J.; SHELTON, R. (2006), pp. 38

Using this matrix, suppliers can get an overview of how balanced their innovation portfolio is and how well aligned it is to their innovation strategy.

Hypothesis 5

In order to be successful innovators, automotive suppliers should manage their innovation portfolio seeking a good level of balance between the targeted degree of innovativeness and the mix between market-pull and technology-push of their innovations.

3.3.3 Innovation Culture

Following SCHEIN's definition of corporate culture as "the climate and practices that organizations develop around their handling of people, or the espoused values and credo of an organization"[136]. Suppliers must create an innovation friendly and supportive climate by ensuring that all three levels of their culture are properly addressed:

Starting with the first level of artifacts, suppliers succeed implement an innovation supporting organization and effective innovation processes. To achieve this, it is not necessary that suppliers create a special kind of organisation or a special unit to take care of innovation, but they have to make sure that there is an appropriate owner of the innovation process and that the process is properly embedded in the existing organizational and hierarchical structures of the firm. In most of the cases, having the right involvement, commitment and support of top management is a key success factor. The process itself should be properly structured, well documented and known to all involved stakeholders.

The second level of "exposed beliefs and values" should properly reflect the innovation strategy and goals of the supplier. The successful implementation of this cultural level is more dependent upon how these values and strategies are understood by the stakeholders and lived by the management than upon a brilliant formulation or fancy presentation of the strategy itself.

The third decisive level of "underlying assumptions" is very hard to observe from the outside. It should ensure that suppliers live in an environment where all key

[136] SCHEIN, E. H. (2004), p.13

stakeholders feel responsible for contributing to the successful implementation of innovations according to the formulated strategies and their innovation values.

The corporate innovation culture of an automotive supplier plays a key role, especially on top management levels, influencing the overall success of their innovation management activities. A key success factor here is finding the right balance between freedom and execution. On one hand, the culture should be flexible and open, encouraging innovators to try new ways and accepting failure as a normal by-product of the creative process. On the other hand it should also create the result-oriented atmosphere and discipline that is needed during the phases of realization and commercialisation.

Culture is the only element of innovation management business architecture wherein automotive suppliers are not always in a worse situation than the OEMs. In some cases, due to greater flexibility and comparative organisational simplicity, they may be even more likely to develop an innovation-friendly corporate culture than the larger OEMs. In a smaller organisation the influence of a single person will generally be higher; a charismatic leader for instance, can have a significant impact on the corporate culture of a supplier. This may be a good explanation for the relatively high NUMBER of innovative small or medium-size suppliers in spite of their limited resources.

Hypothesis 6 – Innovation Culture

To be successful innovators, automotive suppliers must find the right balance between an open culture that fosters creativity and inventiveness and the right amount of discipline and control needed for the realisation of their ideas. It is a key success factor that all three levels of their innovation culture, artifacts, exposed beliefs and values and underlying assumptions are not only supported but also actively adopted by the suppliers' top management and key stakeholders of their organisation.

3.3.4 Marketing Mix for Supplier Innovations

As described in the preceding section, automotive suppliers face serious limitations and hurdles concerning their marketing mix options for commercializing their innovations; therefore, another key success factor for their innovation management is the use of the right marketing mix for their activities.

Targeted Market

As described in the innovation strategy approach, the key is to have the right strategic match with their customers. Successful innovative automotive suppliers must ensure that they target the right markets/segments for their innovation. Suppliers should also not only select the proper OEM, but also choose the right OEM's vehicle/platform. For instance, most OEMs have one brand/model that they use to introduce new technologies and features to the market. In order to be successful, suppliers should not only have a good understanding of the OEMs general market approach but also get as much information and insight about their single product's cycle time and intended strategic market positioning.

Seeking advanced innovation capabilities, automotive suppliers can also expand the range of targeted customers by addressing new markets beside the automotive OEMs. For instance, the can pursue sales to commercial vehicle manufacturers, or even address the end-consumers through the accessories and spare-parts independent aftermarket. These new segments will not only help to reduce their dependence upon the OEMs, but can also provide new sources of inspiration and channels for creating and marketing innovations.

Product

To be a successful innovator in their industry, automotive suppliers must have a very clear understanding of their offerings. This may appear to be obvious, but in many cases it proves not to be so trivial. For instance, build-to-print suppliers don't really sell an engineered part to the OEMs but a manufacturing service. In this case the supplier should mainly target to innovate their production or logistic process and not the produced part itself.

Most OEMs are open to implementing cost reducing technical changes suggested by their suppliers. But, in many cases automotive suppliers cannot change the specification or can only partially influence the parts and components they sell. Therefore their logistics and production strategy can be a key differentiating factor for them. They should have a strong focus on the innovation of these, since any innovative gains there can often be more easily realised and provide higher returns than innovations targeting the produced part / component itself.

Following this argumentation, in order to be more successful innovators, suppliers must consider the complete value chain within their innovation management approach. Key areas to be considered here are production, logistics, development and purchasing.

Price

As described before, innovations are one of the few opportunities that suppliers have to obtain a premium price and higher returns for their products. However this doesn't happen by default, and in most cases it has to be hard-won by the supplier.

To obtain a higher price from the OEMs, the innovation must be unique and provide value to the OEM in a relevant area according to their strategy and their customer's needs. The greater the uniqueness, customer perceived value and strategic fit of the innovation the higher the premium that can be achieved. It is therefore imperative for suppliers to develop an optimal pricing approach.

When following a skimming pricing strategy, they should first carefully select those segments - meaning targeted OEM platforms - with the broadest strategic fit, in order to introduce their innovations at a high price. After introduction, when the uniqueness of the innovation is reduced target other OEMs with a narrower fit and at a reduced price. A skimming approach to innovation will normally deliver a higher level of returns but it is only possible if the market innovation is relevant to the market and can be effectively protected.

Since it is often very hard to protect an innovation from being copied by a competitor, suppliers may have to follow a penetration strategy, targeting a broad range of OEMs and vehicles from the beginning, in order to reach a large share of the market. This may also be necessary in the case of competing technologies in order to set an industry standard.

There are various other aspects that suppliers must consider when developing their pricing tactics for innovation. For instance, they should avoid being leveraged by the OEMs through the combined sourcing of a standard existing product and the innovation. One possible way to avoid this this could be to use a separate organisational entity, or a completely different company, to market important innovations. It is also crucial for suppliers to market their innovation following a market price approach based on the value that the innovation represents and avoid

using the usual “cost + margin” pricing, that will not reflect the value adding aspect of the innovation and can not be used to justify a premium.

Finally, suppliers should also consider pricing the value they get for service related innovations. However, this will prove to be very hard to realize if the OEM is not cooperative and fails to recognise the real benefit linked to the process innovations. It is always easier if the innovation is linked to a direct price reduction for the OEM, which can be easily identified and quantified.

Placement

Since OEMs represent the sole channel for most automotive suppliers to place their products on the market, suppliers tend to rely only on their key account management organizations to market their innovations.

To be successful innovators, suppliers should consider implementing special sales organisations / channels for innovations. Especially in the case of technology-push generated innovations, this will prove in many cases to be a key success factor, since only a dedicated innovation sales group will focus on performing all the advanced marketing activities that are needed to realize and commercialise an innovation that was not generated by an OEM. For instance, some of the leading automotive suppliers have included this function within a dedicated product management organisation.

Successful automotive innovators also have to consider that sales channels work in both directions, they are not only important to convey information and sell to the customers, but they are equally important to obtain information from the customers and the market in general, which is of particular importance for the creation of innovations. Automotive suppliers should therefore consider how to establish a communication channel to the end-consumers, which could be done through an accessories or aftermarket organisation but could be also done as a pure marketing communication channel to support their innovation strategy.

Promotion

Due to the nature of the industry, promotion for automotive suppliers will not have the same importance it has in B2C markets. Nevertheless, it can be a significant success factor for technology-push innovations. Suppliers must make sure that, as a part of their advanced marketing activities, they start with early promotion of their

innovations, targeting key persons at the OEM to decrease possible acceptance barriers from their side.

Summary of Marketing Mix Success Factors

The following picture summarizes the automotive supplier innovation management success factors postulated in this research work.

Figure 44: Innovation marketing-mix success factors (author's illustration)

Hypothesis 7 – Innovation Marketing Mix

To be successful innovators, automotive suppliers must apply the right marketing mix for their innovations:

- Target Markets: choosing the OEM's program(s) that provide the best strategic fit to the suppliers' innovation.

- Product: aiming not only at product innovations, such as the vehicle's part to be delivered, but mainly targeting innovations of those elements of the value chain, such as the production process or logistics, which can best be influenced by the supplier.

- Place: implementing a dedicated sales channel for innovations, not only to communicate and sell to the market but also as a source of vital information and insights needed to successfully create innovations.

- Price: supplier must implement an appropriate pricing strategy for its innovations trying to maximise their returns and protect the uniqueness of their new offerings.

- Promotion: when marketing technology-push innovations they must start promoting their innovations as early as possible, in order to reduce possible barriers of acceptance from the OEM side.

3.4 Automotive Supplier Innovation Management Framework

As described in the preceding sections, the success of the innovation management activities of automotive suppliers is directly linked to having the right strategy for the targeted customers, implementing a synchronized or aligned innovation process with them, fostering an innovation friendly culture, that is also adopted by the top management and using a tailored innovation marketing mix to successfully position their innovations in the market.

Obviously, as in every complex business management system, it will not be enough to just focus on one element of the system and neglect the importance of the others. Ideally, all the other supporting elements of the innovation architecture should also be aligned to the overall supplier strategy and innovation management approach and consequentially also be synchronised to the innovation approach of the targeted OEM.

Following the hypothesis formulated in the previous section of this research work, suppliers can use the following framework to be more successful innovators:

First of all, suppliers should select those OEMs and specific programs that provide the best target to realise the suppliers market strategy. Based on a deep understanding of the targeted OEM's strategy, suppliers must align their market scope to maximise the chances of success for their innovations. Accordingly, suppliers must make sure that their own innovation strategy is compatible to the OEMs innovation approach. This cascading definition approach is illustrated in the following figure.

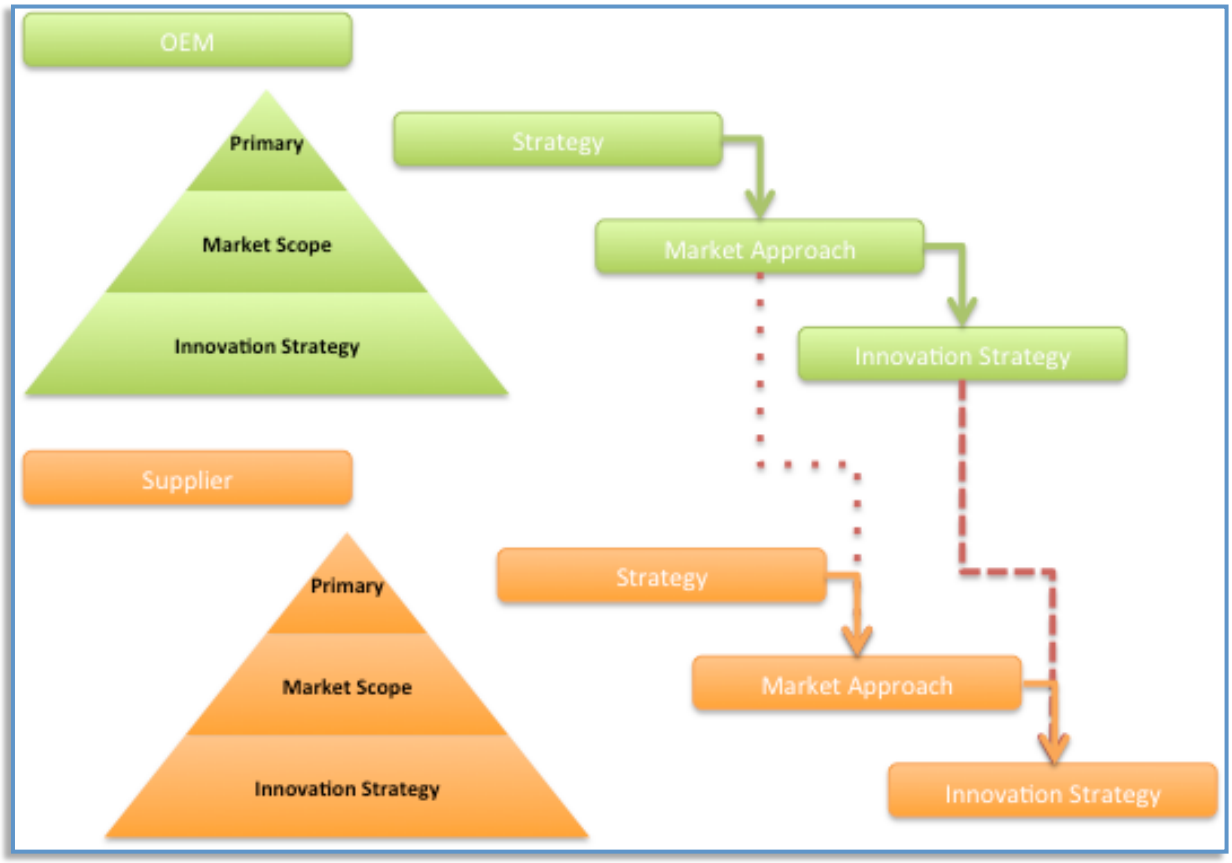


Figure 45: Cascading supplier strategy definition process (author's illustration).

After selecting the right strategic approach, suppliers should develop a portfolio of innovation prospects considering the targeted level of innovativeness and aiming for a suitable level of balance between technology-push and market-pull innovations. Market-pull innovations will be developed in supplier innovation processes triggered by OEM's. A technology-push innovation, on the other hand will be initiated by an automotive supplier and must be well synchronised to the OEM's innovation process in order to be successful.

To be successful, suppliers must take care that they develop the right innovation culture assuring that all three levels of culture are aligned with their innovation goals. Additionally, the other supporting elements of the innovation business architecture (organization, capabilities, tools and applications and performance management) must be in place and well aligned with the key innovation architecture elements and strategy. Finally, suppliers must use the right marketing mix to successfully bring their innovations to the market. This approach is summarised in the following illustration.

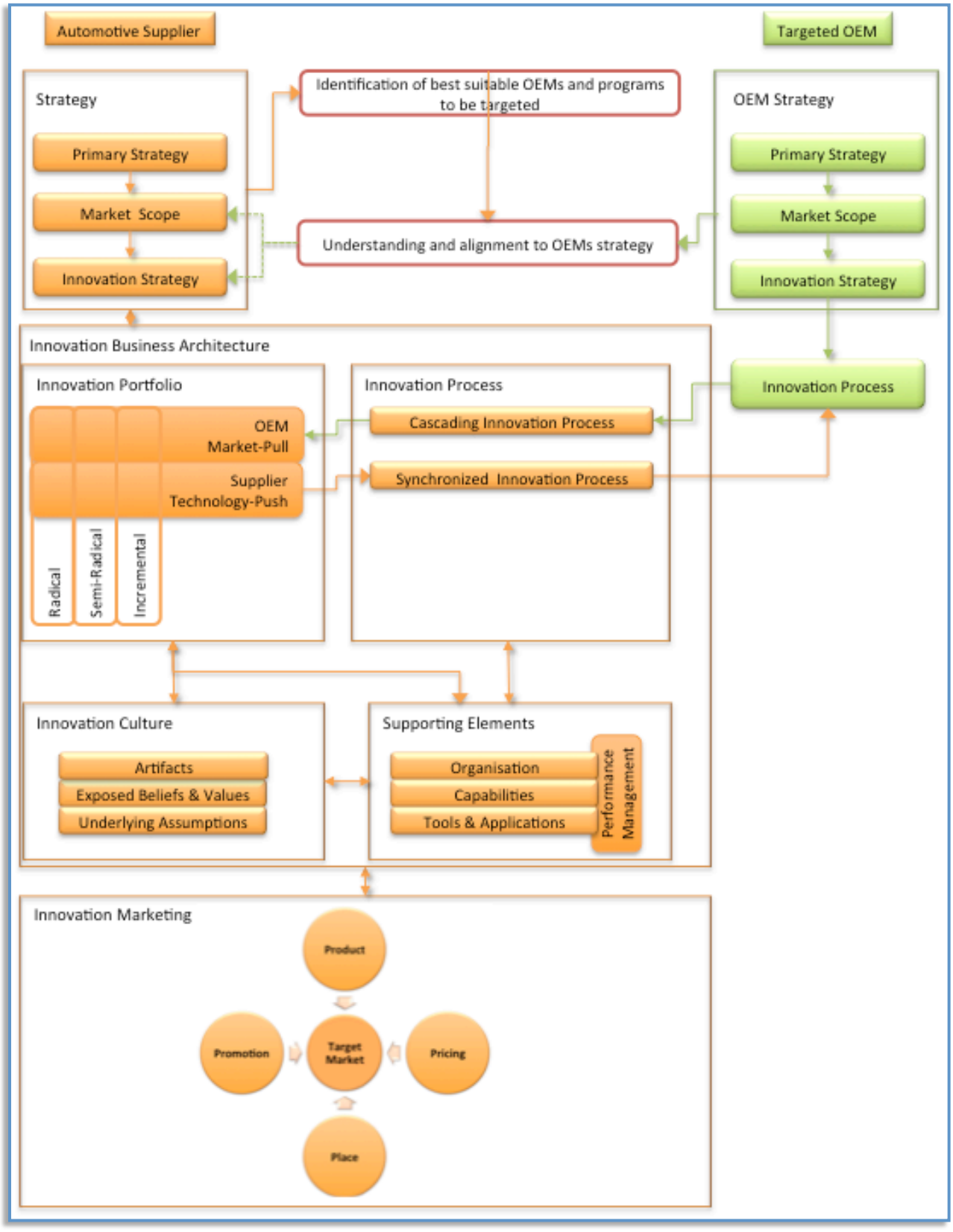


Figure 46: Automotive supplier innovation management framework (author's illustration).

3.5 Roadmap for Implementation

According to the definition used of innovation management as “the strategy-based systematic management of capabilities to obtain and maintain competitive advantage through innovation“, suppliers that follow the suggested framework will not only be successful innovators, but should, in the long term, be able to generate better competitive positions than their less innovative competitors.

Systematically ensuring that all success factors of innovation management are properly addressed will help suppliers to reduce the effect of innovation barriers, both external and internal.

Depending on a specific supplier’s initial situation, implementing the framework may be a complex endeavour that will require a serious amount of transformation and a very efficient change management approach. For these reasons, a phased implementation approach is recommended.

Basic Innovator Stage

All suppliers that want to implement innovations in the market in a structured and continuous way should implement this phase. It is also the basis for more advanced phases.

Addressing the main innovation hurdles facing suppliers, they should concentrate internally on laying out the formal foundations of the framework by formulating and communicating their innovation strategy to all relevant stakeholders defining a formal innovation process and all the other needed supporting elements of the innovation business architecture as described in the framework of this research work.

On the cultural side, it is key that top management takes care of laying the right cultural foundation by explicitly introducing the first level of artifacts that support their innovation culture, starting with the formulation of suitable innovations beliefs and values.

In this phase, suppliers should ideally focus on one OEM with the best strategic fit, following its’ innovation roadmap and mainly targeting market-pull, incremental innovations in order to gain the OEMs trust and reduce risk.

Key success factors in this phase are to establish a solid communication base in order to understand all the OEM requirements and to get as much relevant information from the market as possible.

Advanced Innovator Stage

Suppliers that have already reached a basic innovation level should advance their innovation level by generating their own insights about needs and trends in the market and translating them into their own ideas for innovations.

Based on a solid basic innovator curriculum, advanced innovators shift the focus from market-pull to technology-push. In this role, suppliers should aim to become system partners of one or more OEMs, being to a broad extent fully responsible for the development and the innovation of a specific system or functionality of a car. In this role, suppliers will often have to cooperate with other suppliers and coordinate their joint innovation; working in these innovation networks can be a key success factor to increase the innovativeness and reduce the risk of a single supplier.

Advanced marketing and innovation portfolio management capabilities are key success factors for advanced innovators to overcome the external and internal barriers and mitigate the increased risk and complexity due to the higher share of high-innovative technology push innovations targeted.

Leading Innovator Stage

Finally, to become a leading innovator, suppliers must seek to overcome all hurdles limiting their access to the end-consumer market and create innovations that directly address an existing need, or even create a new vehicle buyer need. In an ideal case, suppliers could create an innovation that is not only highly innovative but is also so unique that it can help them establish a desired brand in the market for consumers. This would place the leading innovator in a very strong position, giving them the opportunity to market their innovations without the restrictions created by most of the hurdles associated with a low power position.

Due to the nature of their products, reaching this level of innovation capabilities may not be a feasible option for all suppliers. Nevertheless, there are existing examples of companies that have managed to reach such a position. For instance: Bosch with its Anti-Blocking-System and Common Rail innovations or Gentex with its Auto-Dimming

mirrors. In both cases, the suppliers were able to obtain significant financial returns from their innovation and hold a dominating position in their markets.

Summary

The following table summarises the three phases - basic, advanced and leading - suggested for the implementation of the framework to overcome the characteristic automotive innovation hurdles.

Hurdles	Basic Innovators	Advanced Innovators	Leading Innovators
Ideation Hurdles	Good and intensive communication to OEMs to understand its strategy and gain better understanding of the end consumer market demands and trends. Validation & completion of information through secondary research.	Generate own insights through scouting activities & direct marketing research, i.e. through consumer clinic studies or collaboration with repair-shops.	Get direct access to consumers through aftermarket & accessories channels. Establish an own brand.
Acceptance Hurdles	Using market-pull OEM initiated innovations to build trust. Tightly linking own innovation process to the OEMs. Basing single technology-push innovations on advanced marketing activities.	Shifting focus to technology-push innovations. Becoming a system partner by taking responsibility of the long-term development of a specific functionality/system.	Creating non OEM-specific products targeting directly the car drivers to address or create a new need at the consumer market.
Realisation & Commercialisation Hurdles	Protecting the uniqueness of innovation through patents and proprietary know-how. Establishing a dedicated unit for the commercialization of innovations to avoid commercial leverage through the OEMs.	Working together in supplier innovation networks to reduce risk and create more unique innovations.	Move to a lead-user driven open innovation approach including end-consumers, OEMs, other suppliers and other partners.
Internal Hurdles	Innovation management as top management priority, with explicitly formulated and well-communicated innovation strategy and innovation management framework.	Introduction of a formal innovation portfolio management process.	Corporate venturing approach to foster innovations in and outside the borders of the organisation.

Table 5: Phased implementation road-map (author's illustration).

4 Empirical Research: Case Studies

To validate the suggested model and the relevance of the postulated hypotheses, a series of empirical case studies within the European automotive supplier industry was conducted. A number of expert interviews at top-management level were the primary source of information for the case studies. The interviewed experts in alphabetical order were:

- Christian Juricek, Head of Engineering Magna Cosma Europe with input from Dr. Franz Trubert Cosma Engineering Europe
- Dr. Dag Wagner, former Vice President Global Advanced Engineering & Electronics at Schefenacker, Vice President R&D Magna Mirrors Europe
- Dr. Peter Egger, former Head of Engineering Magna International
- Günther Zehenthofer, Head of Advanced Engineering Magna Thermocraft, General Manager Magna Auteca
- Herwig Polzer, former Head of Engineering Hohe Group, General Manager Magna Donnelly Dorfprozelten
- Joachim Fuchs, former Head of Advanced Engineering Hohe Group, Director R&D Magna Donnelly Europe
- Nial Liam, former Vice President Advanced Engineering Donnelly Corporation, Vice President R&D Magna Electronics
- Prof. DI. Jürgen Stockmar, former Chief Technology Officer (CTO) Magna Steyr and Magna International

Additional information was obtained through materials provided by the interviewed experts, secondary research in the websites of the analysed firms and Magna marketing.

A total of fourteen innovation cases studies were analysed including the following firms:

- All six main players in the Western European Outside Mirror Supplying Industry, as a benchmark of a complete supplier segment with a clear defined product scope (This analysis will help comparing the results of different innovation approaches without any disturbing influences due to product scope differences). The companies are:

  - Donnelly (Outside Mirrors Group)
  - Hohe Gruppe
  - Ficosa
  - Schefenacker
  - Magna Mirrors
  - Magna Donnelly
- The comparison of the only two automotive suppliers of auto dimming technology, as an example of a very innovative innovation using a unique protected technology
  - Donnelly (Inside Mirrors Group)
  - Gentex
- Selected innovation management projects of various European automotive suppliers:
  - Steyr Daimler Puch: M1 Motor
  - Magna Steyr Fahrzeugtechnik: Viscous Clutch, Vehicle Engineering and Complete Module Supplier
  - Cosma: Hydroforming
  - Auteca: Actuators
  - Magna: Distalight

The companies were analysed regarding their approach in the key areas of innovation strategy, innovation process, innovation portfolio, the supporting culture and their applied marketing mix approach. Their overall approach was examined both individually and in relationship to the targeted customers.

Wherever possible, using the suppliers' overall financial performance, their ability to survive as an independent company and their market share development as an indicator for success or failure, key success factors and barriers linked to their innovation management approach were identified and set in relationship to the postulated hypotheses.

Using the two-step portfolio model suggested in this research work, the case studies can be classified as following:

1. Step: classification of case studies innovativeness & process type.

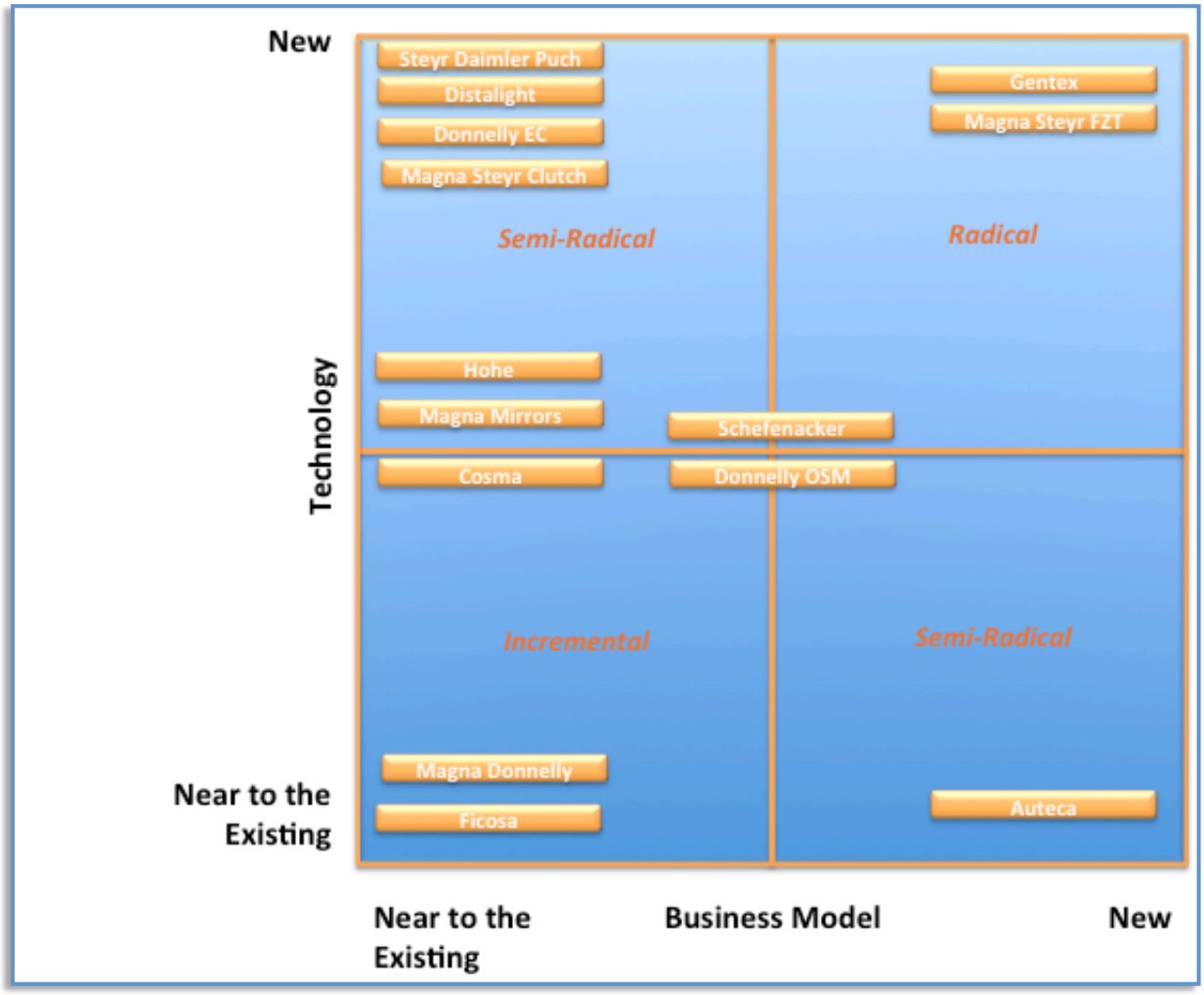


Figure 47: **Innovativeness matrix of case studies (author's illustration).**

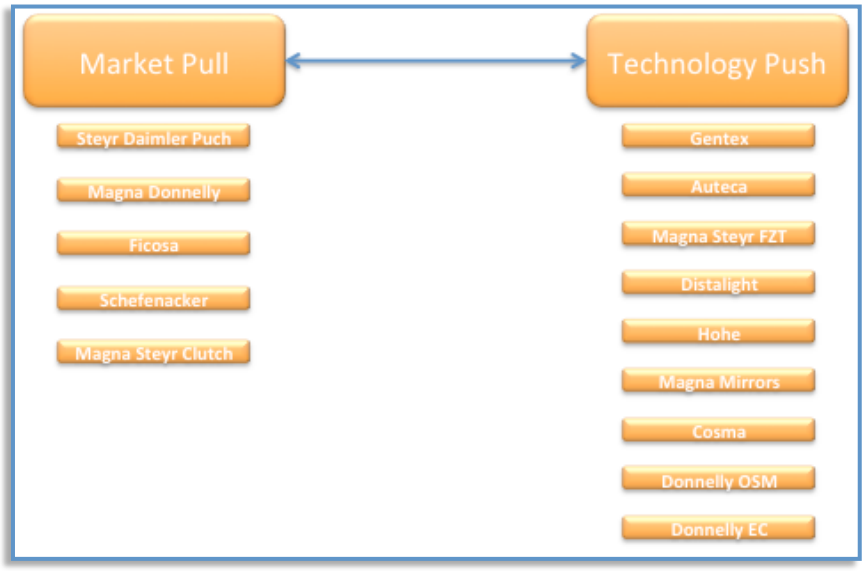


Figure 48: **Categorization of case studies according to the innovation process type (author's illustration).**

2. Step: categorization in portfolio.

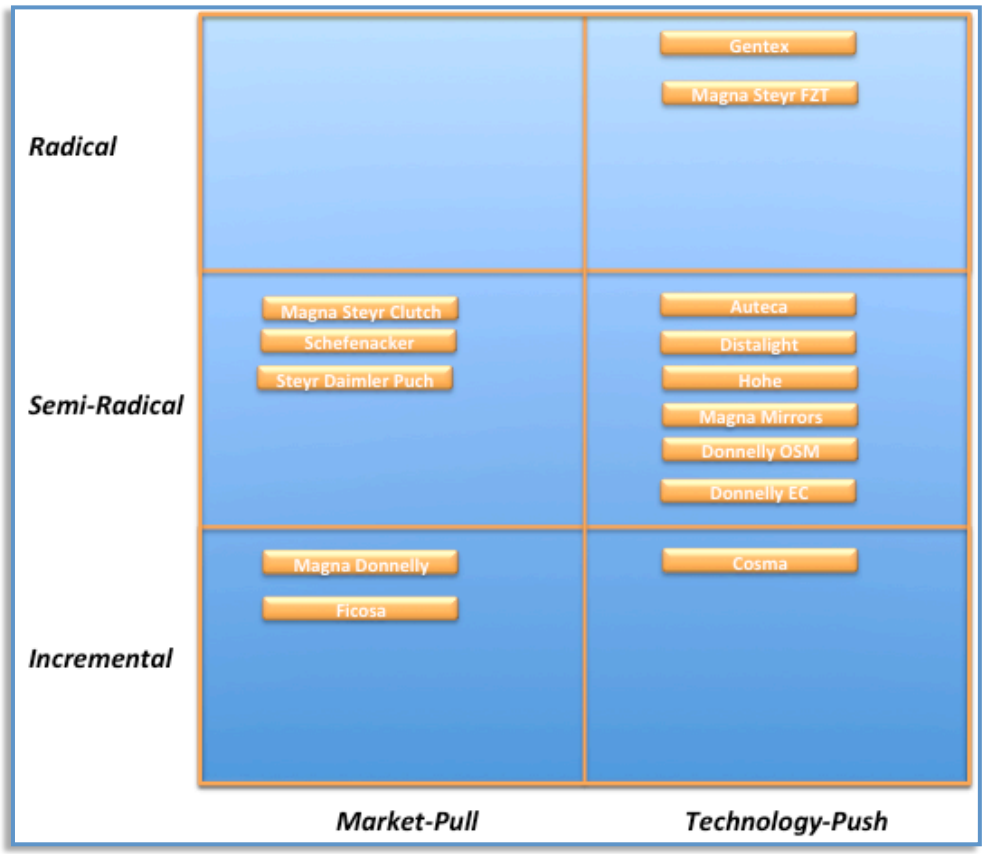


Figure 49: **Case studies portfolio (author's illustration).**

4.1 Case Studies

Excursus: Introduction to the Outside Mirror Supplying Industry

Since some of the case studies analysed in this research work concern the outside mirror market, a short introduction to this industry will be given prior to the description of the cases to illustrate the external context of the analysed innovation cases.

Product

Outside mirrors are a safety-relevant part of an automobile; they are affixed at the outer edge the car's front door and reflect the views to side of and behind the vehicle.

An outside mirror consists typically of structural, cosmetic and complementary parts: a grained housing cover, plastic/metal brackets and as inner base are the main structural parts, cosmetic elements like the plastic housing painted cover are often delivered separately to the OEM, glass actuator, glass, heater, gasket, screws and wire harness are examples of main complementary parts. Additionally, a wide range of features, such as auto dimming electro-chromic glass, BUS-system, illuminator, turn signal, sensors, cameras and antennas can be integrated to provide extra functionalities.

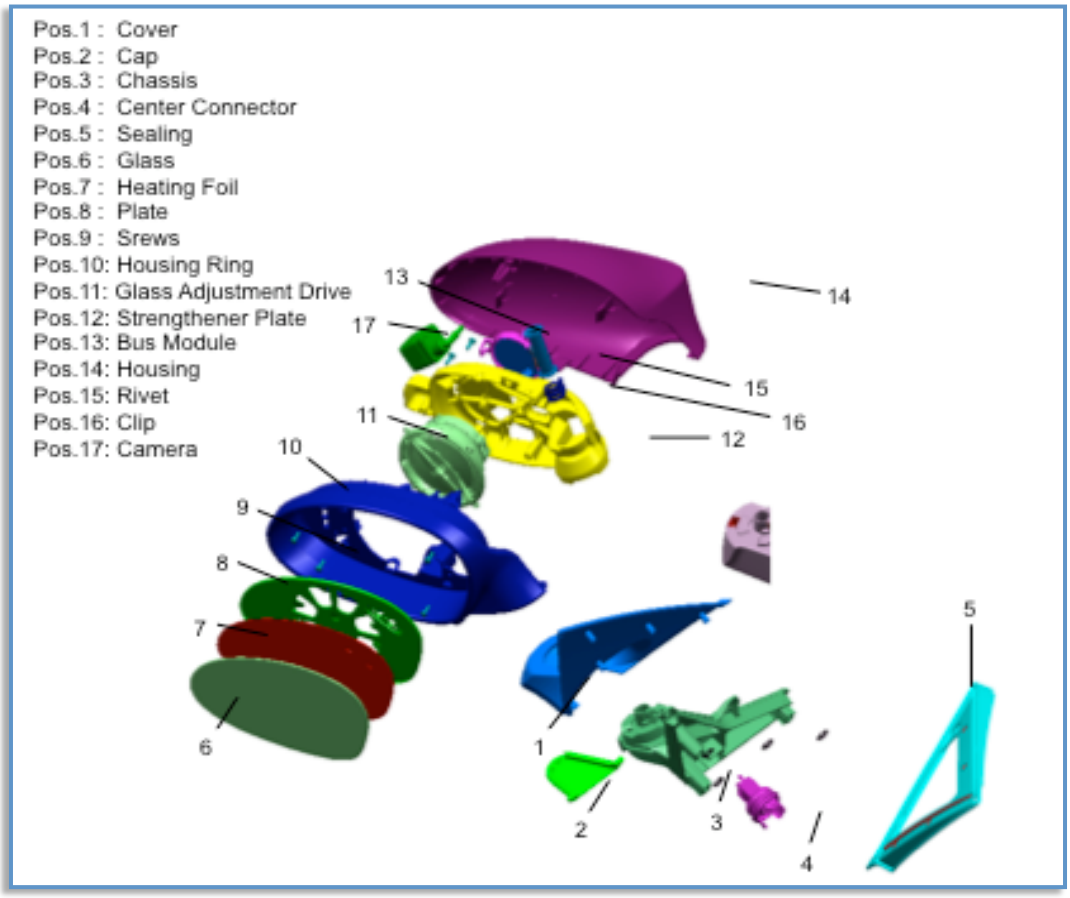


Figure 50: Exemplary design of an outside mirror[137].

Market and players

The market for outside mirrors can be characterized as a mature commodity market: while the premium segments are partly driven by technology, the medium/low segment is purely cost driven. The industry has high entry barriers for new competitors, and the buyer's power is the dominant market force. The key production processes are plastic injection moulding, aluminium die-casting, painting and assembly.

The total market size in Europe 2009 was about 32 million pieces and about €650 million. The following chart gives an overview of the market size development and projected growth.

[137] Source Magna Mirrors Marketing

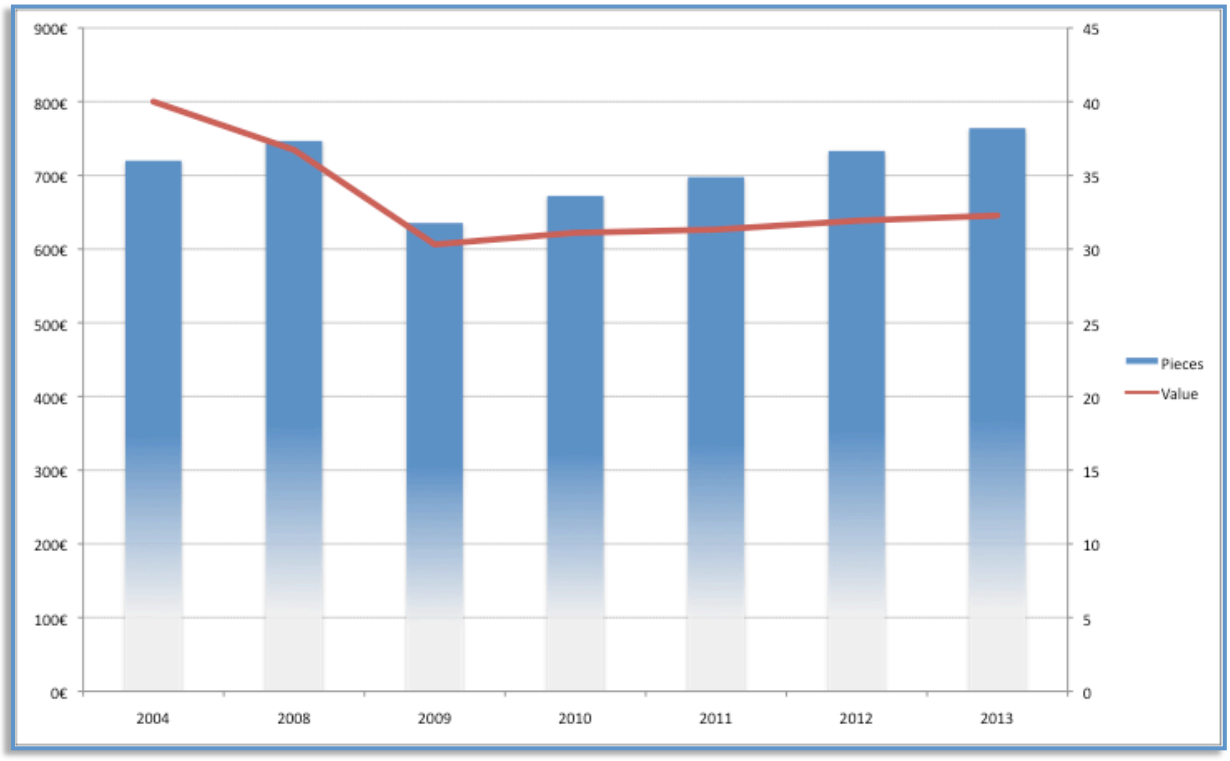


Figure 51: European outside mirror size in volume and value 2004 - 2013 (author' illustration)[138].

Currently, three mayor companies dominate the market in Europe: Magna Mirrors, Visiocorp (SMR) and Ficosa. The following picture describes the actual market share distribution and its development between 2004 and 2011 (forecast).

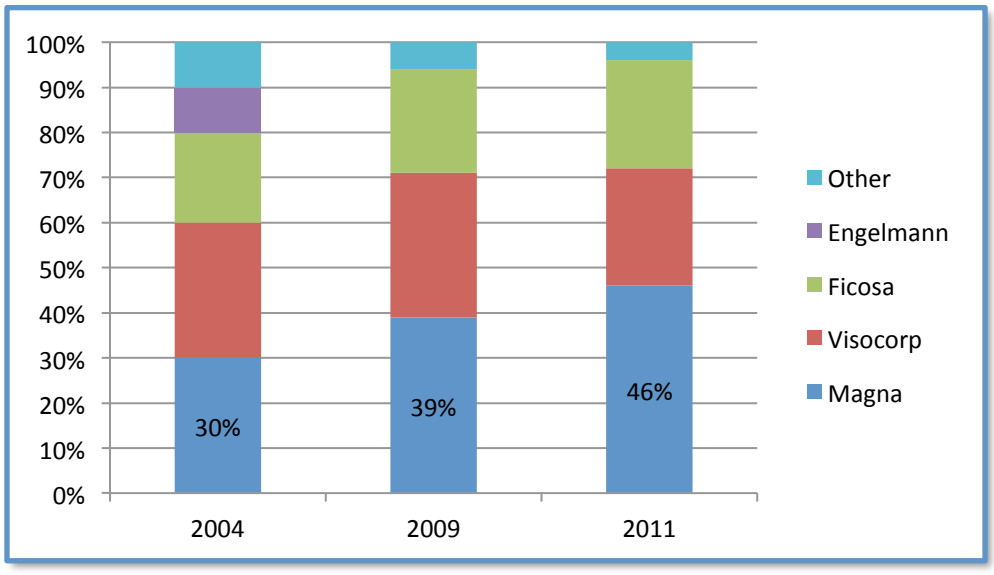


Figure 52: Outside mirror market share in Europe 2004-2011 (author's illustration)[139].

[138] Data Source Magna Mirrors Marketing

The outside mirror is a very mature market; the main competitive dimension is the sales price. Additionally, product and engineering quality and service level are other relevant competitive dimensions.

4.1.1 Incremental Innovations: Outside Mirror by Ficosa and Magna Donnelly

Ficosa

a) Company Profile & Market Approach

The company was founded in 1949 in Spain as a cable supplier for the aftermarket. Between 1950 and 1960 the product range was expanded to also include rear-view mirrors. In the late 1980s, Ficosa began internationalizing its footprint, founding dependencies in other European countries first, and then in the 1990s in Asia and America.

Currently, the Ficosa group generates a turnover of around €900 Mill. in 16 countries with more than 7000 employees. Their main product is the outside mirror with an estimated annual turnover of more than €150 million in 2008. They currently own around 23 % of the OSM European market[140].

In this market, Ficosa is mainly focused on the lower segments, offering a very price-competitive product with a clear strategy aimed at cost leadership in this segment.

b) Innovation Management Approach

Targeted Innovation Portfolio

The Ficosa group targets very few innovations at all, in most cases they have been pursuing incremental improvements of existing products and always following the OEM pull innovation process.

Innovation Strategy

Following its overall cost leadership market strategy, Ficosa has a very defensive “play to not lose” & “me too” innovation strategy approach. They focus on replicating

[139] Data source Magna Mirrors Marketing

[140] Data source: FICOSA, access date 04.09.2009

those technologies that are seen as standard by the market, often buying innovative components from their competitors to avoid expensive developments.

Innovation Process

As a “me too” company, their process is focused on cost avoidance rather than the generation of new ideas. Their innovation activities are mostly triggered by the OEMs.

Innovation Culture

The culture of Ficosa is driven by the goal of reducing costs. When it comes to innovation it is a rather risk-avoiding enterprise, whereby all investments have to be approved by the strong central management, which operates like a traditional, conservative, family-owned business.

Innovation Marketing Mix

Targeting the low cost oriented OEMs and lower cost programs, Ficosa offers a very simple product at a low price and conducts no significant promotion activities. They market all innovations through their normal sales organisation, although they do have an independent aftermarket channel. This, however, is only used as a source of additional revenue without any links to their innovation approach.

c) Key Innovation Results and Main Success / Failure Factors

Ficosa managed to expand their market share during the years prior to the latest automotive crisis. Their clear focus on low cost products has given them a good position in the lower segments, where the lack of innovative products is not a significant competitive disadvantage. However, this exclusive focus on the lower segments implies significant risks; since this market is extremely price sensitive, the margins that can be achieved are very small. To improve their financial results, Ficosa has often tried to penetrate the higher value segments, but has not been very successful so far. Asides from other issues, like their low level of engineering, the missing innovation capabilities have been a key success-limiting factor.

The main reason for the lack of innovation capabilities is the missing strategic focus on innovation due to a faulty strategic understanding. A cost leadership strategy doesn’t mean that innovations are not needed; on the contrary, constant innovations in the production process areas for instance are the key to obtaining and maintaining the desired cost advantage against competitors.

This situation has put Ficosa in a very challenging situation during the last major market drop caused by the global financial crisis. To survive as an independent company they required financial help from the Spanish government, and are still experiencing serious liquidity issues.

d) Findings regarding suggested model

H1 & H2 Market Scope and Innovation Strategy

Although not an innovative automotive supplier, Ficosa was successful in their targeted market space: Since the automotive OEMs they were targeting were not following an aggressive innovation strategy either, this was the right approach for them. However, when they tried to approach customers with higher expectations of innovation their approach was no longer valid.

As long as the market scope and innovation strategies of Ficosa and the targeted customers were well aligned, the company was successful. When it tried to target more innovative customers, the strategic match was no longer a given, and they failed.

H3, H4 & H5 Innovation Process Portfolio: Market Pull & Technology Push

Having an OEM triggered innovation process, to copy only those basic innovations that were desired by their customer was the right approach. The missing process synchronization with new targeted customers represents an additional hurdle for the successful penetration of the new targeted segments. The total lack of technology-push and more innovative projects limits the strategic options of Ficosa, since they are not largely accepted as a supplier for the premium and more innovative segments.

A good process synchronisation with the existing customers helped Ficosa to be successful with them; the lack of it at higher market levels was one of the reasons for their inability to succeed with new customers.

H6 Innovation Culture

The lack of strategic interest, beginning at the top management level, created an environment that was not very stimulating to the production of any innovations.

Without the right strategic commitment to innovation starting at the top management level, no innovation can flourish.

H7 Innovation Marketing Mix

Since Ficosa is not pursuing many innovations at all, their innovation marketing mix is not a relevant success factor.

e) Summary

At first sight, Ficosa was following a successful approach; it had a defensive innovation strategy that was well aligned with the needs of their targeted OEMs. They avoided all innovation-related expenditures to maintain a low cost base. Following a cost leadership strategy however doesn't necessary imply not focusing on innovation at all: While investing in product innovations may not be necessary, cost leaders should still aim to develop new capabilities that allow them to maintain their competitive cost advantage, for instance focusing on production process or material innovations.

This example also illustrates the incumbent need for western suppliers to be innovative, since having a pure cost-leadership-based strategy is a difficult approach when based in a high-cost region like Europe. It requires constant improvement of the supplier's cost base, which cannot be maintained on a long-term basis without innovations. The total addressable market for non-innovative products in Europe will in most cases not be of significant size and/or will be shrinking. Therefore, it is not likely that it will allow for the creation of sufficient value to support a long-term business case.

Outside Mirrors (OSM) Magna Donnelly

a) Company Profile

The Magna Donnelly group was founded in 2002 after Magna acquired the Donnelly Corporation and merged it with its own mirror operations group, Magna Mirrors. Although it was Magna Mirrors that acquired the Donnelly group, Donnelly was the bigger company, so the integration process into the Magna system took some time. Right after the merger, the new company was not operated as a typical Magna company but instead kept many of the Donnelly procedures and standards and former Donnelly managers comprised the main portion of central management. This situation led to some problems and the company lost market share during this phase.

Not until after Magna Donnelly had its strategy realigned did their market share begin to grow and the company started to play a leading role in the market.

In 2009 the company employed 8000 employees worldwide, and was the market leader for outside mirrors in Europe with more than 40 % market share and €280 Million sales[141].

Initially, the company continued to follow the original Donnelly strategy, focusing on the global development of new products, mainly electronic features for differentiation in the market. Later on, the strategic focus changed to a less aggressive innovation strategy, focusing rather on defending the market leadership position in the mirrors market through cost leadership based on a high level of vertical integration and focusing the innovation activities in other product areas to support its overall diversification approach.

b) Innovation Management Approach

Targeted Innovation

The Magna Donnelly group targeted both process and product innovation, mainly looking for incremental innovations and ideally generated by OEM market pull.

Innovation Strategy

Right after the merger, Magna Donnelly continued the offensive innovation strategy of Donnelly aiming at developing new products as a base for differentiation. Just like in Donnelly times, the activities were mainly driven from the US. Later on, based on a new product portfolio strategy, the Magna Donnelly group started following a two-legged approach, wherein their core product - the outside mirror - was considered a cash cow product with a defensive fast-follower strategy and all major innovation activities were focused on other product lines to reach a greater level of diversification in their product portfolio.

Innovation Process

Since the former Mirror Group didn't have its own structured innovation management process, the former Donnelly Corporation process became the standard approach. Aiming for a technology push, Magna Donnelly mainly triggered the process. However, the synchronisation to the targeted OEMs was insufficient.

[141] Data source: MAGNA, access date 04.09.2009

Innovation Culture

The decisive influence of a supporting culture on innovation management success can be easily observed after the merger between Donnelly and Magna Mirrors. Compared to the former Donnelly days, it was the same strategy and the same process mostly executed by the same group of people, but suddenly the creative output was dramatically reduced, which was mainly due to the negative influence of the short-minded and variance-avoiding atmosphere created by the new Magna management.

Innovation Marketing Mix

The marketing mix used by Magna Donnelly was very well-fitted to their strategy. Their innovative products, mostly incremental innovations, were priced at a moderate level targeting deep market penetration. They managed to implement a sufficient level of promotion to present their products and later created a dedicated product management organization as an extra channel for innovations.

c) Key Innovation Results and Main Success / Failure Factors

Right after the merger, the newly founded company was not successful in the market and lost market share. The main reason for this loss was the disconnection between the overall general Magna strategy & culture and the former Donnelly innovation management approach.

After adapting their innovation approach to a less offensive strategy, Magna Donnelly managed to turn this negative trend around and systematically improved their market position to become industry leader. The key success factor was the focus on competitiveness combined with a successful fast-follower-approach that was very well synchronised to the OEMs innovation strategies and processes.

d) Findings Regarding Suggested Model

H1 & H2 Market Scope and Innovation Strategy

After Magna Donnelly recognised that their targeted customers were more interested in attractive pricing than in new features outside of their own roadmaps, it changed its approach and synchronized its strategy to the OEMs. This change was a major driver for success although the innovativeness of its products was still not high.

The change to a well-synchronized innovation strategy approach from Magna Donnelly toward their OEM customers was a key success driver for the company.

H3, H4 & H5 Innovation Process Portfolio: Market Pull & Technology Push

After an initial phase, where the company unsuccessfully tried to push their own products into the market without being properly coordinated to the OEMs, Magna Donnelly shifted their portfolio to a market pull OEM triggered approach that was less inventive but more successful.

Changing their innovation portfolio and improving the innovation process coordination with their customers immediately increased the success of Magna Donnelly.

H6 Innovation Culture

In the initial phase, the innovation-unfriendly atmosphere and the Magna management's tendency to focus exclusively on the short term diminished the innovation success of the company. Later on, the strong focus on discipline helped to improve the overall success rate during the realization and commercialization phases.

The short-term management focus had a negative impact on creativity, hence limiting the results of the ideation phase. This negative effect was compensated for by improvements in the realisation and commercialisation phases due to the higher level of discipline and focus on results.

H7 Innovation Marketing Mix

The innovation marketing mix level of Magna Donnelly was basic but sufficient to support the incremental market-pull innovation approach, and helped Magna Mirrors to be more successful.

e) Summary

The Magna Donnelly case is a good example of the fact that the overall success level of an automotive supplier is not directly linked to the targeted level of innovativeness but rather depends on the appropriate and synchronized implementation of an adequate innovation strategy. In this case, the effective implementation of a fast-follower strategy made Magna Donnelly more successful than the aggressive first-to-market innovation strategy they were targeting before.

4.1.2 Incremental Innovation: Hydroforming by Cosma

a) Profile of Supplier

Cosma International is a wholly owned operating unit of Magna International, providing a comprehensive range of body, chassis and engineering solutions to their OEM customers.

The company was formally consolidated into the metal forming group of Magna in 1987. In 1989 it opened its first European facilities in Germany and Austria.

b) Description of Innovation Management Case

Process Innovation Hydroforming

Hydroforming is a process for shaping malleable metals into lightweight, structurally stiff and strong pieces. In a closed die-form *a* high-pressure hydraulic fluid is used to press room temperature working material into a die. It allows the production of very complex forms[142].

The introduction of Hydroforming at COSMA

The idea for hydroforming is rather old. The first patents were already issued back in the 19th century but due to the missing needed technical equipment, it only began to be used in the automotive industry by the 1980s. The main application was the production of exhaust pipe section using rather small presses.

After BMW introduced the first aluminium rear axle made out of mainly hydro-formed aluminium tubes for the 5 series, the hydroforming technology caught Cosma's attention. The then-president of Cosma contacted BMW and found out the supplier that had made the prototypes for the tubes was the German company Gelenkschmiede Aalen. Shortly thereafter in 1993, Cosma acquired the complete hydroforming development department including equipment, engineers and patents and built around it the new MAGNA-IHV (= German "Innenhochdruckverfahren" for Hydroforming) in Bopfingen, Germany. Based on this technology, Cosma started a new hydroforming development project and bought what was at the time the biggest press available for hydroforming of 5.000 tons for their development centre in Detroit (as a benchmark the European series production used presses of a tonnage between 160 and 1.000 tonnes).

[142] Cf. THYSSENKRUPP, access date 10.08.2012

Although known in Europe, hydroforming was completely new to the American OEMs. Cosma soon gained General Motors (GM) as a first customer for the technology, winning in 1995 the largest supplier contract ever to be awarded at the time: the complete frame assembly for the General Motors full-size pickup and sport utility vehicle (SUV) program that started production in 1998 in Canada and 1999 in Mexico. Cosma delivered up to 5.000 frames per day.

Using this new process, Cosma could produce frames that were lighter and more accurate at a lower cost than the existing solutions. The commercial success was huge and soon other customers could be won and various new production facilities were built.

Figure 53: Hydroforming presses[143].

[143] Source MAGNA access date 04.09.2009

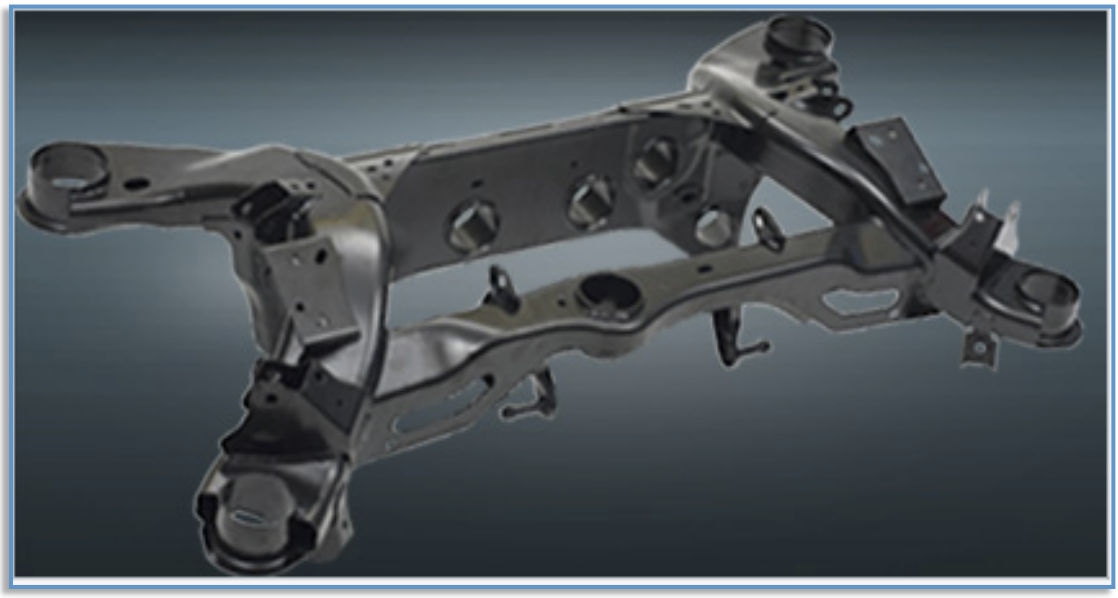


Figure 54: Hydroformed rear subframe[144].

c) Key Innovation Results and Main Success / Failure Factors

The introduction of the hydroforming process by Cosma was a very successful innovation, and based on this success, the Cosma division could establish themselves as one of the leading suppliers in their business field. Since then they have been one of the main drivers for the overall success and growth of the complete MAGNA group.

It must be pointed out that the technical invention was not made by Cosma, but they recognised the potential, secured the intellectual property, developed the process know-how needed to upscale the process and introduced it to a new market.

Key success factors were:

- Active technology screening and scouting
- Acquisition of ripe technology and intellectual property after having recognized the chance at the right time.
- Technology transfer among different regions.
- Adaptation and further development of the innovation to better meet the needs of the targeted customers
- Focus on process know-how and innovation.

[144] Source MAGNA access date 04.09.2009

- Top management involvement and commitment.

d) Analysis of the Suppliers' Innovation Management Approach Regarding Innovation Strategy, Portfolio, Process, Supporting Culture and Marketing Mix

Innovation Strategy

When it comes to living the original strategy and culture, Cosma is the archetype and role model for a MAGNA company. With full focus on operational and shop floor excellence, they targeted producing a better product for a better price, meaning a clear strategic orientation towards cost leadership.

The hydroforming process innovation clearly supported this strategy, which was perfectly synchronised with the targeted OEM's own strategy, such as GM, which was mainly looking for cost reductions in their existing programs.

Also, from the innovation strategy perspective, the match between the hydroforming innovation of Cosma and their targeted customers was optimal. Neither Cosma nor GM was looking to be first to market with new technologies. Quite the contrary, as fast followers they were mainly searching for technologically proven and ripe innovations that they could optimise and scale up to improve their cost position. Since BMW had already proven on a small scale that the technology was ripe for use in an automotive series production, when Cosma found the way to scale it up for larger parts and bigger volumes, it was a perfect strategic fit both for Cosma as well as for GM.

Innovation Portfolio and Process

When Cosma approached GM, it was a case of technology push driven innovation process. But, due to their extensive scouting and screening activities, they performed a very successful advanced marketing approach that allowed them to synchronise their approach very well with GM's technical roadmap. Additionally, the hydroforming innovation being a process innovation and not a product one, the barriers to accepting a supplier-driven innovation are much lower for the OEM.

Innovation Culture

Although COSMA also had a very result-oriented and operational driven culture, they found an optimal way to create an environment in which innovation could flourish. The lack of initial creativity was compensated for by the implementation of very

efficient scouting and screening capabilities to identify new ideas and technological trends from the market and the research community.

The key success factor again was the full commitment and support from the top management for this innovation and its realization through all phases.

Cosma Innovation Marketing Mix

Based on their good understanding of the market, Cosma had a clear picture of the targeted market, the American OEMs that were not aware of the hydroforming technology. The product Cosma offered was a production process that clearly offered cost advantages versus other technologies used at that time. Due to these cost advantages, Cosma could produce the parts for their customers at a very competitive price and at the same time generate substantial returns for themselves.

e) Findings Regarding Suggested Model

H1 & H2 Market Scope and Innovation Strategy

In this case, the strategic alignment between Cosma and the targeted customers was optimal, both for the market approach and the innovation strategy. Adapting a technology that had been proven to work in Europe for the US market and offering significant cost reduction potentials was a perfect match to the needs of a customer like GM.

H3, H4 & H5 Innovation Process Portfolio: Market Pull & Technology Push

Cosma used a technology-push approach, but since it was based on extensive advanced market activities and used an existing technology that only had to be adapted, the acceptance barriers on the OEM side were not an issue and the innovations processes of both could be well synchronised, which was the key success factor of this innovation.

H6 Innovation Culture

A committed top management that supported all activities and provided the right environment for the implementation of the strategy was without doubt one of the main enablers for this successful innovation. This especially applied during the scouting and advanced marketing phases when there were no visible results but high risks and costs.

H7 Innovation Marketing Mix

Based on the systematic scouting for technology and advanced marketing intelligence capabilities, Cosma was able to implement a very efficient marketing mix that contributed to the successful commercial implementation of the hydroforming technology in the targeted market.

f) Summary

The Cosma hydroforming case clearly shows that even companies that are not very creative and inventive can be very successful innovators if they choose the right strategy and implement the needed process and culture to support it.

It also reinforces the often overseen opportunities for suppliers to be successful with process innovations. Once developed, the risk of failure in the commercialisation is significantly lower, since the acceptance barriers from the OEMs are much lower than with product innovations. They also normally provide higher financial returns and are not so easily imitated by competitors.

4.1.3 Semi-Radical Innovations: Outside Mirror by Magna Mirrors, Donnelly Corporation, Hohe Group and Schefenacker

Magna Mirrors

a) Company Profile & Strategic Approach

Magna founded the Magna Mirror Systems group in 1984 after the acquisition of the Lowell division in North America. The European Mirror Systems' footprint was first established in 1987 by the foundation of Magna Auteca in Austria and later, in the 1990s, expanded through the acquisition of the German company Zipperle. In 2002, Magna merged the Magna Mirrors System Group with the recently acquired Donnelly Corporation forming the Magna Donnelly group.

The Magna Mirrors group followed an aggressive growth strategy driven mainly by acquisitions. The groups' core competence was the strong focus on operational excellence striving to become the most efficient manufacturer, following the Magna founders' motto of offering a "better product for a better price".

b) Innovation Management Approach

Targeted Innovation Portfolio

On the one hand, the group targeted the improvement of their operational position through incremental process innovations and market-pull innovations. On the other hand it targeted radical product technology-push innovations through a separate stand-alone R&D division.

Innovation Strategy

The company had a fast-follower strategy, not aiming to be the first to introduce new features into the market, but to develop or acquire through mergers & acquisitions (M&A) activities already established technologies and features, aiming to improve them and offer them at a more competitive price. The independent operational entities were responsible for their own results and approaches; they developed their own resources and capabilities for implementing their strategy.

At the same time, the Magna Mirrors group established an independent division named Thermokraft, focused solely on the development of innovations, new products and technologies. This division was totally separate from the normal mirrors operation and had its own independent management and budget. It followed its own strategy and technology roadmap. Thermokraft had a target of developing new technologies and products to be sold independently or licensed to the Magna Mirror divisions as added features to their existing mirror products. The expectation was that the major part of their innovations and revenues were to be produced through the Magna sister divisions.

Process

The Magna Mirrors group didn't use a structured standardised process for the creation and management of innovations. Innovation activities were mostly triggered by specific OEMs requirements following a dependent approach or had a defensive background where the group tried to imitate a competitors' innovation to close a gap in their technology or offering portfolio.

Within the Thermokraft organisation, there also wasn't a standardised process for innovation. Independent engineers generated their own ideas and worked parallel on various innovation projects. The acceptance of innovation ideas and projects was mainly based on a subjective potential assessment of the market potential. The

targeted innovation costs and hurdles for realisation and commercialisation were barely considered.

Culture

Magna Mirrors had a result-oriented management culture, focused on the short term. Management was mainly measured based on the level of achievement of their financial plans. Deviations, even positive ones were not welcome. This management style didn't encourage creativity and created a very risk-averse attitude since any failure that affected the economical results of the company was strongly criticized and had negative consequences for the responsible management.

This cultural environment was very innovation-unfriendly and mainly responsible for the low number of innovations generated and overall the very low level of innovativeness of the company.

The Thermokraft culture was different, with a very open approach to innovation, allowing creativity to flourish and a lot of ideas to be generated. However, the missing connection to the operations led to a very undisciplined environment that lacked the focus needed to realise the targeted innovations.

Innovation Marketing Mix

While Thermokraft was targeting radical product innovations but never managed to position any on the market, the other divisions of Magna Mirrors were targeting incremental innovations, trying to position them at a lower price level thanks to operational improvements. Neither placement nor promotion played an important role in their innovation approach.

c) Key Innovation Results and Main Success / Failure Factors

Magna Mirrors was not an innovative company. They followed a short-term oriented strategy based on operational efficiency that didn't require a high level of innovation. Overall they were moderately successful in the market, gaining some market share but were considered a follower rather than an industry leader.

Their approach of having within a group a separate entity responsible for innovation proved unsuccessful. The innovation "think-tank" was too far removed from the rest of the organisation and their strategies, and their cultures were totally disconnected.

The main obstacle to successful innovation at Magna was the missing supporting culture and especially the lack of commitment from the top management level. Therefore the implementation of a separate R&D group that should have generated innovations was never the right substitute for having an innovation-friendly environment embedded in the whole organisation.

Since the group could not gain significant market share through organic growth and in order to close the technology gap with the industry leaders, Magna decided to buy the Donnelly Corporation in 2002 and to merge the two companies into the newly founded Magna Donnelly. The Thermokraft division was closed, and none of their projects were successfully commercialised by Magna.

d) Findings Regarding Suggested Model

H1 & H2 Market Scope

Magna Mirrors' strategy, although not explicitly formulated, was to follow a cost leadership approach. They were moderately successful in positioning themselves as an alternative second source to the targeted OEMs.

Their intention to develop additional growth through the innovations developed by the Thermokraft division was not successful, not only because of their implementation problems, but also because of the missing strategic alignment both internally to their own market approach and externally to their targeted customers.

Since the Magna Group was mainly targeting the premium OEMs, it was not an optimal strategy to fully neglect the development of innovative products. This strategic misalignment limited the success of the Magna Mirrors group and led to a relatively small growth in their market share.

To be successful, a clear commitment to the defined innovation strategy has to be aligned to the targeted OEMs strategy. Compromises often lead to being stuck in the middle. In this case, Magna Mirrors was not perceived as an innovative supplier with many innovations to offer. Even so, they had to cover the high costs generated by the Thermokraft group.

H3, H4 & H5 Innovation Process Portfolio: Market Pull & Technology Push

Considering the fact that Magna Mirrors was striving to introduce the Thermokraft innovations into the market, they completely lacked the right alignment to their OEM's

process. Additionally, when pursuing an OEM triggered defensive innovation, the innovation process was not well-synchronised and didn't follow the ideal cascading approach.

The misalignment of process from Magna Mirrors to the OEM was a key hurdle limiting the success of their innovation activities.

H6 Innovation Culture

The missing commitment to innovation from the top management, the intense focus on short term results and the averseness to any deviation from planned results created a very innovation-unfriendly culture that severely limited the innovative success of the group. The idea of creating a separate unit to foster creativity and innovation was foiled by the disconnection to the rest of the group and the lack of focus in the realization phase.

The main hurdle impeding the successful implementation of any innovation in the Magna Mirrors group was the inappropriate culture, which not only limited innovation but also opposed the realisation of their few ideas.

H7 Innovation Marketing Mix

Due to the poor success rate of the Thermocraft innovations and the very limited level of innovations of the rest of Magna Mirrors, the innovation marketing mix was not a relevant success factor.

e) Summary

The Magna Mirrors group was not successful pursuing a defensive fast- follower innovation approach in the market. Their strong focus on short-term financial results helped to establish themselves as a suitable second source for their targeted premium oriented OEMs. However without being recognized as a technology leader, they didn't have a chance to really become a dominant player in that segment.

The idea of having a separate entity focused on innovative products and technology development proved inadequate. Instead of having the best of both worlds, Magna Mirrors dilemma of being strategically stuck in the middle had to end. On the one hand, they didn't have the benefits of differentiation through successful innovation. On the other hand they suffered the cost of a large engineering entity.

Donnelly Corporation

a) Company Profile & Strategic Approach

The Donnelly Corporation was founded in 1905 in Michigan USA as a manufacturer of mirrors for the furniture industry. During the 1920s, the company started supplying automotive manufactures with rear windows for touring cars. After World War II the company began manufacturing exterior and interior automotive mirrors that soon became the core business of Donnelly. Due to various innovations like the introduction of the encapsulated mirror which was delivered to automotive manufacturers as a single-unit-mirror enclosed in a plastic frame, the company was able to successfully expand their business. It founded its first European production site in 1968. In 1995 it acquired the Hohe group in Europe. In 1996 the company successfully introduced the ground illuminator outside mirror into the market. In 2002 the Donnelly Corporation was taken over by Magna.

The Donnelly Corporation followed a growth strategy targeting differentiation through technological product innovation. The company was centrally managed out of the USA, where the major product decisions were made and the R&D and innovation management activities were concentrated.

b) Innovation Management Approach

Targeted Innovation Portfolio

Donnelly targeted radical innovations rather than incremental, aiming at introducing mostly new features to the market instead of improving existing functionalities. They were more focused on product innovation than on innovation of their processes. A large portion of the targeted innovations in their portfolio was technology-push innovations.

Innovation Strategy

Following a differentiation strategy, Donnelly had an aggressive “play to win” innovation strategy aiming to be the first to market with new products. It was a very inventive organisation that generated numerous ideas for new products, but was not always successful in its commercialisation. The main reason for this was that, as a US based company, Donnelly’s innovation strategy was well-synchronised with the American OEMs but not as well with the European or Asian OEMs. The issue was that in those days, American OEMs were not following a very aggressive technology innovation strategy for themselves. Most product innovations were first introduced in

Europe. The Japanese OEMs were the innovation leaders when it came to implementing process innovations to reduce cost.

Innovation Process

Donnelly used a very well defined and formalized innovation management process that was mainly driven by technology push. The process was very effective in generating ideas for new products, and the OEMs were approached with concrete product ideas, most of which were well received, but seldom successfully introduced to the market. The commercialisation phase was the weak point in their process.

Innovation Culture

The culture of Donnelly was very innovation-friendly, failure was not condemned and there was a strong commitment from the top management to support innovation and the creation of new products. This was the key strength of Donnelly and the main driving force behind its inventions. Everyone knew that the entire top management was fully committed to and focused on the creation of innovation. On the other hand, Donnelly's corporate culture lacked the rigidity and perseverance needed during the phases of realisation in general and more specifically when it came to the industrialisation of the new products.

Innovation Marketing Mix

Donnelly mainly targeted the North American-based OEMs with their innovations. Striving to implement new features in their outside mirrors, Donnelly merely focused on the creation of product innovations aimed toward obtaining a premium price from their customers. Compared to the other outside mirrors suppliers, Donnelly was very active in promoting their products in order to support their technology-push approach. However they lacked a specialised innovations sales channel.

c) Key Innovation Results and Main Success / Failure Factors

Donnelly didn't manage to survive as an independent company, although it was not in financial troubles when it was taken over by Magna. Still, it is evident that, with its existing structure and capability base at that time, it would have faced serious challenges in the following years.

Considering market penetration as another key indicator for market success, the Donnelly group was most successful with the American OEMs. These were also their most important customers in Europe. Through the acquisition of Hohe, some German

OEMs like BMW were also included in their portfolio. However, the success rate with those OEMs was lower than during the time when Hohe was a stand-alone company.

Donnelly managed to conceive various product inventions. In spite of this fact, the company cannot be considered as a truly successful innovator: the overall amount of innovations commercialised was too small in comparison to the wide portfolio of ideas and technologies the company developed and the corresponding amount of resources invested in their creation.

Analysed in retrospect, the main hurdles that limited Donnelly's' innovation success were the following:

- Poor strategic alignment to their main OEM customers: Donnelly was following an aggressive "first to market" innovation strategy while its main customers, the American OEMs, mostly had a "follow the leader" approach.
- Donnelly was often more innovative than its US customers, and too often the added value of its innovations was neither recognised by nor relevant to the targeted OEMs. Occasionally the proposed inventions were considered too ahead of their time and overpriced.
- As for more innovative European OEMs, Donnelly lacked the strategic understanding of their needs required to successfully align its products to the customers' requirements.
- An innovation process more focused on ideation than execution, mostly technology-push driven but without an appropriate alignment to the targeted OEMs.
- A culture that encouraged creativity but didn't pay much attention to discipline and control during the realisation phase.
- Innovation activities were mainly concentrated on product development and lacked focus on process engineering and industrialisation.

On the positive side the success factors for Donnelly were:

- A well-defined and structured innovation management process.
- Absolute commitment from top management to innovation, making for a very creativity-friendly environment.
- Advanced innovation marketing mix approach.

d) Findings Regarding Suggested Model

H1 & H2 Market Scope and Innovation Strategy

The Donnelly Corporation had a differentiation market scope and a first-to-market innovation strategy. Its main customers, the American OEMs, also followed a differentiated strategy, but had a rather me-too / fast-follower innovation approach. Donnelly was therefore more innovative than its main customers, which led to problems in the realisation of its ideas.

Regarding their innovation management approach, the lack of strategic alignment to their main customers represented a major hurdle for successful innovation management.

H3, H4 & H5 Innovation Process Portfolio: Market Pull & Technology Push

The technology push approach for Donnelly was not successful due to the lack of alignment with the approach of the OEMs. This was even more obvious when dealing with European OEMs. The innovations suggested by the Donnelly group were frequently not compatible to their technology roadmaps, which strongly limited their commercial success.

The push-oriented innovation process was not sufficiently aligned to the OEMs to be successful. Additionally, the lack of attention to the OEMs pull demand and the missing cascading approach were significant innovation hurdles.

H6 Innovation Culture

The Donnelly top management strongly encouraged and supported a creativity-friendly corporate culture that fuelled the creation of innovative ideas. However it lacked the right amount of discipline and control needed for their realization.

A more balanced culture between creativity and control would have been more effective for the Donnelly Corporation.

H7 Innovation Marketing Mix

The marketing mix tools that Donnelly used to support the marketing of their innovations were very advanced and well implemented. However, due to the lack of execution in other areas and poor strategic fit, their impact was not as beneficial as it could have been.

e) Summary

The Donnelly case is a perfect example of the key challenges for innovation management in the automotive supplier industry. Being inventive and creating a lot of ideas is simply not enough to succeed. The realization and commercialization through a good alignment of strategy and innovation processes to the main OEM customers are the key. Without these, all the good ideas and innovative initiatives are virtually worthless.

Donnelly would have been more successful if they had invested more resources in understanding the real needs and strategies of their customers and targeting fewer innovations instead of ideating so many of their own new products. The potential degree of innovativeness may have been less, but the overall success rate of their innovation management would have been higher.

Hohe Group

a) Company Profile & Strategic Approach

The Hohe group was founded in 1954 as “FAM” in Germany. It started in1954 with the production of mirrors for the automotive industry. It introduced various innovations to the market, such as the first electrical adjustable outside mirror in Europe (1971), the first self-controlled heated mirror (1975) and the first memory-mirror (1983). In 1995, due to financial problems, the group was taken over by the Donnelly Corporation and became the Donnelly Hohe Group. In 2002 it became part of Magna.

The Hohe group didn’t have an explicitly formulated strategy, its approach can be characterised as a focus strategy concentrating on the needs of its main European customers, predominantly the BMW group.

b) Innovation Management Approach

Targeted Innovation Portfolio

The Hohe group was completely focused on inventing new products with the highest level of innovativeness possible. They paid almost no attention to process innovations and their innovation portfolio consisted primarily of technology-push innovations.

Innovation Strategy

The Hohe group pursued a play-to-win and first-to-market strategy with a very aggressive innovation approach for their main targeted customers. The main focus was on invention, not innovation.

Innovation Process

The innovation process of the Hohe group was not a formal one; it was mainly driven by technology-push and didn't follow a specific structure. Ideas were often generated in a very unconventional way ("Bierdeckel-Ideen"= "beer coaster" ideas) and their evaluation was made based mainly on gut feelings.

Innovation Culture

The owner and CEO of the company was the main driver of an invention-oriented, creative and risk-oriented culture aimed at developing as many inventions as possible. But he lacked the needed control mechanisms and discipline for a consequent and systematic implementation and commercialisation of these inventions.

Innovation Marketing Mix

Following their overall unstructured " hands-on" way of doing business, the Hohe group did not use a structured marketing mix approach. It was all based on individual actions and ideas of the founder. Still they managed to establish a very good relationship with their main customers based on intensive personal channels and direct early promotion of their innovations. The main weakness of their approach was the total lack of strategic pricing tools limited them from capturing the real value of the innovations they managed to realize.

c) Key Innovation Results and Main Success / Failure Factors

The Hohe group managed to generate a large number of inventions like the first electrically adjustable mirror, the first mirror with integrated heating, the first aspheric glass mirror, the puddle lamp / ground illuminator and the idea for the first mirror with integrated turn signals. Hohe's problem was that they only managed to successfully commercialise a few of these ideas. For instance, the puddle lamp invented by Hohe was only a commercial success after Donnelly took over Hohe. Another example is the turn signal in the mirror, which was invented by Hohe, but only realised years after its invention by their competitor Schefenacker.

This lack of commercial success, the financial burden of the wide range of different unfinished projects and a critical lack of strategic focus led to the challenging financial situation that forced the owners of the company to sell it to Donnelly.

The Hohe group was a successful inventor mainly because of its risk-open and very creative culture that encouraged “out of the box” thinking. However, there were some significant hurdles that limited their overall innovation success, like:

- Poor strategic skills and lack of clear strategic focus
- Missing formal, structured innovation process
- Poor synchronisation of push-technology approach with the OEMs innovation processes
- Lack of discipline and control needed for the realisation and commercialisation of innovations

d) Findings Regarding Suggested Model

H1 & H2 Market Scope and Innovation Strategy

The Hohe innovation strategy had in principal a good strategic fit to its main targeted customers. The issue was Hohe’s lack of strategic know-how. Their vaguely defined market scope strategy and poor systematic understanding of their customers’ strategies were significant hurdles to the systematic alignment of the corresponding product strategies. This was partly compensated for by a constant communication and very close tracking of all relevant customer activities. Most of the time the poor strategic alignment led to the innovations from Hohe being well received by the OEM but perceived as unripe and too risky to be implemented.

➔ The lack of strategic tools and a clear understanding of its own strategy as well as the OEM’s, was a major hurdle to the successful implementation and realisation of innovations for the Hohe group.

H3, H4 & H5 Innovation Process Portfolio: Market Pull & Technology Push

The innovation process was an informal one, mostly consistent with a very creative ideation phase and an unstructured realisation & commercialisation phase. The process was almost purely based on technology push and very poorly synchronized with the OEMs process.

➔ One of the main factors responsible for the poor innovation success of the Hohe group was a poorly structured process, which was neither triggered by nor well-synchronised to the OEMs innovation process, despite its high inventive potential.

H6 Innovation Culture

The strong commitment by top management and the risk-friendly culture created an optimal foundation for the development of new ideas. The missing discipline and control, however, compromised their successful realization and commercialization.

➔ The risk-friendly culture supported by top management was very beneficial for inventions. However, to be a successful innovator, a more balanced culture with a higher level of control and focus would have been more appropriate.

H7 Innovation Marketing Mix

The lack of a structured approach to marketing their innovations represented a significant hurdle to the Hohe group, since they were not able to successfully harvest the full market potential of their inventions.

e) Summary

The Hohe case is a perfect example that illustrates the substantial difference between invention and innovation. The main hurdle impeding the success of Hohe was not the technical implementation of their ideas but their commercialisation. While invention can in some ways be considered an art, innovation clearly needs a strongly structured link to a well formulated strategy, a formal process for realization and a solid business case for commercialisation supported by not only a creativity-friendly but also results-oriented culture.

Schefenacker

a) Company Profile and Strategic Approach

The company Reitter & Schefenacker started in 1935 with the production of interior lights in Esslingen, Germany. In 1950 the production of exterior mirrors for passenger cars was initiated. It was the first company to introduce the modern mirror-triangle based exterior mirror adjustable from the inside. With the acquisition of the Britax mirrors division in the year 2000 and in 2006 of the Engelmann Group it became the largest exterior mirror manufacturer in the world. In 2005 it launched the first video

based blind spot detection system. Serious financial troubles led to a major restructuring and shareholders change in 2007, and various facilities had to be closed. The company was renamed Visiocorp plc. Due to on-going financial troubles it had to be sold in 2009 to the Indian Samvardhana Motherson Group, and the name Visiocorp was changed to SMR – Samvardhana Motherson Reflectec.

Having been the European Market Leader for outside mirrors in the late 90's the company has recently lost significant market share, now holding less than 30% of the market with an estimated turnover of around € 200 Million in Europe. Globally the company has 4,400 employees and approximately € 660 Million sales.[145]

Schefenacker pursued an aggressive growth strategy targeting all OEMs based on a differentiation strategy.

b) Innovation Management Approach

Targeted Innovation Portfolio

The company feared that the outside mirror, its key product and main contributor to total sales, was at risk of being replaced by alternative technologies like cameras and other sensors. Therefore it was a core element of their strategy to develop new product / technologies to ensure their long-term existence.

Following this strategy, most of their targeted innovations were aimed toward creating new features and products rather than improving processes or reducing cost.

Innovation Strategy

Schefenacker pursued an aggressive innovation strategy, aiming to be the first to market with new features.

Innovation Process

The well-structured innovation process of Schefenacker was mainly driven by technology push. Their main intention of many of these technology push-activities was to generate OEM interest and attention through " technological eye-catchers".

[145] Data source: VISIOCORP access date 04.09.2009

The process started with a high-level internal discussion among the management, where general trends and new ideas were born and discussed. These top management brainstorming sessions were followed by presentations of selected ideas and concepts to their main OEM customers, attempting to generate enough interest to motivate them to invest in a joint technology / product development project.

Whenever an OEM became convinced, a joint project was launched and the next phase of the innovation process was started to develop the new product.

Innovation Culture

Schefenacker had a very innovation-friendly culture, which was mainly driven by top management. It allowed for a good balance between creativity and discipline of implementation.

When the company changed to Visiocorp, the new shareholders were financial investors, who introduced a new management team that was interested in short-term results. With this new management, the culture changed completely and creativity disappeared. No new ideas for further innovation were pursued afterwards.

Innovation Marketing Mix

Schefenacker was clearly a technology-driven company with a very strong and structured approach in the R&D area. However, they lacked structure and a similar level of skills when it came to marketing their products. Their innovation marketing mix approach was less than basic, although they had a very strong channel to the independent aftermarket. They limited themselves to direct contacts through their sales and technical organisations to market their products. They also lacked a structured pricing approach to market their innovative products.

c) Key Innovation Results and Main Success / Failure Factors

In spite of the various successful launches of innovative products, Schefenacker failed to survive as an independent company and lost significant market share during the last years. At first glance, this could be interpreted as a sign that a successful innovation management was needed but not sufficient by itself to make a supplier successful. In this case, it should be considered that Schefenacker was not a really successful innovator: a successful launch of an automotive supplier's product is not identical to its' successful commercialization. The business case for the suppliers'

innovation depends upon many factors, such as the market success of the complete vehicle and acceptance by the end consumer. The following example for the blind spot detection system developed by Schefenacker perfectly illustrates this point.

In 2005 Schefenacker launched the Blind Spot Detection system (BSD) in a Volvo car on the market. The BSD is a driver assistance system embedded in the outside mirror to monitor the driver's blind spot, helping to make overtaking easier. It is able to independently recognize moving objects due to electronic image processing. Digital cameras located in the door mirrors observe traffic behind the vehicle, taking 25 pictures a second. Small microprocessors in the door mirrors process the image information. If a vehicle enters the warning zone, an orange LED located inside the car near the door mirror lights up to warn the driver.

The innovation was initially well-received and had good reviews. However, the total sales volumes of both the car and the option were not as high as they needed to be for the product to have been a commercial success. After the launch of the first generation BSD, the total financial returns generated were not large enough to cover the original development costs, let alone the funds needed to invest in the required further development of later product generations. The problem was not only the small volumes of the Volvo platform, but the fact that most other suitable OEMs had chosen a different technology for the BSD functionality making it very difficult toa leverage of Schefenacker's investment and technology..

From a strategic point of view, relying on the technological roadmap of a single rather small OEM like Volvo was risky. Schefenacker knew that their camera technology was competing in the market place with the alternative radar solutions that most of the other OEMs preferred. They found themselves in a rather challenging situation with a product that required deep investment to develop and launch yet targeted a rather small market with only limited possibilities of successfully offering it to other OEMs.

This high persistent need for additional financial resources further deepened the critical financial situation of the company, which finally forced the shareholders of Schefenacker to sell it off to avoid bankruptcy. The new shareholders called for a new approach where innovation and new product development were no longer strategically important. All initiatives were stopped and the technological advantages in this area were completely lost. The second generation of the BSD system was

never developed; the concerned OEM implemented an alternative solution based on a different technology.

In spite of the successful technical implementation and market introduction, the BSD project cannot be considered a commercial success due to the poor financial results and is therefore not a successful innovation according to the definition used for this research work.

In retrospect, considering the resources that Schefenacker had, it proved to be the wrong strategy for them to focus solely on developing new products aiming mainly for radical innovations. In their challenging financial situation, it would have been more beneficial for them to also focus on developing process innovations aimed at improving their competitive position for the short term instead of having an unbalanced innovation portfolio requiring high up-front investments and yet prone to offering only long-term payback.

Key success factors for the innovation of Schefenacker were the good strategic alignment of its strategy and innovation process to the targeted OEM, supported by a culture that not only fostered the creativity to develop new ideas but also provided enough focus and management support to make sure that the ideas were also realised and successfully marketed.

The key hurdle for Schefanacker's innovations approach was the misalignment of their pursued strategy and the resources that were available for them to implement that strategy.

d) Findings Regarding Suggested Model

H1 & H2 Market Scope and Innovation Strategy

Following a differentiation strategy based on new functions, Schefenacker was mainly targeting technology oriented OEM customers with a similar strategy. For these customers, their market approach and innovation strategy was properly synchronised which was a key factor in their becoming a successful innovator.

The good strategic synchronization of Schefenacker to their target customers was a key initial success factor for their innovation strategy.

H3, H4 & H5 Innovation Process Portfolio: Market Pull & Technology Push

Schefenackers' innovation process was mainly OEM triggered and fully synchronised to the targeted OEMs process. This guaranteed a seamless integration and successful implementation of their products into the OEMs vehicle. Paradoxically, the strong integration to a single OEM was, on the one hand, a success factor with this OEM but on the other hand a hurdle to success with the other OEMs that were following a different technological roadmap. For those OEMs the innovation was no longer market pull but technology push and Schefenackers' process was not well synchronised to them. This explains why they were successful with the first OEM but not with the later ones.

Schefenacker's OEM triggered market-pull innovation process was a key success factor for their innovation approach. When trying to sell the innovation to other OEMs, the missing process synchronization was a key hurdle for them.

H6 Innovation Culture

Schefenacker managed to strike the right balance between a top management - supported creativity-friendly culture and the appropriate level of discipline and focus needed for its realisation. The importance of top management support became evident when, after the change of shareholders, new management created a new cultural environment, which from one day to the next greatly curtailed the creative output of the company.

The right balance of creativity and discipline was a key element supporting Schefenackers' successful innovation approach. The importance of top management support becomes evident when analysing the change of culture after new players took control of the company.

H7 Innovation Marketing Mix

Neglecting the development of the required level of marketing capabilities to market their innovation proved to be a significant hurdle for Schefenacker. Realisation & innovation are both vital elements of the innovation process. Without the right technological know-how, the ideas cannot be realised. The same is true for the commercialisation, without the right level of marketing skills a completely successful commercialisation will in most cases not be possible as can be seen in this example.

e) Summary

Schefenacker successfully introduced various innovations to the market. These positive results were mainly due to the high level of strategic alignment and a cascading innovation process derived from the OEMs' own innovation roadmap. They also found the right level of cultural balance between creativity and discipline needed for the successful realization of their innovations.

However, the overall lack of success of the company is a further example of the specific challenges facing automotive suppliers. Regarding their innovation activities, Schefenacker did many things right. However, for a market leader following a growth strategy, they should have had a broader innovation project portfolio targeting a wider customer range and a more balanced initiative mix, not only pursuing differentiation through new features but also looking for innovations that would help them to improve their competitiveness and cost base. Additionally, Schefenacker followed a strategy that required more resources and capabilities that were available and finally they concentrated too much on the technological part of innovation neglecting to develop the level of marketing skills needed for the successful commercialisation of innovations. This is a very common pitfall among western automotive suppliers: relying too much on their technical capabilities and neglecting the importance of marketing and strategic competency plus adequate resources.

4.1.4 Semi-Radical Innovation: Actuators by Auteca

a) Profile of Supplier

MAGNA Auteca AG is a fully owned MAGNA company located in Weiz, Austria. It is one of the world's leading suppliers of micro actuators for various kinds of automotive systems and components. They provide solutions for the adjustment and movement of mirror glasses, mirror power-fold, bend-light and air conditioning systems. The company employs 300 people and has currently annual sales of about € 70 Million.

It was founded in 1987 as the first MAGNA Company in Europe. The production of mirror glass actuators started in 1989, the production of plastic parts in 1991 and painting parts like steering-wheel covers and mirror housings in 1996.

At the beginning of 2003 the company began focusing solely on the production of actuators. Mirror production was transferred to other MAGNA companies, the tool

shop and other plastic parts production were outsourced in 2004, and finally the paint shop was closed in 2007.

b) Description of Innovation Management Case

The product portfolio range of Auteca in the early years of their history was widely diversified without a clear strategic focus. After deciding to consolidate all the MAGNA mirror actuator production into the company, the Auteca division developed a clearer strategic profile as a tier 2 supplier based on their developed competence for micro-injection moulding and process automation. Their main product, the MR-4 glass actuator was a huge success and soon captured more than 40% of the European market generating annual sales of more than € 30 million in 2006.

Based on this success, the Auteca management gave birth to the idea of focusing the company on the development and production of actuators alone. Since the installation rate for mirror actuators is limited to maximal two per car, and Auteca already owned almost 50 % of the market, there was a need to develop a new product line. For this purpose, the management initiated an innovation process to create new product areas for future growth. After a thorough analysis of the automotive actuator market, they identified the area of “Heating, Ventilating, and Air Conditioning” (HVAC) as one of the most attractive segments to be targeted.

Due to the increasing installation rates of air conditioning systems in European vehicles, the market was steadily growing. In addition, the specific requirements of European OEMs for systems capable of managing various climate zones required the use of up to 10-15 actuators per car in high-end versions. Focusing on the high segment of this market was targeted representing a potential of 25 million actuators per year or approximately € 75 million yearly sales in Europe.

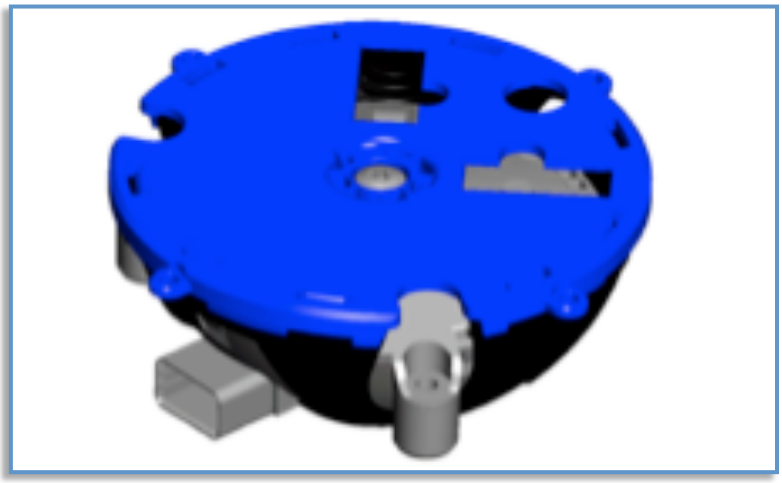


Figure 55: The MR 4 Actuator[146]

A cross-functional team was installed to develop this innovation. After benchmarking existing solutions and defining a target cost level, their product development activities aimed to create a better and more cost efficient solution than the existing products in the market.

As part of their advanced marketing activities they presented and discussed their strategy with various OEM and Tier 1 HVAC suppliers, their targeted customers. One of these system suppliers advised them to obtain the license of an existing actuator concept that had been developed by another tier two supplier. It was a very innovative actuator but the developing firm lacked the interest and resources for its industrialisation and production. The Auteca management followed this recommendation and decided to change their innovation strategy. They licensed the technology of the other supplier and concentrated on its further development, especially the industrialisation process development. Due to this approach, they not only got faster access to an advanced robust technical product, but also gained their first customer orders from the HVAC Tier 1 supplier that recommended the technology to them. The product was launched in 2009, targeting annual sales of more than € 14 million in 2010 and the following years.

[146] Source Magna Mirrors Marketing.

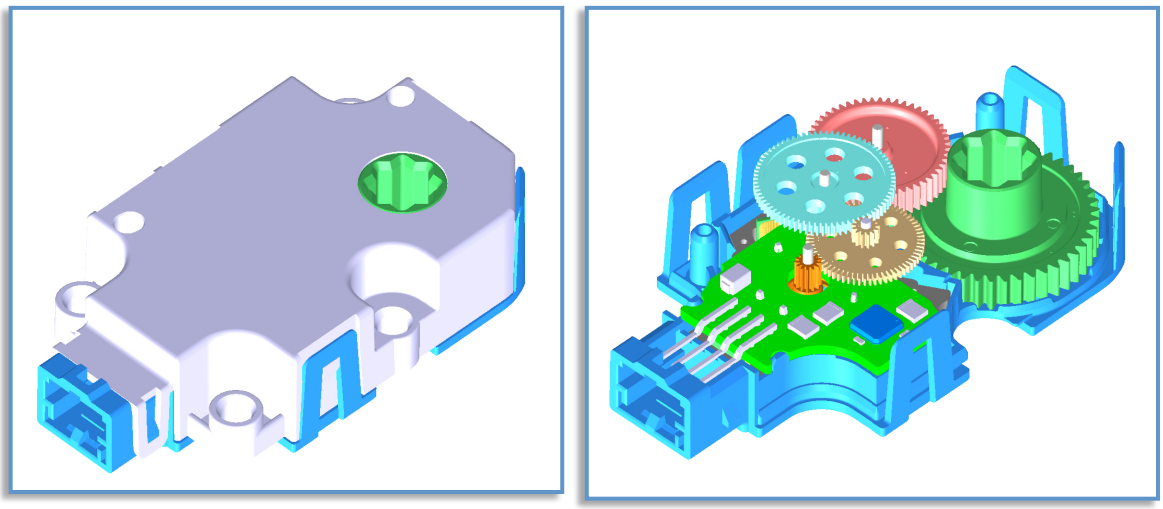


Figure 56: HVAC Actuator[147]

c) Key Innovation Results and Main Success / Failure Factors

The introduction of a new product line was a big market success for Auteca, they managed to increase their sales significantly and expand their customer portfolio.

One key success factor was the clear strategic direction from the beginning of the innovation process. Pursuing the development of a new product based on its own idea, Auteca's management initiated a very well executed advanced marketing approach targeting not only their direct customers, the Tier 1 HVAC system suppliers, but also including their respective customers, the automotive OEMs in their activities.

After understanding that there were already new and good technical solutions on the market, they switched their approach and, instead of developing a new product, they concentrated on the improvement and industrialisation of an existing solution. Since by doing this, they were following a recommendation of one of their main targeted customers, they automatically achieved an ideal strategic level and process synchronisation with that customer which led to the first orders at a very early phase.

This very focused and flexible innovation approach was possible due to the extremely high level of top management support that was not only the initiator of this innovation process but also provided the right amount of resources and support, allowing for the successful realisation of this innovation for the Auteca division.

[147] Source Magna Mirrors Marketing.

d) Analysis of the Suppliers' Innovation Management Approach Regarding Innovation Strategy, Portfolio, Process, Supporting Culture and Marketing Mix

Innovation Strategy

One of the main success factors was the clear strategic direction that the innovation initiative of the MAGNA Auteca followed right from the first step.

They had a clearly defined strategy of diversification based on a product innovation, which, in turn, was based on their own strengths, like their know-how in the production of micro-actuators and the area of highly automated production processes. This strategy was based on and supported by an extensive research of the market needs that allowed a high level of strategic alignment, not only to the Tier 1 customers, but even more decisively, to the automotive OEMs. In the middle of the realisation phase, the Auteca management decided to change their approach from developing a new technological solution to improving an existing one. The level of innovation strategy synchronization with their customer became optimal.

A key success factor for the Auteca management was recognising that to become better aligned with their customers, it was necessary to change from a technology leadership approach to a fast-follower approach, regardless of their initial plans.

Innovation Portfolio and Process

Auteca followed a technology-driven push-innovation process that was very well supported by extensive and advanced marketing activities. These activities not only allowed for greater synchronisation with the Tier 1 supplier, but also with the OEMs and were the basis for recognizing the need to adapt the innovation approach that then became a rather exemplary market-pull process.

Innovation Culture

Changing the strategic approach in the middle of the innovation process would have been, in many other companies, a huge challenge and a main reason for the failure of an innovation project. In this case however, the innovation could successfully be realised despite these changes but only because the top management as the initiator of this innovation was completely committed to the project. It provided not only full support but encouraged a culture that was flexible enough to recognise that the initial plan and strategy required adaption in order to fully meet the needs of the market. Without this flexible supporting culture the initiative would have stuck to the initial plan and certainly not have attained the same level of success.

Innovation Marketing Mix

Auteca had a clearly defined product which they wanted to market, their actuator know-how. They conducted a very systematic study of the market to identify possible applications and start promoting their capabilities. Based on this information they selected the Tier 1 HVAC suppliers as the best targeted customers, implemented a dedicated channel to address them and worked out a very effective pricing approach to maximize their results.

e) Findings Regarding Suggested Model

H1 & H2 Market Scope and Innovation Strategy

Auteca's good strategic match with their targeted customers, the tier 1 suppliers, was key for the successful implementation of this innovation.

H3, H4 & H5 Innovation Process Portfolio: Market Pull & Technology Push

The technology push approach of Auteca was well based on very effective advanced marketing activities and market intelligence.

H6 Innovation Culture

A key enabler of this innovation was the fact that Auteca's top management was not only fully committed to innovation but also made sure to include all key persons in the strategy and innovation process. This deep involvement cemented the desired culture within the organisation.

H7 Innovation Marketing Mix

Performing a dedicated study of the market, followed by extensive advanced marketing activities targeting the new customers, was a perfect start for this innovation. Focusing on Tier 1 suppliers as the targeted customers and developing a dedicated channel for them were also key elements of this successful innovation.

f) Summary

Tier 2 suppliers will in most cases, have higher innovation barriers than Tier 1 suppliers, since they have to consider two steps in the innovation cascade. The successful innovation case of Auteca illustrates the key importance of having the right strategic approach, a well synchronized / integrated innovation process that is supported by the top management and the right corporate culture.

It also shows that, for suppliers, it is often the better approach to make some compromises on the level of targeted innovativeness and innovation strategy if this allows them to attain a better level of synchronisation with the targeted customers. This obviously can only be done if the supplier has a deep understanding of the market and its needs.

4.1.5 Semi-Radical Innovation: Distalight by Magna

a) Profile of Supplier

MAGNA is one of the largest automotive suppliers in the world. MAGNA's capabilities include the design, engineering, testing and manufacture of automotive interior systems, seating systems, closure systems, metal body and chassis systems, mirror systems, exterior systems, roof systems, electronic systems and powertrain systems as well as complete vehicle engineering and assembly.

The company was founded in 1957 when Frank Stronach opened a one-man tool and dye-shop called Multimatic. In 1959 he received his first automotive order to produce sun visor brackets for GM. In 1969 Multimatic merged with Magna Electronics Corporation Limited and achieved sales of $ 4.5 million. The company was renamed Magna International Inc. in 1973 and listed on the New York Stock Exchange in 1992. Between 1996 and 1998 MAGNA underwent a major European expansion, acquiring various European based automotive system suppliers.

MAGNA had 240 manufacturing operations and 76 product development, engineering and sales centres in 25 countries on five continents as of March 2010. In 2008 MAGNA recorded $ 23,7 Billion US sales with almost 80.000 employees, including 30.000 in Europe[148].

b) Description of Innovation Management Case

The Win Initiative

In 2007 Magna International Europe started the innovation initiative 'WIN - Winning Innovations by Magna' to make use of the creative potential of its employees. WIN was conducted as a Europe-wide contest and allowed all Magna employees to submit their ideas for new products, innovative services and new technologies to one

[148] Source MAGNA access date 04.09.2009

central collecting point. All ideas were filtered, processed and evaluated by a cross-functional committee that selected the best of them for realization.

A total of 900 ideas were submitted, the winner of the contest was the Distalight idea.

The Innovation Idea: Distalight an Innovative Signal Light

Distalight is the name of a cost efficient possibility to provide a warning function to the rear-lamps of a car. Depending on its distance to the vehicle, a driver following it will perceive the tail light either as a steady or a warning blinking light. This warning should help reduce accidents caused by unsafe distance from following vehicles. The advantages of this system are that is easy to implement and very cost efficient since it doesn't need any additional sensor.

Figure 57: Distalight innovation[149].

c) Key Innovation Results and Main Success / Failure Factors

Two patents were applied based on this idea. A first prototype was successfully tested on a vehicle and used to demonstrate to various customers, the idea was well received by some OEMs but none of them could be convinced to actually implement it in a vehicle. Besides some legal and homologation questions, most OEMs were afraid that it would be very difficult to convince a car buyer to pay extra money to provide a functionality that would warn other drivers, but not the driver of the vehicle possessing this special function.

It was a very successful invention but, due to lack of commercialisation, a failed innovation. Other ideas of the Win initiative were also further developed and a couple of them are still in the process of being developed, but so far none of them could be successfully commercialised.

[149] Source Magna Exteriors and Interiors Marketing.

d) Analysis of the Suppliers' Innovation Management Approach Regarding Innovation Strategy, Portfolio, Process, Supporting Culture and Marketing Mix

Innovation Strategy

The approach of searching for ideas without any given strategic direction has the advantage that it doesn't limit the creativity of the ideas submitted but at the same time it bears the risk that the generated ideas may be not be well-aligned with the suppliers' or the customer's general and innovation strategies.

Such was the case with the Distalight invention: it didn't match well with the strategies of the Magna groups. In the first place, it was an invention designed for the rear-lights of a car, which was one of the few product areas that Magna didn't produce in Europe. This was not a K.O. factor in itself, but because they were not innovating in a core product area, there was not enough understanding of the market and OEM expectations for this product. For the same reason, the Distalight invention was not very compatible with the product and innovation road map of any of the Magna divisions, which also limited the level of ownership for its commercialization.

When the first commercialization activities started, it became clear that, from the market side, the interest was moderate and would require considerable effort to establish a demand for the functionality that this product provided. It was a poor match with the innovation strategies of the OEMs.

Innovation Portfolio and Process

Based on an individual idea, the innovation was developed on a pure technology-push process that was not synchronized with any OEM innovation process. To have been successful, it would have required extensive advanced marketing activities, but due to the lack of ownership among the groups and the missing experience in the targeted product area, the needed activities were not conducted in an appropriate and substantive way.

When presented to the OEMs, the idea was well received from a technical point of view, but there was too little interest on the OEM side to trigger the innovations projects that would have been needed to homologate the idea and introduce it into a car.

Innovation Culture

The Magna culture is prone to supporting the generation of short-term financial results rather than pursuing long-term strategic objectives. This kind of environment is not ideal for supporting the development of creative ideas. To compensate for this fact, it was a valid approach to start an innovation idea contest like the WIN initiative. The large number of very creative ideas the WIN initiative generated demonstrates that the problem is not the lack of creativity from the Magna employees.

The main cultural barriers are the short-term orientation, the unwillingness to tolerate failure and the lack of innovation focus and support from the Magna management.

The fact that the idea for Distalight was created by a central initiative, as opposed to a group that would afterwards carry out its realisation, led to an additional lack of commitment and ownership. This presented an additional, substantial hurdle for the Distalight innovation, leading to an early stop of most activities as soon as the first obstacles appeared.

Innovation Marketing Mix

Due to the lack of ownership for this product, no structured marketing was done. The idea was presented to some OEMs but without a strategic plan or follow up.

e) Findings Regarding Suggested Model

H1- H7

The Distalight invention is a very good example demonstrating the importance of the success factors of the postulated model. In this case, none of the key success factors was addressed properly, there was not a good strategic match, the push-process was not synchronized, the culture was unsupportive; and there wasn't any adequate innovation marketing mix. It is therefore not surprising that the innovation failed.

f) Summary

Employee innovations contests like WIN are like a lottery; there is a chance to win and hit the jackpot with a very successful innovation, but following the logic of our model, it is more likely that the outcome will not lead to any truly successful or long lasting innovation results.

These kinds of initiatives can be very valuable as an add-on, but never as a substitute for a systematic strategically oriented innovation management process,

supported by an appropriate culture. This has already been recognised by the responsible MAGNA management. A new second round of the WIN initiative started andhas a more focused approach that is better aligned with the overall MAGNA roadmap.

It is also not surprising that the Distalight invention, although in itself very interesting and of a high degree of newness was not a successful innovation since all three prerequisites for successful supplier innovations were not applied in this case.

Firstly, the strategic alignment was poor, both internally and also towards the targeted OEMs.

Secondly, striving to conduct a technology-push innovation process is always a risky enterprise for an automotive supplier, even more so when it's targeting a non-core product area. It is crucial to address the need for extensive advanced marketing activities to make sure that the supplier's idea can be embedded into the customer's innovation road map. This didn't happen in this case, which was one of the major causes for the lack of interest among the OEMs in spite of the attractive technical concept of the invention.

Finally, the lack of an adequate supporting culture or management support made the failure of this innovation almost inevitable.

4.1.6 Semi-Radical Innovation: The M1 Motor and the Unit Injector System from Steyr-Daimler-Puch AG

a) Profile of Supplier

Company Profile Steyr-Daimler-Puch AG

The Steyr-Daimler-Puch AG was founded in 1934 after the successive merger of three companies; the Steyr-Werke AG founded in 1864 as an arms factory and sawmill, the Puchwerke AG founded in 1899 as a bicycle factory and the Austrian Daimler-Motoren-Gesellschaft a subsidiary of the German car manufacturing company Daimler-Motoren-Gesellschaft founded in 1899. In 1998 Magna International Inc. acquired the majority of the Steyr-Daimler-Puch AG, and in 2001 the Magna Steyr AG & Co KG was founded.

Today, Magna Steyr is a fully owned daughter company of Magna International providing engineering services, complete vehicle production, systems and modules, operating in 13 countries worldwide[150].

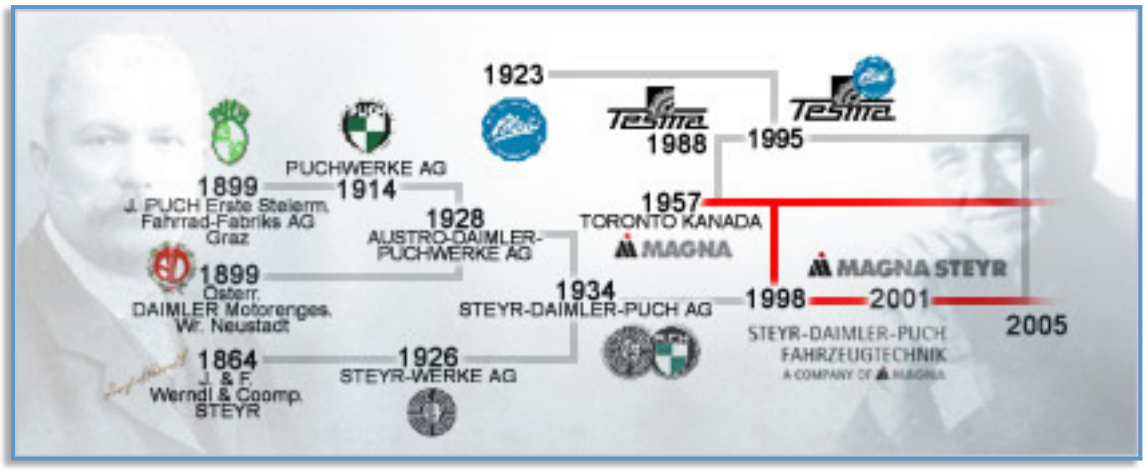


Figure 58: History of MAGNA STEYR[151].

b) Description of Innovation Management Case

Product Invention

Steyr-Daimler-Puch had the idea of improving diesel engines to make them suitable for passenger cars. At that time, they were more fuel-efficient than the normal fuel motors, but had the disadvantage of being very loud and producing malodorous emissions. They were considered inadequate for high-level passenger cars.

Around the years 1953 and 1954, direct injection technology was introduced to small diesel motors which provided a further reduction of about 20% in fuel consumption. In the 1970's Steyr-Daimler-Puch, together with the Austrian supplier AVL, had the idea of developing a direct-injection motor for passenger cars. At that time, this was considered a very visionary idea since all the experts thought that the direct-injection motor, in spite of its low fuel consumption levels, would never be accepted in a passenger car due to the combustion noise and general motor characteristics.

Because of its promising advantages in performance, the two companies decided to take the risk and began the development of what would later be called the M1 motor, a mono-block high-speed direct injection diesel engine specifically developed for use in passenger cars. The two companies recognised that several changes needed to

[150] Source MAGNA access date 04.09.2009

[151] Source MAGNA access date 04.09.2009

be made in order for this innovation to be successful; first it had to become a more dynamic high speed engine; second the acoustic problem had to be solved and third, and most relevant, the emission problem had to be mastered.

To improve the emission characteristics of the motors, a high-pressure injection solution was needed. The existing solutions at that time, mainly produced by the company Bosch were in-line or distributor solutions which were very cost efficient and reliable products but only provided pressure levels of 400-500 bar for the distributor and 700-800 bar for the in-line injection pumps. To solve the emission problem a level of more than 1000 bar was needed. The technical solution chosen was the development of the unit injector system (UIS) combining the injector nozzle and the injection pump in a single component. UIS were already in use for commercial vehicles and ship engines but only in a low-pressure version and in sizes that were not feasible for a passenger vehicle application.

After the first M1 prototypes the concept was believed to be very promising, and a joint venture with BMW, the BMW Steyr Motoren GmbH was founded in 1979 to further develop the prototypes until they reached the necessary series-production readiness.

The key technical solution needed was to develop an injection system based on the UIS-approach of small size, but capable of handling much higher pressure than the existing solutions. To minimize the risk, BMW asked another supplier, the leading injection system producer of that time, to conduct a technical feasibility study regarding the construction of a low volume system able to handle twice the pressure of existing unit injectors. They officially stated that, due to material constrictions, such a small size, high-pressure system was technically unfeasible. It is not clear whether the supplier really believed it was not feasible or whether the response was a tactical attempt to stop an innovation that would have jeopardized their existing injection business.

This negative recommendation in combination with a delay in the initial development plan led BMW to stop their development activities of the UIS. In spite of the high risk linked to this development the Steyr management decided to continue alone with the development project. Due to the fact that most of the developers involved in the project stayed with BMW, the Steyr management had to make a second risky decision, assigning the task of developing the UIS to the non-automotive engineering team of a recently acquired precision mechanics company. Not having any

automotive experience proved to be a huge advantage since this team ignored all prejudices and developed an out-of-the-box technical solution including the utilization of new materials that had never been tried out in an automotive motor environment. This innovative approach allowed them to develop a functioning prototype for a unit injector system according to the required specification within two years' time.

Although the injection problem was solved, the success of the M1 motor for large series was limited in the end by the necessity of a mono-block design, where the cylinder head and the cylinder block were cast together. This design made all existing transfer lines for motor work obsolete, since the honing of the cylinders would only have been possible from one side.

Nevertheless, although the invention itself was not successful, the M1 motor today is considered to be the technical father of all modern diesel motors in light commercial cars and played a key role for the acceptance of diesel motors in the premium segment. In those times, it was inconceivable that a premium car would have a diesel engine, nowadays a diesel engine is the motor of choice for a large portion of the vehicles produced in the top-luxury segment by Audi, BMW or Mercedes.

Commercialisation

After having managed to overcome all technical obstacles and successfully invent a new kind of UIS that made the idea of the M1 motor feasible, Steyr had to face several additional hurdles to the commercialization of their invention. They soon realised that there was no market for a new motor. Volkswagen and Daimler, which were the main users of diesel engines, already had their own solutions, and, since at that time, motors were considered to be key differentiating core competence of automotive OEMs, they were not interested in buying a motor from an automotive supplier.

After realizing that they had made a good technological invention but faced a major problem, namely that there was no market for the product, the Steyr management opted for a different marketing approach and, instead of aiming to sell a complete motor, focused on commercialising some of the single technologies they had invented in the process of developing the motor. The UIS was licensed to other suppliers, among them Bosch, who improved the concept regarding the industrialisation and became very successful selling the concept to Volkswagen (VW) who, in turn, built all their direct injection diesel engines with the UIS until their late change to the common rail technology. The M1 motor itself was never used on a big

scale in the lightweight automotive industry but it is still being used for marine solutions and special vehicles.

The revenues generated through the licenses were significant, making this without question one of the largest intellectual property-based businesses in the history of the Austrian automotive industry. The total amount of license fees was not only enough to cover the complete development costs for the UIS, but also paid for a significant part of the M1 motor costs.

c) Key Innovation Results and Main Success / Failure Factors.

The targeted innovation of developing a direct injection diesel engine for passenger cars was not successful. However, from a technical perspective, the M1 motor represented a great step forward since, contrary to the negative expectations of most experts at that time, the technical problems could be solved. From a commercial perspective it was not a success; the developed solution didn't find noteworthy commercial application in the light passenger car market.

Considering the unit injection system as a single innovation project, it can be seen as a success. Not only was the technical progress significant, but also the commercial success for Steyr-Daimler-Puch. The fact that the invention itself was not produced by Steyr-Daimler-Puch and sold as a part of a complete motor as originally planned but marketed through license fees, points to the significance of alternative marketing approaches for automotive suppliers, in order for them to become successful innovators.

The main hurdle to the successful innovation of the M1 motor was the non-existent market for complete motors. After BMW had lost interest in this solution, it was almost impossible to convince other OEMs to apply the technology. From a market strategy point of view, developing a complete engine was a very risky idea, since most OEMs at that time considered the development and production of engines to be one of their core competences and the key differentiator of their products. From a technical point of view, the main hurdle to the successful commercialisation was the indirect costs passed on to the OEMs by the integration of the product into their production process, something that was not part of the initial specification, but later became a clear KO factor for the large scale implementation of the motor.

On the other hand, the key success factors for the UIS innovation were the very innovation-friendly culture of Steyr-Daimler-Puch and their flexible commercialization approach.

The innovation-friendly culture linked to the uncompromised commitment of the top management helped the project even through the critical phase when the targeted OEM customer lost faith in the technical concept and withdrew from the joint project. Another facet of this innovation-friendly culture can be seen in the fact that a team with no automotive experience was assigned to the project of developing the system. Their technically unbiased approach helped them to find new solutions for problems that were hitherto believed to be unsolvable.

Commercialising single system elements after the failure of the M1 motor as a whole proved to be an optimal solution and can be even considered a successful example of an open innovation approach.

d) Analysis of the Suppliers' Innovation Management Approach Regarding Innovation Strategy, Portfolio, Process, Supporting Culture and Marketing Mix

As described in the previous section, the Steyr-Daimler-Puch case study can be analysed from two perspectives, one focusing on the reasons for the commercial failure of the M1 motor development and the other, understanding the key factors of the successful commercial licensing of the UIS invention.

Innovation Strategy

Regarding the M1 motor development, Steyr-Daimler-Puch had a clear strategic understanding of the BMW market scope strategy, but not of the other OEMs. Initially, it seemed like the strategy was well synchronised to the market needs, the foundation of a joint venture (JV) was a clear sign of commitment. However basing so much investment upon the support of just one customer is risky, and it proved to be the wrong decision, because when BMW withdrew from the project, it was commercially doomed.

The strategy of marketing single innovative system elements instead of the complete motor, combined with the use of alternative commercial approaches, like using a licensing model for the UIS, was a good idea and a key success factor. In the end this compensated for a large portion of the development costs for the complete motor. The business case for the UIS alone was a great commercial success and

can be considered a good example of a successful innovation project in the automotive supplier industry.

Innovation Portfolio and Process

The M1 Motor project started as a market-pull project based on the idea of BMW developing consumption efficient diesel motors; the approach was cascading and well synchronized. When BMW lost confidence in the technological solution chosen by Steyr-Daimler-Puch, this whole situation changed. After losing the target customer, it suddenly became a technology-push process and Steyr-Daimler-Puch had to realise that there was no market for their product. The absence of advanced marketing was one of the main contributors to the project's failure: it would have given them an early indication that of the few OEMs interested in the diesel technology, they were not interested in using an externally developed engine at all.

The commercialization of the UIS in turn followed a typical technology-push approach. Based on an in-house development, Steyr-Daimler-Puch started looking for customers to whom they could market their invention. Their systematic approach helped them to identify other suppliers like Bosch as the most suitable clients for their products and the innovative approach of choosing a licensing model laid the foundation for the unplanned but very successful innovation project.

Innovation Culture

Regarding the culture there are no differences in the case of the M1 motor development or the UIS. In both cases the innovation-friendly environment and full support throughout top management were decisive for the successful invention and for overcoming all technical hurdles. Key characteristics of this innovation friendly culture were:

- the confidence and perseverance to continue supporting and funding a project even when facing unexpected new hurdles, like the loss of the main targeted customer,
- the audacity of pursuing a solution counter to the existing expert opinion that there was no solution for a specific technical problem,
- the courage to forge completely new paths such as assigning the development to a development team with no automotive experience,
- the creativity of finding new approaches and solutions like choosing a completely different commercialization strategy.

This case study emphasizes the key importance of the corporate culture in innovation. Having the right culture can create an environment that allows people to convert a failed project into a success story.

Innovation Marketing Mix

The M1 Motor is yet another example of a purely technology-lead innovation project without a proper supporting marketing approach, which was one significant factor in its ultimate failure. The commercialisation of the UIS on the other hand is a brilliant example of creative marketing: using the existing know-how to create a new product out of the single developed components and, defining a license price model using an existing technology resulting in a business model innovation.

e) Findings Regarding Suggested Model

H1 & H2 Market Scope and Innovation Strategy

The initial strategy and market scope alignment to the targeted OEM was defined and was certainly a success factor during the initial phases.

H3, H4 & H5 Innovation Process Portfolio: Market Pull & Technology Push

Similar to the Schefenacker case study, the change from market-pull to technology-push was a breaking point for this innovation. Having neither performed any advanced marketing work nor having had a synchronised approach to other OEMs lead to the poor commercial results of the M1 innovation are not surprising.

H6 Innovation Culture

The culture supporting this project was ideal, since it was creative enough to explore new paths and, at the same time, provide enough structure and discipline to help overcome the various technical challenges the innovation project encountered. Finally, the ability to totally change the scope of the innovation and switch to marketing single components would not have been possible without the appropriate cultural environment.

H7 Innovation Marketing Mix

It is not ideal to rely too much on a single OEM without having one's own solid marketing view and concept for an innovation, as seen in other examples. Even a

great technological invention needs appropriate marketing support to be successful on the market.

f) Summary

The Steyr-Daimler-Puch M1 and UIS case study illustrates in a very impressive way the challenges that automotive suppliers face when trying to create innovations. Even when they manage to bypass severe technical hurdles and overcome challenging problems to create a new, unexpected technical invention, there is no guarantee that it will have a chance to prove itself in the market if they don't consider all the different dimensions of the innovation management business architecture. Then again, it is also an encouraging example for other suppliers that, provided they have the right culture, even a very disappointing failure can be converted into a partial success story as demonstrated by impressive commercial success of the UIS.

On a side note, it should also be mentioned that the M1 project not only impacted on the results of Steyr-Daimler-Puch, but also had macro-economic importance for the Austrian automotive industry since it was the initiator of the BMW Steyr engine production plant. This is now a crucial structural element of the automotive footprint, not only in the weakly industrialized region of Upper Austria but also in the entire Austrian automotive industry.

4.1.7 Radical and Semi-Radical Innovation: Viscous-Clutch and Business Model Innovation by Steyr Daimler Puch GmbH (later Magna Steyr Fahrzeugtechnik)

a) Profile of Supplier

Already described in the preceding section.

b) Description of Innovation Management Case

Due to the serious downturn of the bicycle- and motorcycle-production in the late 80s, the financial situation of the company in Graz was heavily challenged. The strategy of the new management in 1990 was to shut down the unprofitable two-wheeler-production and increase the automotive business. The existing engineering capacity with highly experienced engineers was regarded as a door opener to different OEMs. Although the idea was not new, there were already other competitors offering engineering services, Steyr-Daimler-Puch had a great asset due their all-wheel-drive competency based on their famous off-road models Haflinger, Pinzgauer

and the Mercedes/Puch G-Modell. The production of these vehicles in the Graz factory was another important asset on the production site.

The management strategy was to first use these engineering capabilities to increase complete vehicle production, and then, after the integration of the Steyr-Daimler-Puch into MAGNA, to increase the existing modules engineering and production capabilities in cooperation with other MAGNA groups.

Product Innovation: Viscous Clutch

The viscous clutch is used in the drive train of automobiles. It transmits in its center a circular motion from a package of discs on the entry side via a silicon liquid that in turn moves another disc package on the exit side of it. This construction makes the transmission of circular motion under compensation of different number of revolutions possible. In an all-wheel-drive vehicle one axle of the car is permanently driven by the motor, the second axle can be additionally driven when needed but without a center differential. The viscous clutch is positioned between the font- and rear-axle to compensate different rotational speed between the axles.

The particular characteristic of the viscous clutch is that, as the number of revolutions increasingly differs between the two disc packages, the clutch stiffens so that both discs nearly rotate at the same speed. Used in an all-wheel-drive car this means that the viscous clutch automatically distributes the power between the axles. Under normal conditions all power is applied to the main axle and only when their wheels start to slip will the viscous clutch distribute power to the secondary axle.

The idea to develop such a system was born after Steyr-Daimler-Puch received the order from Volkswagen in 1982 to develop a very cost efficient all-wheel-drive solution for the T3 transporter. Prof. Jürgen Stockmar, CTO of the Steyr-Daimler-Puch, and Prof. Reinhard Seiffert, Vice president engineering of Volkswagen, had the idea to develop a permanent all-wheel-drive solution using a viscous clutch solution instead of the manual shift all-wheel-drive system that VW had used so far. The idea for the viscous clutch itself existed patented since 1917 but could not been realized at that time since there were no appropriate liquids available for use. Later, after World-War II modern silicon oils were developed and could be used for the viscous clutch. At the start of the development of the T3, there was not a feasible working solution for large-scale automotive application.

Although some of the experts at Volkswagen were skeptical, the development was very successful and the all-wheel-drive T3 model “Syncro” was introduced in 1984 to the market. Steyr-Daimler-Puch produced more than sixty thousand vehicles in Graz. The image of Steyr-Daimler-Puch in Graz of being the “Mecca” of the four-wheel-drive technology was mainly created by the invention of the viscous clutch. Development orders for the engineering team of Steyr-Daimler-Puch Fahrzeugtechnik from Honda, Fiat, Mercedes Benz, Chrysler and Nissan followed.
All OEMs placed production orders parallel or after the development phase of the Graz company thus enabling the management to increase the number of employees to over 6000 during the best production phases.

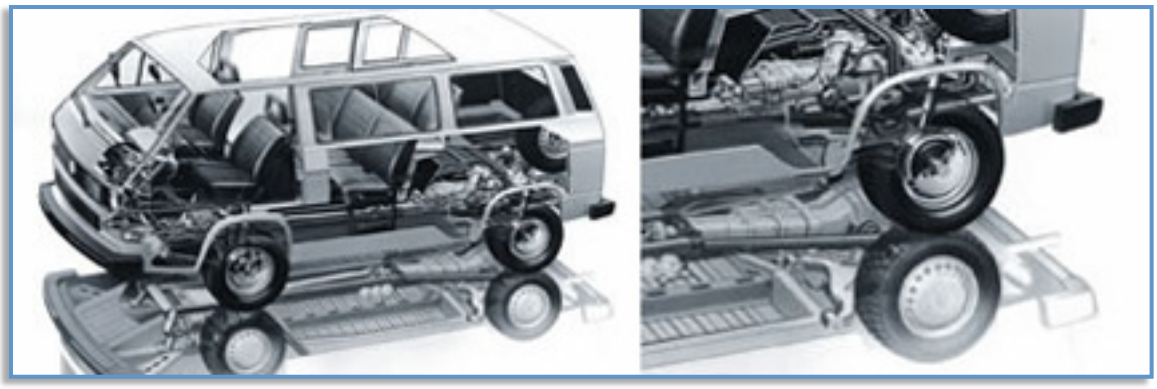


Figure 59: VW T3 Cross-Country Van[152].

Business Model Innovation: Complete Car Engineering and Vehicle Production

Due to financial difficulties, Steyr-Daimler-Puch had to sell most of their product lines in order to avoid bankruptcy. The ingenuity of all-wheel-drive technology was recognized as the most important asset the company had. This knowledge was based on their experience building the off-road vehicles Haflinger and Pinzgauer, which were developed to meet military standards. In 1973 Daimler-Benz AG and Steyr-Daimler-Puch AG agreed to jointly develop and build an off-road vehicle. A joint venture was established in 1975 and production began in 1979 in Graz. In 1981 the JV Company was then wound up, Daimler-Benz focused on further development and sales and Steyr-Daimler-Puch on production. The G continued to be sold as a Mercedes or Puch, depending on the market. Manufacturing contracts with Daimler AG have been renewed for the continued production of Mercedes-Benz's G-Class at Magna Steyr's facilities in Graz, Austria, until 2018. The Magna International division in Graz has made about 200,000 vehicles over 30 years.

[152] Source MAGNA access date 04.09.2009

Figure 60: Puch / Mercedes G[153].

Despite the success of the G-Class, the VW T3 project was done as a pure supplier providing complete vehicle engineering and production in Graz for an OEM, which would later become the main business model of Steyr-Daimler-Puch and later Magna Steyr. After that, further production orders for complete vehicle production in Graz for VW and Mercedes but also for other OEMs could be won, all of them originated by engineering work based mainly on the all-wheel-drive capabilities of the company. Examples include the Jeep Grand Cherokee (since 1994), Mercedes-Benz M-Class W163 (1999–2002), Volkswagen Golf Country (1990–1991), Mercedes-Benz E-Class 4MATIC (1996–2007) Chrysler Voyager (1991–2007; prior to 2002 the Eurostar site belonged to Daimler-Chrysler), BMW X3 (2003-2010), Chrysler 300(2005), Jeep Commander (2006) and the Saab 9-3 convertible (since 2003).

In 2006 a production record of 248,000 vehicles was manufactured at the plant in Graz. In 2007 MAGNA STEYR won the Best Innovator contest organized by A.T. Kearney, mainly due to their efficient process control system in development, but also due to their innovative product ideas for the market.

Business Model innovation: Module Supplier

After their successful business model innovation in the area of complete vehicle engineering and production, the management of what is now Magna Steyr wanted to extend their successful model and include the other MAGNA groups to engineer and produce complete modules and systems for the automotive OEMs instead of offering only components and parts.

[153] Source MAGNA access date 04.09.2009

Based on their own capabilities and a series of alliances with other suppliers, a road map was defined to position MAGNA as a supplier for modules & systems for complete doors, roof modules, cockpits and in the area of electrics / electronics.

The strategy, however, could never be implemented; it was in compatible with the decentralized cultural and overall organizational approach of the MAGNA groups and the owner of the company who didn't believe in the future of modules.

This may be speculation, but there are some hints that a significant chance was missed by not executing this innovation strategy, considering for instance the success that other suppliers like Brose, had with their module strategy. Today they are the dominant player in the area of door modules. Although their original content was only a window regulator, they now successfully produce and supply complete doors to some of their OEM customers. Another example Is Webasto and their roof modules production.

c) Key Innovation Results and Main Success / Failure Factors

Viscous Clutch

The viscous clutch innovation was a huge success, not only because of its great technical performance and commercial results but also because it laid the foundation for the successful development of Steyr-Daimler-Puch and later on Magna Steyr as a leading expert supplier for all-wheel-drive technology.

Key success factors for the innovation were:

- Having an ambitious but realistic vision of the product and its targeted technical performance. The team knew that it had to deliver significant technical improvements and at the same time dramatically reduce the system costs. Before the first technical concepts were ideated, the performance and commercial target framework was defined by the development team.
- Using experts with a broad base of knowledge about existing technology, and the creativity to use it in a new context. Developing a working viscous clutch to provide a cost efficient all-wheel-drive system was a creative idea. Applying an existing idea in a new context and combining it with the latest technical developments, in this case new materials.
- Having a management culture based on the right "gut-feeling" for what is possible and the necessary courage to take some risks and try to solve

problems that had existed for a long time by using new ideas and developments.

Complete Vehicle Engineering & Production

The business model innovation of Steyr-Daimler-Puch, respectively of Magna Steyr, was a full success. Their transformation from a manufacturer of small motorcycles to becoming a supplier able to engineer and produce complete vehicles was not only a major organizational innovation success but also very commercially successful.

Key success factors were the clear strategic direction based on a unique technical differentiating factor, the all-wheel-drive capabilities and the top management support to adopt this new strategy. It was also a crucial factor that their approach matched the OEMs' need for engineering services to create all-wheel-drive versions from existing programs and for flexible production capabilities of small series.

Module & System Supplier

The targeted business model innovation of positioning Magna Steyr together with other MAGNA groups was not successful. With very few exceptions, Magna is still a component supplier and the number of cross-group product offerings is very limited.

The main hurdles to the successful realisation of this strategic business model innovation were the lack of top management support on the group's side and the poor cultural match between this strategy and the decentralised culture and organisation of Magna.

d) Analysis of the Suppliers' Innovation Management Approach Regarding Innovation Strategy, Portfolio, Process, Supporting Culture and Marketing Mix

Viscous Clutch

Innovation Strategy

The strategic approach of Steyr-Daimler-Puch was very well synchronised with the overall innovation strategy of VW. The strategic goal of developing a new cost efficient all-wheel-drive was clearly defined and of mutual interest. This good strategic fit gave Steyr-Daimler-Puch the freedom to propose innovative but risky solutions like developing a viscous clutch and was certainly one key success factor for the innovation.

Innovation Portfolio and Process

The idea of the viscous clutch innovation was conceived by Steyr-Daimler-Puch to fulfil the need of VW for a cost efficient all-wheel-drive solution. The overall innovation process was also driven by market pull.

To have one clearly defined target customer with a well-formulated need, who was also willing to pay for the development of the suppliers' innovation as part of its own innovation process, was an ideal circumstance and clearly one key success factor for this innovation.

The process itself was informal and driven by individual initiatives rather than following a previously defined structure.

Innovation Culture

The fact that the idea for the innovation was generated at the top level of management of Steyr-Daimler-Puch provided a perfect cultural environment for the innovation to flourish. It encouraged all the team members to use creative ideas to solve all upcoming challenges and also provide the right amount of discipline to make sure that all creative ideas were properly executed.

Innovation Marketing Mix

As a pure market-pull generated innovation with deep customer involvement, the marketing mix was not relevant for this program.

Complete Vehicle Engineering & Production

Innovation Strategy

The strategy was very well synchronised; on a market scope level it was a good decision to build the new business model based on their all-wheel-drive expertise. Primarily because it was a clear differentiator against other possible competitors, and secondly because there was a growing market demand for all-wheel-drive solutions, for which many OEMs lacked the resources necessary for developing their own solutions. Finally, from a pricing perspective, for a high-cost production facility like Graz, it was an optimal approach to target a high-price system like the all-wheel-drive solutions from a high-perspective all-wheel-drive vehicle.

From the innovation strategy perspective, the match was also excellent with the targeted customers looking for solutions in precisely this technological area.

Innovation Portfolio and Process

The process was a supplier triggered technology-push innovation. Due to their extensive experience in the all-wheel-drive area, Steyr-Daimler-Puch / Magna Steyr had a deep understanding of the targeted market and OEM needs. This experience was based on and supported by extensive advanced marketing activities to convince other OEMs to give them orders, first for engineering work that was in almost all cases the basis for the complete vehicle production orders they later received. This approach was clearly a key success factor.

Innovation Culture

The strong commitment of the top management to the all-wheel-drive technology focus and the new business model was another key success factor that made this successful innovation possible.

Innovation Marketing Mix

Magna Steyr did an excellent job promoting their new service line. It managed to create its own brand and gain a significant level of recognition within the industry.

Module & System Supplier

Innovation Strategy

When MAGNA tried to expand their business model to become a full module supplier, the approach was well synchronised to the targeted OEMs. Those of them following a modular strategy were interested in outsourcing the development and assembly of larger modules.

Innovation Portfolio and Process

Magna Steyr again pursued a technology push approach and the process was well synchronized with the targeted OEMs.

Innovation Culture

The main reason for the failure of this innovation was the lack of supporting culture. This project was started after the acquisition through MAGNA, which had a different strategy based on operational excellence as opposed to technological differentiation.

The top management support for developing risky and resource intensive innovative offerings was less than it had been in former times. Also, the decentralised structure of the company created a culture that was not supportive of large centralised projects like this one.

This lack of top management support was the final reason for the failure of this innovation project.

Innovation Marketing Mix

The Magna team did a very good job studying the market, defining suitable targets and defining their product. Through a network of new strategic alliances with other suppliers, they could complete their offerings portfolio and very efficiently promote their new product.

e) Findings Regarding Suggested Model

H1 & H2 Market Scope and Innovation Strategy

For the two successful innovations, the viscous clutch and the vehicle engineering, the good alignment of strategy to the targeted OEMs was key. For the failed module innovation, the poor internal strategic alignment within Magna caused the innovation's failure.

H3, H4 & H5 Innovation Process Portfolio: Market Pull & Technology Push

Magna Steyr's innovation portfolio management was exemplar. Based on a successful market-pull innovation (the viscous clutch), they systematically targeted innovations that followed as technology-push aiming always for a higher level of innovativeness until they finally managed to implement a completely new innovative business model. The synchronization and link to the targeted OEMs was constantly good and a significant success factor.

H6 Innovation Culture

The original innovation-friendly Steyr culture paired with the result-oriented Magna mind-set was initially a winning combination. However, when they tried to extend it to other groups, this delicate balance was lost, and the lack of an appropriate innovation-supporting culture was the main reason for the failure of the planned modules innovations.

H7 Innovation Marketing Mix

Magna Steyr did an excellent job promoting their new offering. They managed to create a very strong supplier brand and gained a lot of activities from their targeted customers.

f) Summary

This case study clearly illustrates the important role that the innovation strategy, process and culture factors play regarding the success of an innovation. It is also a good example of how an innovation that was initially successful can lead to subsequent greater success. It also shows the possibilities that suppliers have when they concentrate not only on technical product innovations but also employ a wider strategic innovation approach.

4.1.8 Radical and Semi-Radical Innovation: Auto Dimming Electrochromic Glass by Gentex and Donnelly

a) Company Profiles

Gentex Corporation

Gentex was founded in 1974 as a manufacturer of fire protection units. The company went public in 1981 to raise funds for the development of a new product line, the automatic dimming inside mirror. In 1982 it introduced the first motorized electromechanical mirror. Its final breakthrough was in 1987 when they created the first electrochromic mirror.

Today, Gentex is a global company with annual revenues exceeding $500 million, with approximately 96% of the company's revenues generated in the automotive division[154]. Gentex is the market leader for auto dimming mirrors and has been one of the top financial performing companies in the automotive industry. With a market capitalisation of about $ 2.7 billion, it currently has the same market value as the TRW automotive group, which has a yearly revenue of more than $ 11 billion, and on the stock market has outperformed the Dow Jones Index (DJI) and publicly listed industry leading competitors like Magna (MGA), Lear (LEA), Johnson Controls (JCI) and Borg Wagner (BWA) as shown in the following chart.

[154] Data Source GENTEX access date 21.12.2010

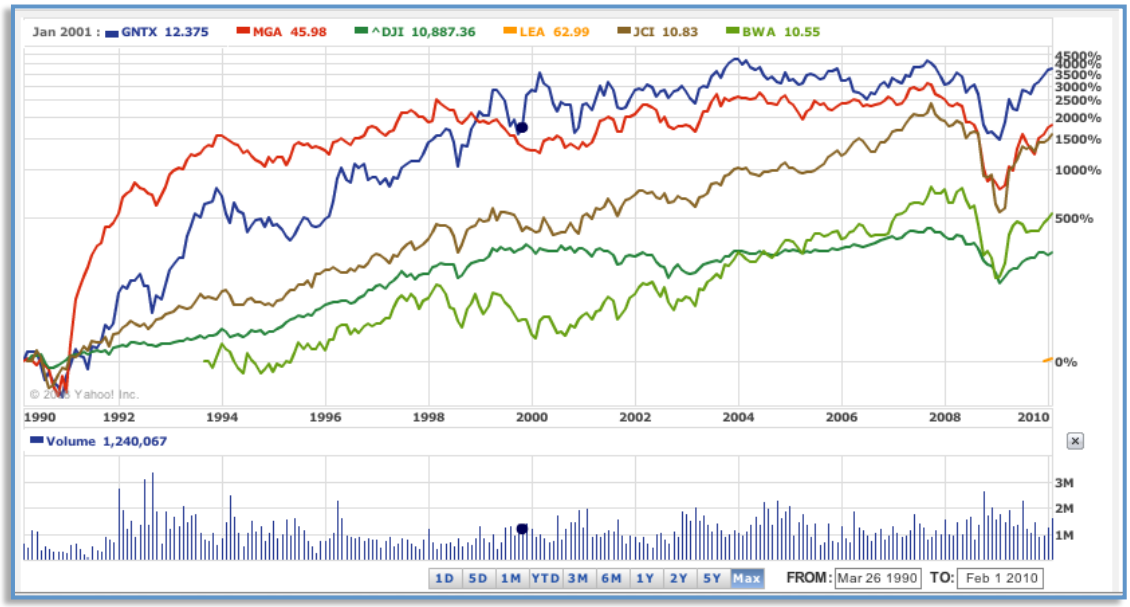


Figure 61: Stock market performance of Gentex vs. selected suppliers.[155]

Donnelly Corporation

The Donnelly Corporation, now Magna Donnelly, was previously described in the outside mirror case study. It is currently the world volume leading automotive supplier for inside mirrors, annually producing over 26 million inside mirrors worldwide.

b) Description of Innovation Case

Product Description: Anti-Glare Inside Mirrors

When driving by night, the lights of the headlamps from following vehicles can blind car drivers. Prismatic mirrors, made of a piece of glass that is wedge-shaped in cross section - i.e., its front and rear surfaces are not parallel - have been used in the automotive industry since the beginning of the 1970s to reduce glare. In the day view position, the front surface is tilted and the reflective backside gives a strong reflection. When the mirror is moved to the night view position, its reflectorized rear surface is tilted out of line of the driver's view. This view is actually a reflection of the non-reflectorized front surface. Since the non-reflectorized front surface allows most of the light to go through, only a small amount of light is reflected into the driver's eyes.

[155] Source YAHOO Access Date 08.10.2010

An automatic alternative to the prismatic mirror using electrochromic (EC) technology has existed since the late 1980s. Electrochromism is the phenomenon displayed by some materials of reversibly changing colour when a burst of electric charge is applied. In their current product, for instance, Gentex uses a sandwich of electrochromic gel between two pieces of glass, each of which has been treated with a transparent, electrically conductive coating, and one with a reflector. Two sensors control the function of the mirror: a forward-facing that recognizes low ambient light levels and signals the mirror to begin looking for glare and a rearward-facing sensor, that detects glare from the vehicles behind the driver, sending voltage to the mirror's EC gel in proportion to the amount of glare detected. The mirror dims in proportion to the glare and then clears when the glare is no longer detected. The following picture taken from the Gentex web site[156] gives an overview of the typical setup.

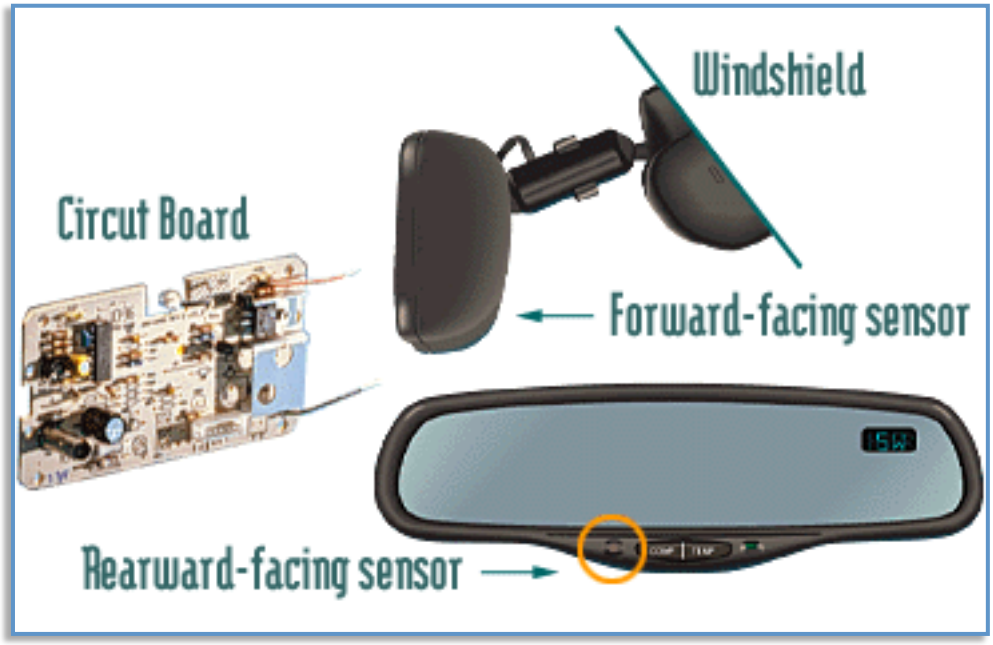


Figure 62: Anti glare mirror set-up[157].

Donnelly uses a different EC technology, but the same setup. Their EC mirrors contain no liquid or gel substance but a solid polymer matrix. They claim to have a safer, more reliable product since there is no leakage, and the mirror functions for a longer period of time, even if the glass is cracked.

[156] Source GENTEX access date 21.12.2010

[157] Source GENTEX access date 21.12.2010

Product Development History

Gentex and Donnelly originally began working together to develop an electrochromic anti glare mirror as a typical technology push innovation project. Very soon, however, the partnership ended, and both companies continued individually to develop their own solutions. When Gentex first announced the electrochromic mirror in 1986, it was hailed as a technological breakthrough. Gentex officials noted that it was the first time a practical product had been made using electrochromic technology, which had been in existence for about 40 years. In 1987 Gentex finally introduced the first world's first electrochromic auto-dimming rear view mirror.

When years later Donnelly presented their EC solution, Gentex was suspicious and after investigating further, believed that Donnelly's product was simply a copy of the Gentex mirror. Gentex sued Donnelly in May 1990 for patent infringement, claiming that Donnelly's recent products were infringing on its patents for electrochromic mirrors. After a lengthy series of suits and counter-suits, the parties reached a settlement in 1993, in which Donnelly agreed to pay Gentex $3.6 million in damages, which took a sizable bite out of their net income for that year.

c) Key innovation Results and Main Success / Failure Factors

Taking a look not only at the financial success reflected in the earnings and market validation but also measured by the 95 % market share they achieved for EC inside mirrors globally, it is clear that Gentex was much more successful and innovative than Donnelly. The decisive factor for the success of Gentex was not the technical performance of the product but the better innovation approach, which they converted into a dominant share position, allowing them to use economies of scale effects to offer a more competitive price than Donnelly and maintain their leading position. Based on these results and due to their dominant market position, Gentex has secured a unique position in the supplier industry and is considered to be one of the industry’s most successful innovators, which is why it is legitimate to consider their innovation as radical within the automotive supplier industry. Donnelly, on the other hand, not only incame second on the market, but failed to replicate Gentex’ business success. Although they were the only alternative solution for auto dimming mirror technology, they did not manage to leverage this position and had to follow the usual supplier business model suffering the “normal” commercial pressure through the OEMs.

d) Analysis of the Suppliers' Innovation Management Approach Regarding Innovation Strategy, Portfolio, Process, Supporting Culture and Marketing Mix.

Innovation Strategy

Both companies followed an aggressive first-to-market strategy. Coming from the electronics industry, Gentex wanted to penetrate the automotive inside mirror (ISM) market as a new entrant. Donnelly, as the market leader for ISM wanted to develop a feature to enhance the value of its products. They both had a clear strategic advantage over other mainly European competitors, which were not following an aggressive innovation strategy.

Their strategic approach was well synchronised to the strategy of their customers, who were looking for a solution to increase their consumers' comfort.

The main difference between the two is that while Donnelly tried to invent / develop everything on its own, Gentex focused instead on "spotting" new technologies to apply them to their products, recognising rather than inventing.

Innovation Portfolio and Process

Both companies pursued an innovation process triggered by technology push. They were well synchronised to their customers. The advantage on Gentex' side was merely the realisation phase: coming from the electronics side of the business, they put much more focus on the appropriate industrialisation of the process than Donnelly did. So when both solutions were on the market, although the products themselves were comparable, the main difference was that Gentex had a large advantage in the lower production process costs and better yields rates. This advantage gave them a head start in the market and enabled them to develop further improvements using economies of scale.

Innovation Culture

Both corporations shared an innovation-friendly culture supported by their boards and top management. This produced a creativity friendly environment for both that encouraged the creation and development of new ideas. However, only Gentex had the right balance of freedom to create and discipline to execute, which enabled them to enter the market first and not only maintain but expand their advantage.

Innovation Marketing Mix

Both companies applied various advanced marketing tools. The product was well defined and so was the targeted market. The main differences between both companies' approach were in the areas of promotion, place and pricing. Donnelly used a traditional supplier approach with a typical key account sales organisation trying to market their complete inside mirror product range without much additional promotion activity. Gentex, on the other hand, put an organization in place that was completely dedicated to the marketing of this innovation. They also followed a more aggressive promotion approach for instance even using traditional advertising in specialised magazines and papers to generate demand for their auto dimming mirrors.

A remarkable aspect of Gentex' promotion approach is that they tried to influence car-dealers and end consumers to increase the take rate of auto dimming inside mirrors as an extra.

As the first-to-market supplier, Gentex was able to implement a very successful skimming strategy, managing to obtain very high prices for their products and avoiding concessions like rebates or market entry fees. Donnelly, as the follower to the market, was not able to match the strategy of Gentex. They had to offer their product at a lower price, and were not able to avoid being commercially leveraged by the OEMs, who asked for price reductions based on the total business volume they had with Donnelly.

e) Findings Regarding Suggested Model

H1 & H2 Market Scope and Innovation Strategy

Both companies were following a differentiation strategy supported by a play-to-win innovation approach that was well aligned to their targeted customers. As Gentex was the first to market supplier, they were able to take advantage the most of this success factor.

H3, H4 & H5 Innovation Process Portfolio: Market Pull & Technology Push

Gentex' innovation portfolio was completely focused on technology-push innovations. Donnelly also targeted development of some market-pull innovations. Having a pure technology-push portfolio was very risky, but since they managed to introduce theirs to the market first, it paid off. For Donnelly, it was good that they had other less risky

innovations in their portfolio: as second-to-market supplier, they would have been in an uncomfortable position, had they placed all their bets on only one horse.

From a process perspective, both suppliers had a well-synchronised approach. However the superior advance marketing activities of Gentex coupled with their better marketing skills, helped them to lower the acceptance hurdles on the OEM side improving their synchronisation to their innovation process. This was an important success factor.

H6 Innovation Culture

Having a culture that was not only innovation-friendly but also result-oriented, helped Gentex to beat Donnelly to the market. This was without doubt a major contributor to their success.

H7 Innovation Marketing Mix

Aside from the previously mentioned advantages of having a more effective sales channel, better promotional skills and the better pricing approach, Gentex also had a better understanding for the scope of the product they were innovating. The fact that they didn't only focus on developing a new feature but included the production process as part of their innovation, aiming to reduce product costs and optimise their yields, prove to be crucial for Gentex. It helped them to maintain their competitive and market share advantages over Donnelly in spite of their aggressive pricing.

f) Summary

Donnelly was perhaps more inventive but Gentex was the more innovative and successful company. Developing a good idea is only one part of the equation, far more important is the execution and implementation. This case study also clearly underlines the importance that (industrial) process innovation has within the automotive supplying industry. As Prof. Dr. Göschel mentioned in a meeting with the author of this research work: "Everybody can copy a new product within months but it takes from three to five years to imitate an innovative process"

Gentex also provides a remarkable example of the fact that innovation success is not a random process dependent on luck. After their initial success, Gentex continued to follow their innovation strategy and using the proper innovation process supported by the right culture, Gentex has successfully developed and marketed an impressive number of innovations after the EC mirror, like the intelligent headlamp control or the

integration of compasses and garage door openers in the inside mirror. For many of these products, Donnelly also had its own solutions, but in most of those cases, they have not been as successful as Gentex.

4.2 Conclusions of the Case Studies

The following table gives an overview of the analysed case studies and their results regarding their overall strategic and innovation approach, their innovation success and the influence of strategy, portfolio and process, culture and marketing mix on the innovation success rate.

The first column lists the case studies described in the previous section, columns 2-4 describe the general strategic market approach, the level of innovativeness they were targeting and the main focus of their innovation portfolio / single innovation according to the model presented in Chapter 3. The columns 5-8 indicate the level of influence that every category of the model- strategy, process and portfolio, culture, and innovation marketing mix - had on the overall success of the innovation. Green means positive influence, yellow is neutral, and red indicates a negative influence. The last column uses the same colour code for evaluating the overall success of the single innovation case study whereby, following our definition, an innovation is only considered successful (green) if there is a completed invention that has been successfully commercialised. Yellow stands for only partially successful innovations and red for unsuccessful ones.

Innovation case Company / product	Intended Market Approach Strategy	Targeted Level of Innovativeness	Innovation Portfolio	Influence on overall Innovation Success: Strategic Alignment	Influence on overall Innovation Success: Process & Portfolio Synchronization /Allignment	Influence on overall Innovation Success: Supporting Culture	Influence on overall Innovation Success: Innovation Marketing Mix	Success Rate of Innovations (Invention + Commercialization)
Ficosa / OSM	Cost Leader	Incremental	Market Pull					
Magna Donnelly / OSM	Cost Leader	Incremental	Market Pull					
Cosma / Hydroforming	Cost Leader	Incremental	Technology Push					
Magna Mirrors / OSM	Stuck in the middle	Incremental – Semi-Radical	Market Pull					
Donnelly / OSM	Differentiation	Semi-Radical	Technology Push					
Hohe / OSM	Differentiation	Semi-Radical	Technology Push					
Schefenacker / OSM	Differentiation	Semi-Radical	Market Pull					
Auteca / Actuators	Cost Leader	Semi-Radical	Technology Push					
Magna / Distalight	Differentiation	Semi-Radical	Technology Push					
Steyr-Daimler-Puch / MI Motors	Differentiation	Semi-Radical	Market Pull					
Steyr-Daimler-Puch / UIS	Differentiation	Semi-Radical	Technology Push					
Magna Steyr FZT / Visco Clutch	Differentiation	Semi-Radical	Market Pull					
Magna Steyr FZT / Complete Vehicle Engineering + Assembly	Differentiation	Radical	Technology Push					
Magna Steyr FZT / Modules	Differentiation	Radical	Technology Push					
Donelly / Auto-Dimming Inside Mirror	Differentiation	Semi-Radical	Technology Push					
Gentex / Auto-Dimming Inside Mirror	Differentiation	Radical	Technology Push					

Figure 63: Overview of case studies (author's illustration).

One remarkable result that can be observed in this overview table is that all unsuccessful innovations have at least one “red”-factor. This is a strong indication of the importance of all the identified factors of the presented model, underscoring the relevance of the formulated hypothesis.

Other relevant findings of the case studies are:

- Many suppliers do not have a clearly defined strategy. They lack a clear strategic direction regarding their market scope and even more often they don’t have any strategy to guide their innovation management activities. Many of them are “stuck in the middle”.
- Due to the necessity of a creative approach for generating new ideas, invention is sometimes considered an art. Innovation management however is not. It requires a clear strategic and structured approach. “Free-style innovators”, meaning companies following a non-strategic and non-structured approach, will probably be only “free-style inventors”.
- For western automotive suppliers, not innovating is not an option; the market for innovation-free products is very small and has very tight margins. Additionally, suppliers that completely lack innovations are perceived as being generally poor in technological skills and not competent partners for complex products.
- Generally speaking, process innovations are more difficult to imitate and easier to commercialise than pure product innovations.
- Successful inventions do not always need to be based on technological break-throughs. More often they are created by the new combination of existing technologies or the use of such technologies in a different context. Incremental innovations, for instance, can have great potential just by using an existing technology in a different context.

Summary of Key Findings

The results of the various case studies analysed in this chapter clearly underline the specific challenges facing automotive suppliers when trying to be successful innovators. But they also show that, however challenging, it is possible to be a successful innovator within the automotive supplier industry. For each case analysed, this research work clearly identified the key success or failure factors of the corresponding supplier. Obviously, having the luck to develop the right idea at the right time is a very important factor that cannot be influenced. Nevertheless, there is enough evidence to suggest that being lucky is neither enough to be a successful innovator, nor to the contrary does lack of luck explain most of the failures.

➔ Automotive suppliers can improve their level of success through an appropriate and well-conducted innovation management approach.

As shown in an Accenture study evaluated by STOCKMAR[158] innovative companies are more successful than their less innovative peers since they are more profitable and manage to grow faster. The results of this research work show that it is necessary to make a very clear distinction between invention and innovation since it is fair to state that there is little evidence that the more inventive companies are more successful than the less inventive ones. And it can certainly be postulated that purely inventive automotive suppliers who are unable to successfully commercialize their innovations have a high probability of failing. On the other hand, it is in some cases possible to be a successful innovator without being very inventive. For instance an efficient market scanning/scouting approach can also be the base for a successful innovation management, finding ideas or innovations outside of the company and converting them into successful innovations supported by the right strategy and culture.

The message that, in order to be a successful innovator, you don't have to be inventive should be good news for many automotive suppliers. Inventiveness is often considered to be an art, mainly driven by rather "soft factors" like creativity and culture. Those are normally more difficult to develop and improve since they are heavily influenced by many intangible factors such as individual personality or corporate values and beliefs. Innovation management, on the other hand, is a systematic approach that can be methodically improved and optimised when following the right principles.

[158] STOCKMAR, J. (2004), pp. 70

➔ Automotive suppliers do not necessarily have to be inventive themselves to be successful innovators. Ideas or even complete inventions can be found / and or bought outside of the companies own boundaries. Innovation management is not an art but a systematic approach that can be methodically developed and improved.

In all analysed cases there was never ONE success or failure factor for an innovation, but always various key elements. There is a pattern of things that successful innovation initiatives by automotive suppliers have in common and it is not very difficult to identify the factors responsible for the failure of unsuccessful initiatives.

➔ Success or failure is dependant upon following and having an appropriate approach for all aspects of innovation management. Focusing on just one aspect is not an option.

When analysing the *where?* and *what?* in the studies of this research work, it became clear that a significant share of innovation hurdles were not linked to developing a suitable technical / product solution, but that suppliers faced their biggest challenges during the acceptance, realisation and commercialisation phases. It also can be shown that innovation activities targeting not only product, but process and even organisational / business model innovation can provide substantial opportunities for suppliers to become more successful.

➔ Automotive suppliers should not concentrate only on technical solutions, but also consider focusing their activities on influencing those success factors that can help them improve their success rate during the acceptance and realization phases. They should also consider assigning a significant share of their innovation management resources to the creation of process, organisational and business model innovations instead of concentrating only on the development of product innovations.

Finally, this research work found evidence that, although innovation management itself should be conducted as a very systematic approach, it is in many cases wise to be flexible. Creativity, openness and out-of-the-box thinking are not only important during the ideation phase; successful innovation can also be reached through new commercialisation ap8proaches, as illustrated the Steyr-Daimler-Puch cases.

5 Recommendations for Implementation of the Model

This chapter combines the results of the postulated theoretical model and the findings of the analysed case studies. Finally it formulates recommendations for the implementation of the suggested framework.

5.1 Postulated Success Factors in Practice Test

Based on these proposed key success factors of innovation management seven hypotheses were postulated and their relevance analysed in a series of innovation case studies.

The results of this study provide very strong evidence that the factors identified in the model presented are indeed key success factors for automotive supplier innovation management and that all postulated hypotheses can be considered valid as described in the next sections.

5.1.1 Strategy

It is obvious that neither a general optimal strategic supplier market approach nor a winning innovation strategy suitable for all suppliers can exist. There is also no evidence that a specific strategic approach is linked to a higher probability or level of success. This means that general recommendations for a single strategic approach are not relevant. For instance being first-to-market will not always be an advantage, nor will the fast followers always win.

What is decisive is having the right approach for the automotive supplier specific situation. Most of the time, this is not determined only by internal factors, but also depends heavily upon external factors, and the strategic fit to the targeted OEMs is of primary importance.

As an additional finding it has been shown, that the better a strategy is defined, communicated and understood by all relevant stakeholders, the more likely it is that the innovation management activities will be able to successfully support it. This

sounds like an obvious fact, but as some of the studies prove it is not always the case in the automotive supplier industry.

Hypothesis 1- Market Scope Strategy

To be successful innovators, automotive suppliers must first understand the market scope strategy of their customers, the automotive manufacturers, and make sure that their own strategic market approach supports them.

The case studies demonstrate how important it is for automotive suppliers to have the right strategic approach regarding the overall intention of their targeted OEM customers, in order to be successful innovators. Implementing, for instance, a feature-based innovation management approach when targeting mainly cost driven OEMs is an obvious example of bad alignment.

The key message for suppliers is that they need to make sure that among all important players and decision makers involved in management activities there is a common explicitly formulated understanding of the customers' strategy and expectations. This again requires a clearly defined strategy of their own and an understanding of their targeted customers.

Hypothesis 2 – Innovation Strategy

To be successful innovators, automotive suppliers need to synchronise their innovation strategy to the OEM's approach, avoiding being substantially more innovative or too far behind their customers' innovation levels.

The empirical findings of this study support the validity of this hypothesis. There are numerous examples of how important it is to have a well-synchronised innovation strategy approach towards the targeted OEMs. For instance, the Donnelly outside mirror innovation case study shows how striving to follow an aggressive first-to-market strategy when targeting OEMs that follow a fast-follower strategy will not lead to a successful innovation.

5.1.2 Innovation Process

Besides the importance of having a well-structured innovation process that focuses and coordinates all activities during an innovation project, the analysed case studies

highlight the importance of suppliers managing their own innovation portfolio. For this purpose suppliers first need to have a clear understanding of what kind of innovation they are targeting regarding the level of innovativeness and how the process is triggered. The level of innovativeness is an important indicator for the complexity and risk of the innovation process. The type of process initiated, market-pull or technology-push, is of key importance in determining the supplier's approach to achieving acceptance from the targeted OEM(s).

As shown before, it is natural in general that technology-push projects will provide the bigger opportunities for returns but also bear the higher risk of failure, especially during the acceptance and realisation/commercialisation phases. To maximise the return of their innovation management activities, automotive suppliers should aim at having an actively managed balanced innovation project portfolio. Depending on their level of innovation capabilities, they should start with a portfolio that consists mainly of OEM-driven innovation initiatives, including later, well selected technology-push projects aiming for more innovative results and bigger returns on a more advanced innovator phase.

Hypothesis 3 – Market-Pull Innovation Process

To be successful innovators following a market-pull innovation process, automotive suppliers must align and synchronise their innovation process to the OEMs. This cascading process system requires a high level of understanding for the customers' goals and procedures, as well as a very effective communication and coordination between the OEMs and the suppliers.

The findings of this study emphasise how important it is for automotive suppliers to have a well synchronised innovation process triggered by the OEMs own innovation management process. The potential results may be limited, and the risk exists of becoming very dependent upon a single OEM, but it has the advantage of having strong OEM support during the commercialisation and realisation phase. This significantly increases the probability of the innovation's success. Additionally the first realization in the market can also work as an important reference and help the supplier to gain other customers for its innovation.

The analysed examples emphasize the importance of implementing a real cascading process that clearly links all the suppliers' activities to the OEMs innovation process.

Hypothesis 4 – Technology Push Innovation Process

To be considered as innovative, automotive suppliers must pursue technology-push innovations by pushing their new ideas / technologies into the OEMs' innovation pipelines. To be successful with technology-push innovation processes, suppliers must embed their own innovation into the OEMs' innovation processes. To do this, they must find the right timing and make sure that their process is endorsed by very efficient advanced marketing activities.

The results of the analysed case studies of this research work clearly support the validity of the formulated hypothesis. To be perceived as real innovative suppliers in the market, suppliers must develop and realise their own ideas and present them to their customers in a technology-push process. It is also clear that technology-push innovations are more challenging than the ones initiated by an OEM. Without direct process alignment from supplier to OEM, the risk of failure for a technology push process is extremely high. A key aspect regarding the innovation process is conducting extensive and efficient advanced marketing activities, not only to obtain all the information regarding the OEMs strategy and approach, but also to start creating awareness and interest on the OEM side. Although the risk that a competitor could get some information about the planned innovation must be considered, the advantages of having a better alignment to the targeted customers should prevail in most cases. Suppliers should also strive to start their advanced marketing towards the OEMs as early as possible and make sure that the information and feedback received from them is included in an early phase of the innovation project. This is done obtain the best alignment possible to the OEM's expectations and a higher rate of process synchronisation.

Hypothesis 5

In order to be successful innovators, automotive suppliers should manage their innovation portfolio seeking a good level of balance between the targeted degree of innovativeness and the mix between market-pull and technology-push of their innovations.

The findings of the conducted analyses show that the right two-dimensional level of balance between innovativeness as the first dimension and the push-pull mix as the

second, depends not only on external targeted market conditions but is also directly linked to the innovation management capabilities of the supplier.

The overall commercial success of an innovation does not depend on the level of innovativeness targeted. Of greater importance is the implemented level. Suppliers should not be overly ambitious and target innovations of a level of innovativeness beyond their existing capabilities. Casually stated, regarding the targeted level of innovativeness, suppliers must learn how to walk before trying to run.

5.1.3 Innovation Culture

The analysed case studies show that the innovation culture of an automotive supplier is probably one the most influential and relevant single factors of innovation management. Having top management's support and the right culture is certainly not a guarantee for successful innovations, but the lack of either will, in most cases prove to be a decisive barrier to any innovation initiative. In many cases it could be shown that the innovation management success rate of an automotive supplier can change dramatically due to a new top management, even if the same people in the company continue following the same strategy, process and innovation management approach.

The right innovation culture must create an environment wherein two main characteristics are standard: first, the culture must allow creativity to flourish. It is mandatory that employees feel encouraged to take risks and try out new things knowing that not all initial ideas will work but not having to fear negative consequences in case of failure. This is particularly necessary during the ideation phase, but also helps to lower internal acceptance hurdles. The second aspect of the right culture is most important during the final innovation process phases of realisation and commercialisation, and is key to having a result-oriented culture that focuses all innovation activity on realising successful innovations.

Hypothesis 6 – Innovation Culture

To be successful innovators, automotive suppliers must find the right balance between an open culture that fosters creativity and inventiveness and the right amount of discipline and control needed for the realisation of the ideas. It is a key success factor that all three levels of their innovation culture, artifacts, exposed beliefs and values, and underlying assumptions be not only supported, but also actively adopted by the suppliers' top management and key stakeholders of their organisation.

Evidence pointing to the importance of culture as one of the key success factors for automotive suppliers innovation management activities can be found in all analysed case studies of this research work. It cannot be emphasised enough: having a supporting culture backed and adhered to by the top management are "conditio sine qua non" to be successful for any innovation activity in the automotive supplier industry. A supporting culture should ideally have the right balance between providing as much flexibility and freedom as possible for creativity to flourish but also have the focus and discipline needed for the innovation's implementation.

All elements of the innovation business architecture are important. One alone is not sufficient, but if there is one to be singled out it would be to have the right innovation culture. With the right culture and individual initiative, deficits in other areas can be overcome. On the other hand, without the right culture nothing works. There is another important point that suppliers should consider, the right innovation culture is a fragile and delicate good, it takes a long time to foster, but can be lost easily and very rapidly.

5.1.4 Innovation Marketing Mix

The empirical results of this research work emphasise the importance that an innovation marketing mix has for automotive suppliers. Western suppliers often tend to focus too much on their technological capabilities and forget about developing the right level of marketing and strategic expertise and skills. Many of them also rely too much on personal relationships instead of installing systematic and structured communications channels to their targeted customers. This lack of innovation marketing skills explains the failed commercialisation of many successful inventions.

Hypothesis 7 – Innovation Marketing Mix

To be successful innovators, automotive suppliers must apply the right marketing mix for their innovations:

- Target Markets: choosing the OEM's program(s) that provide the best strategic fit to the suppliers' innovation.

- Product: aiming not only at product innovations, as the vehicle part to be delivered, but mainly targeting innovations of those elements on the value chain, like the production process or logistics, that can be best influenced by the supplier.

- Place: implementing a dedicated sales channel for innovations, not only to communicate and sell to the market, but also as a source of vital information and insights needed to successfully create innovations.

- Price: supplier must implement an appropriate pricing strategy for their innovations trying to maximise their returns and protect the uniqueness of their new offerings.

- Promotion: when marketing technology-push innovations, promotion activity must begin as early as possible to reduce possible barriers of acceptance by the OEM side.

Depending on the specific type of innovation and its context, the influence of the different elements of the marketing mix model can vary, but it can be shown that is never wise to fully neglect one of them. To do so will not always lead to a failed innovation, but increases the chances, that the full market success potential of an innovation will be compromised.

5.2 Recommendations for Implementation

After having validated the relevance of all fundamental innovation success factors for automotive suppliers - strategy, process, culture and innovation marketing mix as well as the seven postulated hypotheses - it can be concluded that automotive suppliers who follow the innovation management framework postulated by this study will have a higher likelihood of being successful innovators.

Using the model, as can be seen again in the following figure, will ensure that suppliers take care of all key elements of their innovation management business architecture and align them appropriately, which will help them overcome the specific innovation hurdles that they face in this extremely challenging and competitive market.

It is important that suppliers first understand the barriers facing them and then follow the model without loosing sight of any of the key success factors that comprise it. This starts by defining and aligning their strategic market approach and innovation strategy and managing a balanced portfolio of cascading pull and synchronized push innovations projects. This must follow a structured process which is embedded in the right kind of innovation supporting culture through all three levels, without overlooking the implementation and alignment of the other supporting innovation management elements of organization, applications / tools, capabilities and performance management. Finally, they should implement the right level of innovation marketing mix to optimise the results of the successfully implemented innovation.

Following the recommended implementation road-map, depending upon their starting level of innovation management capabilities, suppliers should first aim to reach the basic innovator level, then grow their capabilities and expand their targeted innovations focus, proceeding toward the advanced levels until they can establish themselves as leading innovators.

Accordingly, the next section of this chapter summarises the key recommendations for the key elements of the model.

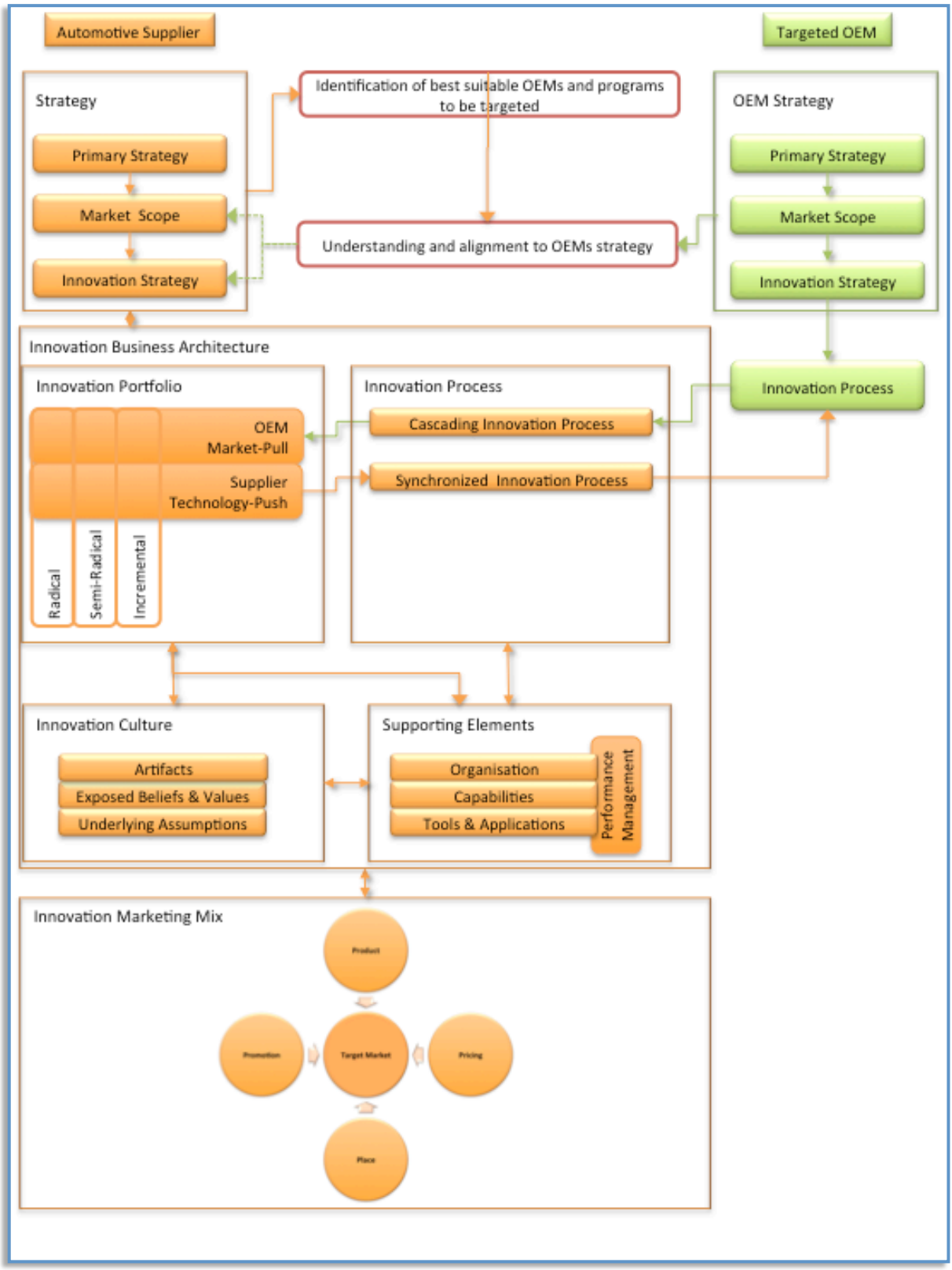


Figure 64: **Validated innovation management framework for automotive suppliers (author's illustration).**

5.2.1 Strategy

In order to be successful, automotive suppliers need to have a clear understanding of the targeted OEM's strategic situation and, based on this understanding, they must formulate a market approach and innovation strategy that is compatible to those of their targeted customers.

The targeted market should be right at the centre of any strategy formulation in any industry from the very beginning. For automotive suppliers, however, this is of vital importance. Due to their limited numbers and strong market position of potential customers, suppliers should not only understand and consider the strategic situation of their targeted customers but also, ideally in a cascading process, align their market scope strategy. They should derive their innovation strategy approach from the targeted OEM's approach.

This is obviously not a one-time exercise, but requires the suppliers to implement their processes and instruments to constantly monitor and understand the strategic actions of their customers, in order to be able to remain strategically aligned.

Suppliers should try to formulate their strategic intentions as clearly as possible, knowing that without a clear strategic direction they run the risk of being in the disadvantageous situation of being stuck in the middle. This is true for the market scope and for the innovation strategy.

Although there is not a single innovation approach that is more likely to make suppliers successful, deciding to not pursue any kind of innovation at all is not a real option for most of the western automotive suppliers. In this extremely competitive market, innovation is important in every segment and for every strategic approach. It need not be a product innovation, nor is the degree of innovativeness relevant. But it is important that automotive suppliers are able to develop or follow innovations in the market. For instance purely cost-leadership players may choose not to develop new product features, but they should work on process innovations to defend their cost advantages.

Since a great strategy is worth less if it is not properly executed, it is the vital responsibility of the supplier's top management that the chosen strategy is clearly communicated and understood by all the relevant stakeholders. They must make sure - together with all relevant persons involved in any innovation management

activities - that this strategy drives all other elements of the innovation management business architecture. Finally, suppliers should implement a performance management system to track and monitor the success of their strategies and their implementation rate.

Due to the limited range of influence automotive suppliers have when designing and developing their products, the right functional strategy for key factors like production, logistics or purchasing can become a major differentiator and success factor for their innovation approach. They should always consider that strategic innovations of their production process, for instance could in many cases bring higher returns and face lower acceptance hurdles than pure product innovations. For this reason, suppliers should always integrate these functional strategies into their innovation strategic approach and ideally consider these important competitive dimensions right from the beginning of every single innovation.

5.2.2 Process & Portfolio

As a basic condition for becoming successful innovators, automotive suppliers must implement and maintain a well-structured internal innovation process that ensures a structured and systematic approach to the development and implementation of the innovation. The process parameters should be well aligned to make sure that the innovation results are in line with the pursued innovation strategy and meet the targeted market needs and desired strategic results.

The top management and all responsible persons involved in the selection and approval process of innovation management projects, should always aim for a balanced innovation project portfolio dependent on the innovation management capabilities of the supplier. Suppliers with little innovation management skills should begin with a portfolio featuring a dominant portion of market-pull projects rather than the more challenging and complex technology driven push initiatives. When managing their portfolio, suppliers should also make sure to consider the additional dimension of the targeted innovativeness of their innovations.

When following an OEM triggered market pull process, automotive suppliers must make sure that their process is fully synchronized with the OEM’s processes, and if additional suppliers of lower tiers are involved, the tier 1 supplier must make sure that they are also included in this cascading innovation system.

The success of a technology-push driven automotive supplier innovation process is mainly determined by the supplier's quality of appropriate advanced marketing activities to make sure that its innovation fits in with the innovation management approach and product road map of the targeted OEMs.

5.2.3 Culture

Since having an innovation supportive culture is a key success factor for automotive suppliers, the top management should take the lead and ensure that such an environment is provided and respected. They should start by implementing the first levels of innovation artifacts, e.g., by formally introducing the innovation process and allocating the right organizational structures to support it. Management should then provide a solid formulation of the desired innovation strategy and supporting culture, behaviours and policies as the second cultural layer of exposed beliefs and values. Finally if they themselves successfully manage to act and turn action according to their own strategy, the organisation will adapt the culture behind their strategy into the third and fundamental layer of underlying assumptions.

It is important that the management understands the different aspects of an optimal innovation management supporting culture. On the one hand, it should provide enough freedom and flexibility to encourage new creative ideas and out-of-the-box findings to allow for a very productive ideation phase. To achieve this, it is essential that the top management demonstrates patience and accepts failure as a natural outcome of creative processes. Later, on the other hand, they must ensure during the realisation and commercialisation phases that the responsible persons follow a very disciplined and result-oriented approach to maximise the effectiveness of the innovation management initiatives.

5.2.4 Marketing Mix

Many automotive suppliers tend to acknowledge their technological capabilities and know-how to be a key success factor for innovation management. The findings of this research work do not fully support this belief; the amount of innovations that have failed due to a missing technical/technological solution is surprisingly low. One possible explanation for this is that among automotive suppliers there is a very good understanding and realistic estimation of their own technical capabilities. On the other hand, this research work shows that poor understanding of the overall strategy

and the customer's situation is a common root cause for many failed innovation processes. This seems to be even more critical for technology-driven push projects, where the negative influence of an inadequate advanced marketing approach represents one of the major hurdles impeding success.

Successful innovation has been characterized as "invention + commercialisation". Taking this into consideration, suppliers shouldn't rely only on their technical know-how and expertise to be successful innovators. When it comes to the commercialisation of an innovation and the mastering of acceptance hurdles, the marketing capabilities of a supplier will play a decisive role in defining the total success of an innovation. Suppliers also need to develop their competence and assign enough marketing resources toward implementing a solid marketing mix approach that will allow for the successful commercialisation of their innovations.

Very important here is to have a clear understanding of the targeted market and its needs before defining the four "P" elements of the model (Product, Price, Place & Promotion). The importance and influence upon the overall success of some of the four marketing mix instruments may vary, depending on the specific context of the innovation,. For instance, when pursuing a market-pull opportunity, the importance of promotion will be less than that of a technology-push innovation in which no OEM has expressed any prior interest. However, it is strongly recommended to all suppliers that they remember to at least explore the possibilities they have and formulate a concrete approach for all elements of their marketing mix before starting the marketing process of an innovation.

In other words, many suppliers would realize a better return on their innovation management activities if they focused not only on improving their technical research and development activities, but would also invested in obtaining a better understanding of the market and developing more effective marketing capabilities.

5.2.5 Other Business Architecture Elements

Due to the scope of this research work only those elements of the innovation management business architecture that are distinctive for automotive suppliers have been analyzed in detail. However, that does not mean that the other elements are not relevant. The opposite is true, to be a successful innovator they can not be ignored.

Therefore automotive suppliers must make sure that their innovation management business architecture framework is complete by properly addressing the elements of innovation management organization, performance management, tools and applications and capabilities.

Innovation Management Organization

The element of innovation management organization, describes the structures and hierarchies that shape the innovation management activities. This includes for instance the definition and description of reporting lines, roles and responsibilities related to innovation management. Due to the strategic importance of innovation management and its cross-functional nature, it is of paramount importance to have a clear understanding of where and how the innovation management organization is embedded in the overall organizational environment. Hereby the key for success is having clear and transparent responsibilities with sufficient hierarchical power and influence involving all relevant functions. Successful innovators in the automotive industry have an innovation management organization including the top management of their research & development and sales & marketing functions.

Innovation Performance Management

The element of innovation performance management deals with the measurable aspect of the business; it defines how value is tracked. An effective innovation performance management should not only monitor the cost and investments related to the creation and management of innovation but also track the value created and set the right incentives to help optimize the ration between the both. It is also much more than the often-found counting of patents and innovation project milestone tracking, it should include the total results of the innovation through all phases (including commercialization) measuring the value created and the total return on investment.

Innovation Management Tools and Applications

The element of innovation management tools and applications implies the portfolio of management practices, methods, tools and software used to support all innovation management related activities and processes. There is a vast range of tools and methods that can be used to support innovation management, starting from simple creativity techniques like brainstorming to more sophisticated methods like TRIZ / TIPS (Theory of inventive problem solving) among which suppliers should select and

implement a suitable set to support their innovation management strategy depending on their specific context and objectives.

Innovation Management Capabilities

Innovation management capabilities are the competences and assets of an organization that define the skills, aptitudes and knowledge needed to be a successful innovator.

Besides important knowledge assets like patents and formulas, the most critical innovation resource for any organization is their human capital. Without skilled, motivated, creative and knowledgeable people, no innovation is possible at all. Leading innovators try to use not only the competence of their own employees but also leverage the skills of other stakeholders, like their own suppliers, customers or business partners.

6 Conclusions and Outlook

This final section summarizes the results of this research work regarding the formulated goals and postulated research questions. It provides an outlook on future considerations for the management practices and further research.

6.1 Summary of the Conducted Research

Starting with the introduction of the automotive supplier industry in general and laying out its importance for the Western European economy, this research work introduced its primary and secondary research goals and presented the intended research approach and general structure that should be employed to achieve them.

In the following section an overview of the relevant status of the discussion in scientific literature regarding innovation management was presented, first by providing an overview and definitions for the concepts of innovation and innovation management itself followed by a section defining and characterizing innovation hurdles and barriers.

Using these state-of-the-art definitions, the research work followed five steps to define an innovation management framework for automotive suppliers: in the first step, the specific characteristics of the automotive supplier industry were described. In the second step, specific automotive supplier innovation hurdles were identified and then used to derive success factors the third step. In step number four, the framework was built, and in the final step a road map for its implementation was presented.

Based on this framework, seven hypotheses defining key success factors of suppliers were formulated. These hypotheses were tested and validated in a series of empirical case studies.

After having validated the established framework and using the main findings of the empirical research, suitable recommendations for the implementation of the model were formulated and a final summary of all results was given.

Research Goals

The main goal of this research was to identify the key success factors of innovation management that are pertinent to western automotive suppliers.

This was accomplished by considering the state of the art in innovation research, whereby three key success factors were identified:

- Strategy & innovation strategy
- Innovation process & innovation portfolio management
- Innovation culture

A fourth factor was then added to complete the framework:

- Innovation Marketing Mix

The relevance of these factors was validated through empirical research in form of innovation case studies.

Additionally, the following secondary goals of this research were fulfilled:

- Description of the effect of the innovation management approach upon the different types of supplier-OEM relationships.
- Design of a model for successful innovation management.
- Recommendations for implementation in practice.

Answers to Postulated Questions

After having achieved all the research works' goals the postulated questions can be answered as follows:
How can the existing innovation management models and concepts be appropriately adapted or re-defined to fit the specific situation of the automotive supplier industry?

- The existing concepts for innovation management can be applied to the automotive supplier industry, but must be adapted to fit the specific requirements of this industry.
- The suppliers' high dependency upon the OEMs is the most important factor to be considered. This research work expands the existing innovation management models by introducing the concept of a cascading innovation management process.

- Within the automotive supplier industry most of the innovations will start with an OEM-driven innovation process, which will then trigger related innovation processes on the tier 1 supplier side, which in turn may also be responsible for the initiation of further innovation management processes on the tier 1+n supplier levels.
- This cascading innovation process landscape is particular to the automotive industry. To be successful innovators, automotive suppliers must start with the alignment of their strategies to those of the OEMs, and further, fully synchronise their innovation processes and other innovation management elements to the targeted OEM's approach.
- Suppliers should also consider a cascading approach when defining their innovation strategy following the basic direction that their targeted OEMs are using.

What are success drivers and pitfalls for innovation management in the supplier industry?

- This research work clearly recognises four main factors as key to the success of automotive suppliers' innovation management activities: having the right strategy alignment to the targeted customer, managing a balanced innovation process portfolio consisting of the right level of innovativeness and processes that either cascade from an OEM innovation process (market-pull) or are well synchronised to their innovation approach (technology-push), supported by the right culture embedded in all three layers of management and implementing an appropriate marketing mix approach in order to tap the full commercial potential of the innovation .
- The importance of every single factor has been demonstrated, first derived from the actual status of the scientific literature, and later validated through the various empirical case studies that were analysed in this research work.
- It has been shown that the right combination of all factors is needed to be successful, although even then, success can never be guaranteed. Suppliers that do not follow an appropriate approach regarding these key elements of innovation management will have a very high probability of failure.

What recommendations can be derived for implementing a successful innovation management for automotive suppliers?

- Automotive suppliers that want to implement a more successful innovation management approach must have a clear understanding of the targeted OEMs and their own situation. Without a clear direction and strategy, they will never be able to systematically improve their innovation success. After analysing the existing situation, they should derive and formulate their desired situation and create a common understanding among their key stakeholders with regard to how they intend to implement it.
- When all stakeholders know, understand and follow the intended direction, it is key to make sure that a well balanced innovation portfolio is established, wherein all innovation processes are aligned to the suppliers' own strategy, in order to make sure that they fit and are synchronised to the innovation processes and the needed innovativeness for the targeted OEMs.
- Additionally, the automotive supplier's top management must make sure that they encourage, support and maintain an innovation-friendly culture that not only provides the right grade of freedom to allow creative ideas to flourish, but also makes sure there is enough focus and discipline for the realisation of the intended innovations.
- Finally, suppliers should not forget that an innovation consists of an invention and its commercialisation, and for this reason they mustn't concentrate solely on the technical aspects of the innovation, but also implement an optimal level of innovation marketing mix capabilities to support the go to market approach on an optimal way.

6.2 Outlook: Innovation Management and the Future Automotive Industry

The automotive industry is going through a very dynamic phase right now. Mega-trends like globalization, global warming, aging population, megacities and the information explosion are having a massive impact on the industry. The emergence of new markets and competitors, electric cars and new mobility concepts are only a few examples of business trends that are currently heavily influencing the industry. However, the basic business models and structures of the industry have not changed dramatically during recent years. One can clearly see this when comparing the automotive industry with the transformation that other industries have undergone, such as the telecommunications industry: There, driven by new technologies almost everything has changed in the last few years: new players are competing globally in new markets with products for which target needs had not existed a couple of years ago.

It is plausible to foresee a change of similar dimensions for the futureautomotive industr. If one thinks of a car as a device that addresses a mobility need, and forgets all the image and emotional factors that are currently attached to the ownership of a car, there are various scenarios one could imagine whereby new mobility solutions can emerge. These in turn could lead to a change of mind-set for many consumers, making the ownership of a car no longer interesting. Examples for successful models can already be found in many large metropolises all over the world. And even in a more conservative scenario, in which people will still continue driving and buying cars, it is very likely that their buying criteria will change. For instance, in a world with a high share of electrical vehicles, the differentiation factors that make the purchase of a premium brand sports car attractive today may be completely different. Perhaps the communication and entertainment capabilities of a car will become key purchasing criteria for some segments of the market. In such a scenario, consumers would no longer be willing to pay a large sum of money for a premium car with technology that soon will be out-dated without the possibility of updating it at a rational cost, as is currently the case. To cope with these new requirements, the architecture of existing cars must be completely changed, and with it the business model of the industry. These changes could provide new opportunities for suppliers to expand their actual business models and increase their levels of influence. Obviously, driving this transformational process will be not possible for a single supplier, but a strong network of suppliers following an open innovation approach could do it.

Those suppliers who will be able to recognise the opportunity and are willing to embrace this new paradigm may create significant competitive advantages through a higher level of innovation. This process may also be accelerated through new players coming from the high-tech and software industries that are currently moving into the automotive industry, due to the increasing share of infotainment technologies and the growing electrification of cars. What had always been considered a threat to the current conventional automotive suppliers could turn into a major opportunity to expand their current business. The new entrants will bring new ideas and products, but will generally lack the strategic understanding of the market in general and of the specific OEM's situation. The current automotive suppliers could use their existing innovation management capabilities, for instance, to integrate the new technologies, adding value to their existing products, or they might even position themselves as pure "innovation brokers" and system integrators, helping the new entrants to introduce their technologies into the cars and at the same time developing new business models for themselves. They could also take this model in the opposite direction, leveraging some of their own inventions into other industries in order to reduce their dependence upon the automotive OEMs.

In order to be able to adapt to an Open Innovation approach, automotive suppliers will first have to change the way they think about innovation and be willing to challenge their existing strategies and business models. Then they will need to expand their existing innovation management approach into a corporate venturing model, like the one depicted in the following picture from Lucent Technologies, a supplier of telecommunication products. Finally however, the key challenge for them will be to manage the required change in culture, combating internal barriers and accepting a new role as a company, convincing those individual stakeholders, especially in the engineering and R&D departments, to adapt to the new paradigm.

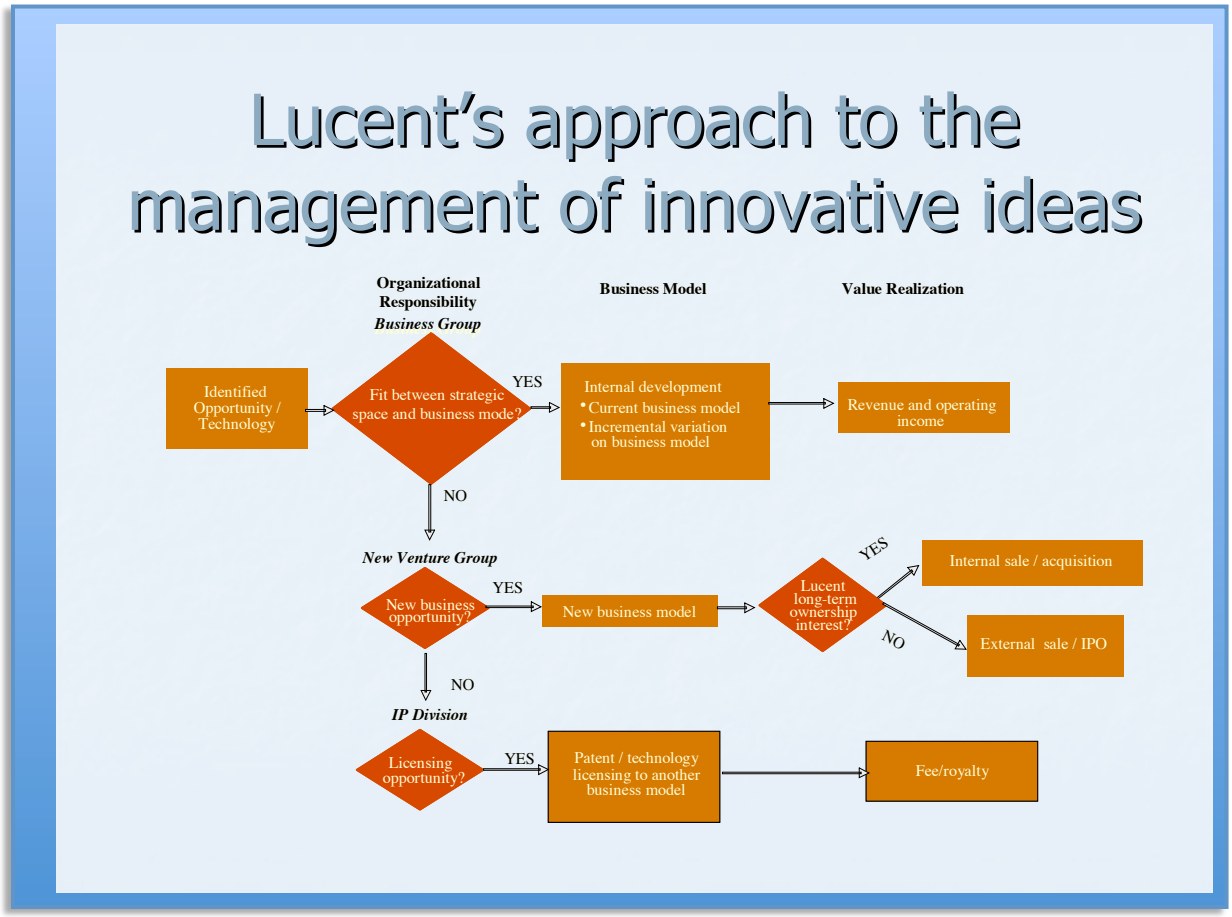


Figure 65: Lucent Technologies corporate venturing model[159].

Taking over influence from the OEMs, however, is not the only innovations scenario for the supplier of the future. It is also possible to conceive a win-win scenario whereby OEMs and suppliers work together to improve the innovativeness of the complete industry. OEMs could start by acknowledging that a big portion of today's innovation has already been initiated by their suppliers, and almost no innovation in the industry happens without their involvement. If they want to take more advantage of this innovation potential, they should also recognise that they are responsible for or at least have a significant level of influence upon most of the external innovation hurdles that automotive suppliers are facing. Following a more cooperative approach, based on a mentality of abundance, OEMs could choose to lower all innovation hurdles for their suppliers and share with them a larger part of their revenues to allow them to develop more advanced innovation capabilities for the good of all. This would without a doubt lead to a dramatically increased level of innovation that could provide a higher level of benefits for all participants of the industry, including the end-

[159] PARHANKAGAS, A. (2006)

costumers, than the actual cost dominated approach that most of the OEMs currently follow.

When taking into consideration the fierce competition within the industry but also the strict compliance and legal restrictions, for instance anti-trust regulations, it is clear that it will not be easy for anyone in the industry to implement this kind of cooperative win-win approach. Here is where the research community could play a key role in the future guiding the management practice with the adaption of existing best practices, the development of new success oriented innovation frameworks and the coaching and facilitation of the various sides during their implementation. This could unleash the creative potential of all players and help this key industry to develop those key innovations that are needed to build a new future automotive industry that provides sustainable answers to the mobility and growth needs of coming generations.

7 Appendix

7.1 Figures

7.2 Tables

7.3 Bibliography

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7.4 Abbreviations

B2B	**Business to Business**
B2C	**Business to Consumer**
BSD	**Blind Spot Detection**
CAR	**Center of Automotive Research**
CEO	**Chief Executive Officer**
CTO	**Chief Technology Officer**
EC	**Electro-chromic**
EU	**European Union**
GM	**General Motors**
HVAC	**Heating, Ventilating, and Air Conditioning**
ISM	**Inside Mirror**
JV	**Joint Venture**
M&A	**Mergers and Acquisitions**
MRO	**Maintenance, Repair and Operations**
OECD	**Organization for Economic Co-operation and Development**
OEM	**Original Equipment Manufacturer**
OSM	**Outside Mirror**
R&D	**Research and Development**
SUV	**Sport Utility Vehicle**
UIS	**Unit Injector System**
VP	**Vice President**
VW	**Volkswagen**