

THE STATUS OF MODULAR SOURCING COMPARED TO OTHER PROCUREMENT STRATEGIES

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Abstract

This article demonstrates that modular sourcing has more significant advantages for a company than the other analyzed sourcing strategies. Thereby the outcome of the research shows that in order to be successful a company should apply the modular sourcing strategy. Consequently, it is indisputable, that modular sourcing cohere to business success. All these insights into scientific evidence concerning of sourcing strategies based on a valid thorough literature survey.

Value: The research results of this paper can be used by companies within the decision for the importance of modular sourcing as primary sourcing strategy in an automotive company.

Key words: *automotive company, business success, Modular Sourcing, procurement, sourcing strategies*

JEL Classification: *M21*

I. INTRODUCTION

The modular sourcing strategy is popular in several industrial sectors (Ippen, 2012). Most particularly, though, in the automotive industry which provided the first example of modular sourcing in this field (Arnold et al., 2004; Kopp, 2006).

The reason for this endeavor is a prevalent target conflict which especially shows in the automotive sector. Here, individualism that is demanded by each customer on the market meets standardization. Standardization, however, is explicitly strived for from the company's perspective (Wildemann, 2012, 2014).

The term individualism, in this case, refers to the manufacturing of the car on the basis of several specific, individually produced components. The term standardization applies to the manufacturing with standardized components and single modules (Herlyn, 2012, p. 208).

For several years now, the conflict between the fields individualism and standardization has been playing an important role that is probably going to gain importance in the future (Buchmüller et al, 2017). Because of this it seems reasonable to establish and implement modular sourcing in all business segments (Wildemann, 2014).

Objective and methodology of research

The targets of this paper are the representation of individual procurement strategies with disclosure of various advantages and disadvantages of each strategy. Based on this performance an evidence can be delivered, why many companies have the strategy modular sourcing implemented or realized.

The authors made a literature research in the field of sourcing strategy, especially single sourcing and global sourcing, as well as local sourcing and modular sourcing. Relevant literature findings are compared to each other and a recommendation for modular sourcing is given. In addition the result of the comparison is underpinned by an example of Daimler AG.

Relevant definitions of terminologies which circumscribe the topic of modularization and procurement should obtain a common understanding and be the base for the following explanations. In addition it can be said, modular sourcing cohere to business success.

At the end a short summary and outlook with regard to the automotive industry is given. The outcome of the research shall provide interesting insights for companies in regard to modular sourcing and to improve company success.

II. DEFINITIONS AND DEMARCATIONS

Modularization, module, building set

According to Koller (1998) and Göpfert (2009) the term modularization, respecting modularity (Feldhusen and Gebhardt, 2008; Eitelwein et al., 2012), is defined as a method of structuring single products on the basis of predefined aspects (Koller, 1998; Göpfert, 2009). Nobel prize winner Herbert Simon's concept (Eitelwein et al., 2012; Simon, 1962) establishes "physical" (Wildemann, 2014, S. 67) independence between the elements – due to relationships being less intensely defined – on the one hand, and through a small number of interfaces that are standardized (Canales Salacerry, 2006) on the other hand. This concept can best be compared to building a car with Lego elements. A fixed number of various elements is used to build different types of cars (Starr, 1965).

Alongside this basic definition, the terms module and building set must not be forgotten, as they are closely related to the concept of modularization.

In the literature, the term module is defined quite variously from differing perspectives. Koller (1998) defines modules rather strictly. He understands a module as an element of a building set that is not bound to a specific structure. This means that each element can be installed at any random place within the product structure and can therefore be exchanged as well. The only requirement is that the modules are part of the overall product range (Koller, 1998). According to Feldhusen and Gebhardt (2008) this definition cannot easily be implemented in practice (Feldhusen and Gebhardt, 2008). Therefore, it is reasonable to examine more thoroughly the term building set and use it as a starting point in order to find a more pragmatic definition of the module (Renner, 2007). According to Pahl et al. (2007) building sets can be understood as assembly groups, machines or single components with differing solutions that fulfill several overall functions by being combined in many varying manners. Meaning that a building set is able to please both the customers' and the producers' needs (Pahl, et al., 2007; Renner 2007). A typical example that reflects the basic idea of a building set is a gear motor. The manufacturer can take into account the customer's wishes regarding construction size, engine power, etc. and at the same time manufacture the product cost-efficiently in the desired quality (Feldhusen and Gebhardt, 2008; Starr, 1965).

Based on this definition and by adding another decisive aspect, the following definition of the term module can be made (Feldhusen and Gebhardt, 2008):

A module describes a subsystem, its boundaries are formed by functional, manufacturing process-related and logic aspects (Klug, 2010; Piller and Warninger, 1999). This system aims at being constructed, examined, manufactured and developed independently and autonomously from the overall system (Waltl and Wildemann, 2014). In doing so, the relative independence from the remaining system with clear interfaces (Waltl and Wildemann, 2014) is the general basis of interchangeability, standardization and reusability (Göpfert, 2009) as well as it ensures configurability (Schuh, 1988; Meier, 2007). As a consequence, a product on modular basis can also be a building set. The destination route, however, is different. This is shown by the modules' consequent independence from each other which is determined and clarified in the module definition (Feldhusen und Gebhardt, 2008).

Procurement and Purchase

In the area of science and practice there are no consistent definitions of the terms procurement and purchase. Hence follows a demarcation of these two terms (Schulte, 2001).

Bogaschewsky (2004) defined the term procurement quite universally. He incorporates every task that is performed in practice by the segments purchase, materials management and procurement logistics. Additionally, he includes the concept of supply chain management (Bogaschewsky, 2004).

Arnold (1997) uses the term procurement to indicate the basic function that procedurally comes before production and sales. Here the definition covers all market- and/or company-related activities that aim at providing the company with the required (however, not self-produced) goods (Arnold, 1997).

On the contrary, Kreutzpointer and Reißer (2006) treat the terms procurement and purchase as being the same. Nevertheless, purchase is interpreted as an operative function and procurement as a strategic one (Kreutzpointer und Reißer, 2006).

This splitting is made even more significantly by Kerkhoff and Michalak (2007). They state that procurement can only be profitable if it is divided into an operative and a strategic function (Kerkhoff and Michalak, 2007).

The literature excerpts shown above demonstrate that there is no consistent definition of the term procurement management. As a consequence, the terms procurement and purchase are not differentiated explicitly, leading to the conclusion that the two terms are going to be used synonymously in the present paper.

III. PROCUREMENT STRATEGIES

Companies that are successful on the market in the long term carry out a lot of procurement strategies. These strategies have different potentials (Wannenwetsch, 2007). In order to provide an overview of the different approaches, a selection of strategies – as well as the respective potentials and risks – is summarized and shown in the figure below. After that, all strategies are going to be outlined and it will be shown which strategy best applies in changing situations.

Procurement strategy	Lower costs	Better performance	Lower risks	Greater flexibility
Single Sourcing	X	X		
Global Sourcing	X	X	X	X
Local Sourcing			X	X
Modular Sourcing	X	X		

Figure 1 - Overview of the different procurement strategies, Source: Wannenwetsch, 2007, p. 148

Single Sourcing

The term single sourcing refers to the procurement of goods from only one supplier (Krampf, 2012; Klug, 2010). This method is for example applied to the aviation and automotive industry where jet engines, gears, seats, engines and cockpits are delivered from one supplier only.

A close trusting relationship is an important requirement as well as delivery reliability, flexibility and high quality on the side of the supplier. The following requirements should be taken into account, too (Wannenwetsch, 2007):

- The implementation of intense negotiation
- The consistent support of the supplier
- The inclusion of the supplier into the product development process
- The contractual commitment of the supplier throughout the whole product lifecycle
- An in-depth analysis of the supplier before he is chosen by the company (Klug, 2010).

The main reason for applying these requirements is the fact that there is a certain interdependency between the supplier and the manufacturer. After a supplier has been chosen by the company he cannot be exchanged easily (Wannenwetsch, 2007).

As a consequence, single sourcing is most suitable for highly complex goods and products with long and intensive product development work (Wannenwetsch, 2007).

The advantages and disadvantages are summarized in the following list:

Table 1. Advantages and disadvantages of single sourcing

Pros	Cons
<ul style="list-style-type: none"> • Closer collaboration • Less prices through higher order volume • Less order and transaction costs • Less suppliers and contacts • Less complexity and better control 	<ul style="list-style-type: none"> • Shortage due to cancellation of the suppliers • Short-term change very costly and difficult • Dependence from suppliers in quality and price • Company know-how is revealed • Less flexibility

Source: Wannenwetsch, 2007, p. 149; Krampf, 2012, p. 16; Klug, 2010, p. 117; Göpfert und Grünert, 2006, p. 137; Morgan, 1987, pp. 52f.; Sheridan, 1988, pp. 34ff.; Bundesvereinigung Logistik, 1991, p. 26

Global Sourcing

Global sourcing generally refers to the worldwide procurement of goods (Appelfeller and Buchholz, 2005; Klug, 2010; Krampf, 2012). Because of the constantly increasing internationalization, which first has been mentioned by Leontiades in 1985 and has been revived by Heß in 2008 and Guinipero in 2009 (Leontiades, 1985; Guinipero et al., 2009; Heß, 2008), the procurement options need to be purposefully extended (Wannenwetsch, 2007; Krampf, 2012). This is why most companies with a strategic and international focus choose global sourcing as their procurement strategy (Krampf, 2012).

Research of scientific literature could not only identify benefits but also various drawbacks of the global sourcing strategy that need to be taken into consideration when choosing the company's procurement strategy.

Table 2. Advantages and disadvantages of global sourcing,

Pros	Cons
<ul style="list-style-type: none"> Worldwide choice of high-capacity suppliers Attainment of low priced acquisition prices and latest know-how Exchange rate fluctuation can be used International contacts, broader diversification of risks as well as less mutual dependence Timely identification of trends due to market transparency 	<ul style="list-style-type: none"> Existance of exchange rate risks and exchange rate fluctuations Problems with customs, high bureucracy and corruption Language, place of trial and mentality are different to procurement company Apperance of delivery and logistic problems Existance of lacking reliability, quality risks and brands as well as patent infringement Through distance increasing freight costs and packing costs due to ocean freight Problems with aspired standardization

Source: Wannenwetsch, 2007, p. 153; Krampf, 2012; p. 16; Guinipero et al., 2009, pp. 191 ff.; Krampf, 2012, pp. 49f.; Klug, 2010, p. 122; Heß, 2008, p. 202; Harrison and van Hoek, 2008, p. 106; Strub, 1998, p. 386

On the basis of the above mentioned advantages and disadvantages global sourcing is most suitable for mass-market products from low-wage countries and for products where the price advantage outweighs higher risks and costs (Wannenwetsch, 2007; Bogaschwesky, 2005). Additionally, there is another requirement that needs to be taken into account: Global sourcing should be understood as the corporate strategy and, thus, all participants should act and live according to this corporate function (Hartmann, 2007; Versteeg, 1999).

Local sourcing/ domestic sourcing

As the word local implies, this strategy refers to the procurement of services and goods from immediate vicinity, respectively from the company’s home market (Krampf, 2012; Guinipero et al., 2010). In this way, logistic interference can be drastically reduced (Wannenwetsch, 2007). That is why local sourcing is most suitable for high-quality procurement goods that are indispensable to keep the manufacturing running smoothly (Wannenwetsch, 2004).

The following table shows all advantages and disadvantages of local sourcing.

Table 3. Advantages and disadvantages of local sourcing

Pros	Cons
<ul style="list-style-type: none"> All suppliers are in the direct sourroundings Transportation costs and other costs are minimal Less country typical problems with law cases Language, currency as well as mentality of the involved parties are the same High quality and flexibility in changes Procurement of the procurement objects is almost synchronous by the production Minimization of logistical problems like supply delay due to status 	<ul style="list-style-type: none"> Due to longtime contacts there is no need for taff price negotiations anymore Avoiding international expertise and contacts Often high prices

Source: Wannenwetsch, 2007, p. 152; Strub, 1998, p. 386

Modular sourcing

Modular sourcing refers to purchasing goods from only a few suppliers that offer complex systems – modules or building sets – instead of purchasing many single units from many different suppliers (Krampf, 2012) . That means that procurement amounts consist of complete, ready-to-mount and sometimes pre-finished functional groups, like the vehicle modules (Klug, 2010; Eger, 2013), purchased from only a few suppliers (Wolters, 1995).

In this system, the companies only are in direct contact with their direct module suppliers, who coordinate the processes with sub-suppliers themselves (Klug, 2010; Bundesvereinigung Logistik, 1991). This approach makes the individual manufacturing processes much clearer (Werner, 2002).

Not only the process coordination but tasks from the development, research, purchase and quality assurance can be handed to the suppliers as well, creating even more potential (Wannenwetsch, 2004; Wingert, 1997; Sarbu et al., 2016). Hereby, a close trusting and long-term relationship is established between the module suppliers and the companies. As a consequence, a sudden change of suppliers is almost impossible (Wannenwetsch, 2004).

Additional benefits and drawbacks are:

Table 4. Advantages and disadvantages of modular sourcing,

Pros	Cons
<ul style="list-style-type: none"> • Reducing of cut surface • Concentration on core competencies • Remaining quality will be fostered • Supplier are nearby the producer • Reducing of logistic costs and costs of material due to higher purchasing per supplier • Simplification of the complexity of supplier relationship • Flexibility of changes • Reduction of development time/ development costs • Less purchasing staff and part numbers means a reduction of the purchasing administration effort • Better usage of information systems and special facilities • Suitable for production construction in development and research • Reduction of floor space required for handling and storage 	<ul style="list-style-type: none"> • High voting effort • Change of supplier gets difficult • Release of company know-how • Mutual dependance • Exploitation of market power from the supplier side

Source: Based on Wannenwetsch, 2007, pp. 155ff.; Krampf, 2012, pp. 90f.; Wolters, 1995; Glöckl, 1997, pp. 140f.; Klug, 2010, pp. 120 f.; Beyer v. Morgenstern and Neumann, 1992; Wingert, 1997; Freund, 1990, pp.75 f.; Schraysshuen, 1992, pp. 100ff.; Fieten, 1991. p. 90; Eicke and Femerling, 1991a, p. 14; 1991b, p.55; 1991c, pp.36f.; Gruber, 1992, B1; Schwabach and Wolters, 1991, pp. 10f.; Clark, Chew and Fujimoto, 1987, p. 735; Blackburn, 1991, p. 510; Brendlin, 1990, p. B11; Eger, 2013; Bundesvereinigung Logistik, 1991, pp. 55ff.; pp. 58ff.; pp. 71ff.

Based on the above mentioned potentials this procurement strategy is very popular in the automotive sector (Wannenwetsch, 2007), since – at it has already been mentioned – there is a high increase of variant diversity, as well as highly complex and technically demanding end products (Krampf, 2012). For instance, BMW, Smart and VW (Krampf, 2012).

Nevertheless, modular sourcing can also be applied to other sectors (Wingert, 1997; Bundesvereinigung Logistik, 1991) such as the computer, food, watch or construction industry (Krampf, 2012; Bundesvereinigung Logistik, 1991). Not only is an extremely close and long-term collaboration (Klug, 2010) between the manufacturer and the supplier a crucial requirement (Sarbu et al., 2016), but the developmental, quality and coordinative performance of the supplier and OEM as well (Krampf, 2012). Furthermore, the supplier has to be internationally competitive, present in the field of Just-in-Time and Just-in-Sequence systems, and capable of specific product and process know-how in combination with consistent optimization. Additionally, suppliers possess a stable and actionable logistic activity and should be able to construct and deliver prototypes and efficiently coordinate their sub-suppliers (Klug, 2010).

If the individual advantages and disadvantages are compared, it can be seen that the purchasing strategy "modular sourcing" has the most advantages.

In order to give a statement about the impact of the corresponding purchasing strategy on the business success, the advantages and disadvantages listed are compared. The focus is on purchasing and material costs because according to Koppelman (2004), a saving of the direct procurement costs immediately results in a high profit effect and thus positively affects the business success (Bräkling und Oldtmann, 2012; Koppelman, 2004). Mathematically, this phenomenon can be illustrated by the following formula.

$GB = \frac{(B \times K)}{UR}$	<p>GB= Profit sharing of procurement, identified as comparable sales increase</p> <p>B= Procurement costs in % of revenue</p> <p>UR= Return on Sale in %</p> <p>K= Cost reduction target in% of procurement costs</p>
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Figure 2 - Lever of procurement potential

Source: Own representation based on Bräkling and Oldtmann, 2012, S.7; Ursel and Haßmann, 2010, S. 16

This means that a total sale of 500 million Euro, procurement costs of 300 Mio. Euro (corresponds 60% of total sales), and a return on sales of 4%, in combination with a reduction of 3 million Euro (corresponds 1% of procurement costs), results the exact same profits as a sales increase of 75 million Euro (corresponds 15% of total sales (Bräkling and Oldtmann, 2012)).

The results of the illustrated confrontation can be seen in the following table.

Table 5. Comparison (with the main focus on material and procurement costs) from the different sourcing strategies

Source: Own representation

Sourcing Strategy	Pros	Cons
Global Sourcing	Attainment of low priced acquisition prices and latest know-how	Through distance increasing freight costs and packing costs due to ocean freight
Local Sourcing	-	Often high prices
Single Sourcing	Less prices through higher order volume	Dependence from suppliers in quality and price
Modular Sourcing	Reducing of logistic costs and costs of material due to higher purchasing per supplier	-
Result	Modular Sourcing has only advantages in terms of cost reduction in the procurement area	

From this comparison, modular sourcing is an elementary factor for business success because it reduces the procurement costs and finally increases the profit.

In addition to this comparison, the annual costs of Daimler AG (as a number and as a percentage of sales) were compared between 2005 and 2016. These indicators were calculated from the difference between the annual revenue and the EBIT achieved (see figures 3 and 4).

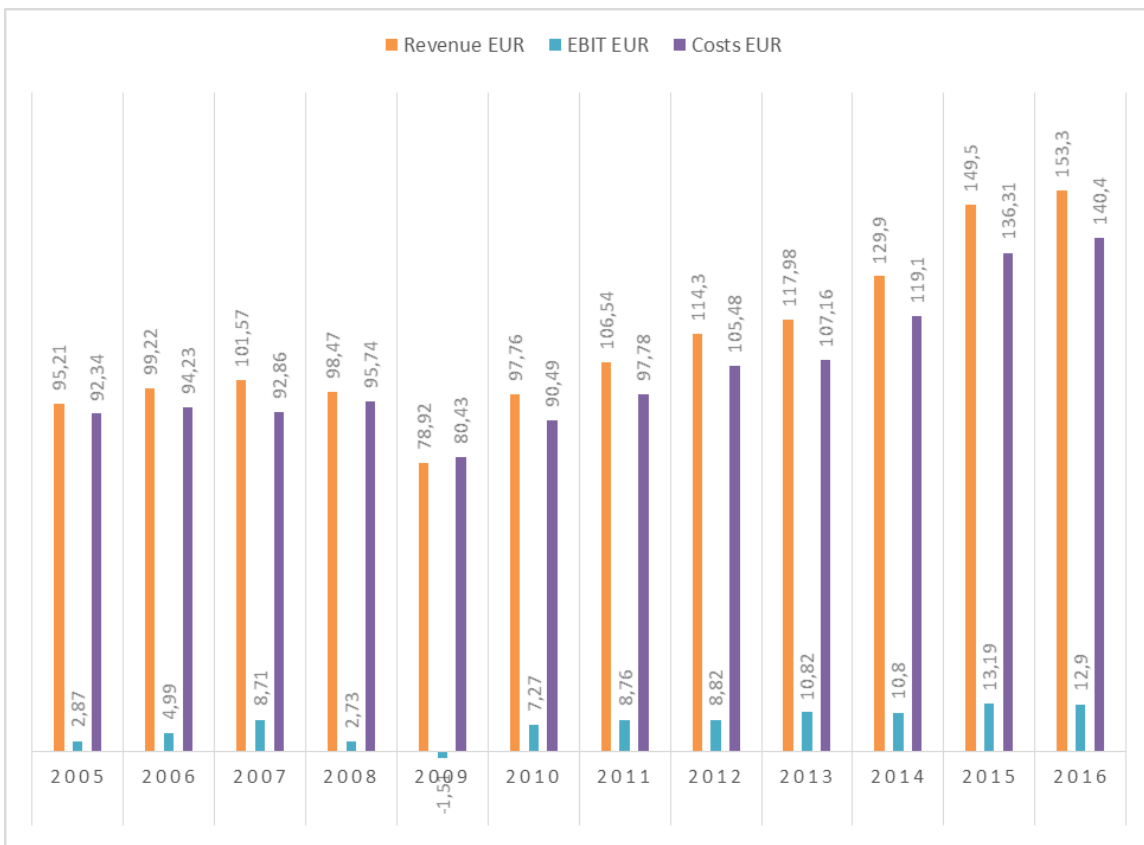


Figure 3 – Revenue, EBIT and Costs of the Daimler AG (2005 – 2016)

Source: Own representation based on Daimler AG, 2017a; 2017b

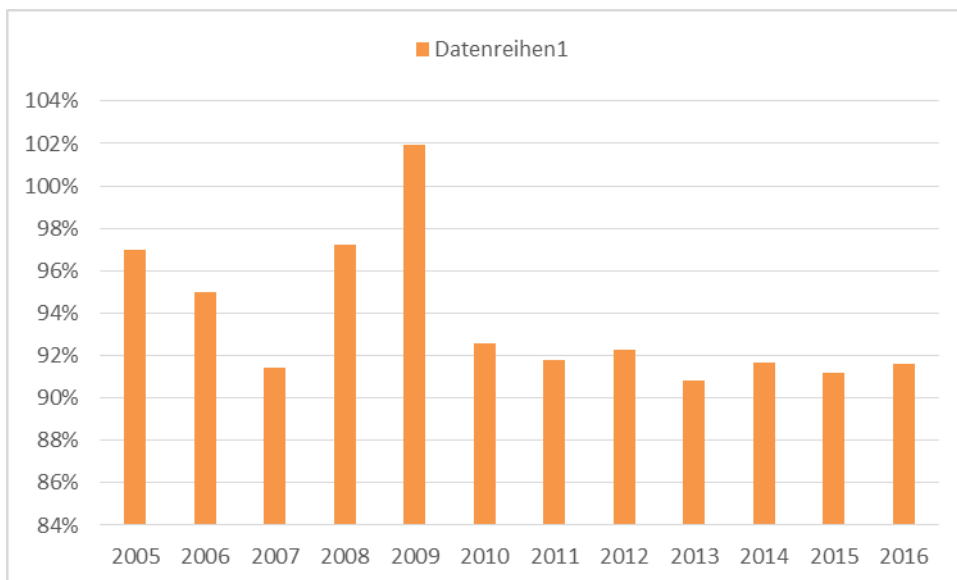


Figure 4 – Costs (percentage of sales) of the Daimler AG (2005 – 2016)

Source: Own representation

In this context, it can be seen that the percentage cost share has fallen since the implementation of modular sourcing in 2009. This result supports and confirms the previous literary comparison.

IV. CONCLUSION

In summary this article demonstrates that modular sourcing has more significant advantages for a company than single-, global- or local/ domestic sourcing as a sourcing strategy. Follow, it can be shows that a company should be introduce modular sourcing for its business success. That means the strategy modular sourcing shouldn't suppress if a company in the automotive branch have to select a new sourcing method. Consequently, it is indisputable, that modular sourcing coheres to business success.

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