Challenges and Solutions for Global Products and Production Concepts

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Abstract:

Globalization as source for challenges and chances is still a well known fact. To find the right path for becoming a „Winner of Globalization“ while facing increasing product variety is another decisive and challenging point. This article gives information about analyzing methods which can help a lot to find and to stay on the right track.

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Challenges and Solutions for Global Products and Production Concepts

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The Press often describes Germany as a "Winner of Globalization". The development of new markets, the foundation of new production sites or the cooperation with international companies and their intense cooperation in terms of development and production are some key elements which gives Globalization an appealing image. Taking chances and transforming these into achievable potentials still demands relentless effort "behind the scenes". Nonetheless, it is a long way to become a "Winner of Globalization".

During the 8th Aachener conference for complexity management, which took place in February this year, this was shown by an example from the automotive industry. (See Complexity Management Journal 02/2008). The article shows the key aspects necessary to successfully perform in global markets from the manufacturer`s point of view.

New customer needs and desires accompany an entry in new markets which more or less correspond with the wishes of existing customers in the company's home region. Different laws and restrictions (e.g. exhaust emission standards) as well as differing vehicle concepts play a considerable role. The variant drivers can be subdivided into customer needs, statutory provisions, and company internal concepts as shown in figure 1 for an example of an automotive engine (Figure 1).

Not only the product itself but especially its development processes demand a coordinated interaction in order to guarantee a smooth and complete process. Companies, which so far had a decentralized structure and optimized their processes individually, often feature independently grown structures and processes. In addition tools, methods, and devices which are helpful in mastering daily business are often unique to each division and show only in the fewest cases actual compatibility.

Furthermore, the maturity of technical development is often different. The different exhaust emission standards and their implementation are often listed as an example. In different countries different variants are necessary to fulfill the norms (e.g. Norm Euro 3 instead of Norm Euro 6). Another critical point is communication. Language barriers still play an important role; cultural differences should also be understood in order to not just interpret the solutions together, but to also act in concert when it comes to implementation.

In front of this background, the challenge to create a worldwide uniform product platform should not be underestimated. The complexity of the products and processes as well as their interaction has to be mastered in the same way a conductor has to be in control of his orchestra including all its instruments and musicians. The music of a badly instructed orchestra pains ones ears, while badly integrated complexity leads to delays in the project schedule, misunderstandings, undesirable developments, and lastly a painful exceeding of the budget. It is certainly worth investing at an early stage in complementary methods to manage the arising complexity.

Approaches for controlling complexity

Start early analyzing variants. During the underlying engine project it was recognized that the early integration of variant management is of great importance. It is the only way that the control levers for complexity can be adjusted effectively. To be consistent, customized methods and tools have to be chosen. The systematic analysis of external complexity, in terms of features and characteristics which are demanded by the market, was ranked most important. In a next step the market needs and its implications have to be linked to the internal complexity. How many components and parts of the entire production program are unique and which can be used as a common basis? How does the product variance evolve in the product development process? How does it affect logistics and assembly? These and other crucial questions have been and need to be systematically completed. The Complexity Manager Module F/V was introduced as a tool, which assured the optimal interaction between external and internal complexity.

For the construction of an automotive engine that will be in used internationally, all attributes driving the variants were defined and the frequency of their use in the product program identified. With the help of this data the expected level of product diversity can be visualized and quantified. It was quickly noticeable that even though there was a small number of automotive features (standard, bus, construction vehicle…,) a

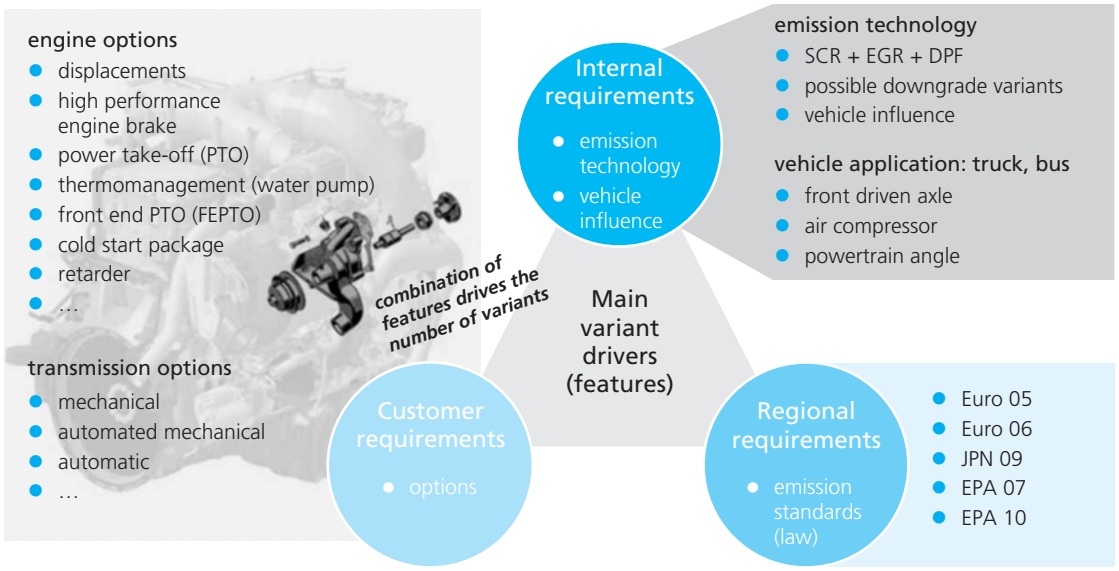

Fig. 1: Source of possible variant drivers

couple thousand engine varieties could be expected due to multiple combinations. With the help of sales forecast data for different features, the frequency of each product variant was determined. Hence it was possible to subdivide the product program into "Blockbusters" and "Flops" in advance (Fig. 2).

With the help of the prepared data and information it is now possible to track changes or adjustments and their effects on the variance throughout the project. Questions such as "What effect does the combination of features have on the cold-start-package with consideration to variance?", "By which amount will the variants increase, if the NAFTA region has to decrease its exhaust emissions due to the demands of export markets?" could, thus, be answered promptly. This approach underlines again the fact that variant management should be a permanent practice. The data has to be kept up to date in order to give fast and accurate answers to questions such as the above. This is not something that can be done "on the fly" for only two months and then end. Variant management can be compared to yard maintenance. If the garden is not cared for properly, huge efforts have to be undertaken in order to gain control again. However, if the garden was cared for on a regular basis, the overall necessary efforts are fewer. Variants act in a similar way. If sustainability is missing the variants will soon grow to an uncontrollable amount again.

In this context it is essential that the above mentioned changes do not question single characteristics (options), instead it is more important to review combinations of characteristics. With this respect the accusation that one is not fulfilling customer demands if certain options are not offered anymore, is incorrect. The goal is not to narrow down the product range, but to identify which weak options can be combined with strong options and what the possibilities are to create bundles. The above mentioned method of visualizing variant diversity and quantities helps to reach this goal. For example for the mentioned automotive project, the variety of certain components was reduced by 30 % due to the creation of the "cold-starter-package" which made it possible to identify and eliminate products with low sales volume. Thus, no one option was eliminated, instead only some combinations of options were removed. The product range offered to the customer has only been adjusted by expected low sales volumes and therefore was not restricted.

In order to achieve this in a global project and working environment and to keep up the variant management, it is necessary to focus on clear communication and a steady information flow. This point should not be underestimated. Inserting data in the Complexity Manager and the general maintenance of the database is in consideration of workload less time intensive than the communication needed to obtain current information. The better the variant management is integrated as a cross-departmental function, the less difficult it will be to obtain up-to-date information. The outcome is a standardized database that does not only consist of tables and numbers but also clarifies, with the help of the variant tree, where variants are generated, where the drivers are and where "focal points" lie. Here,

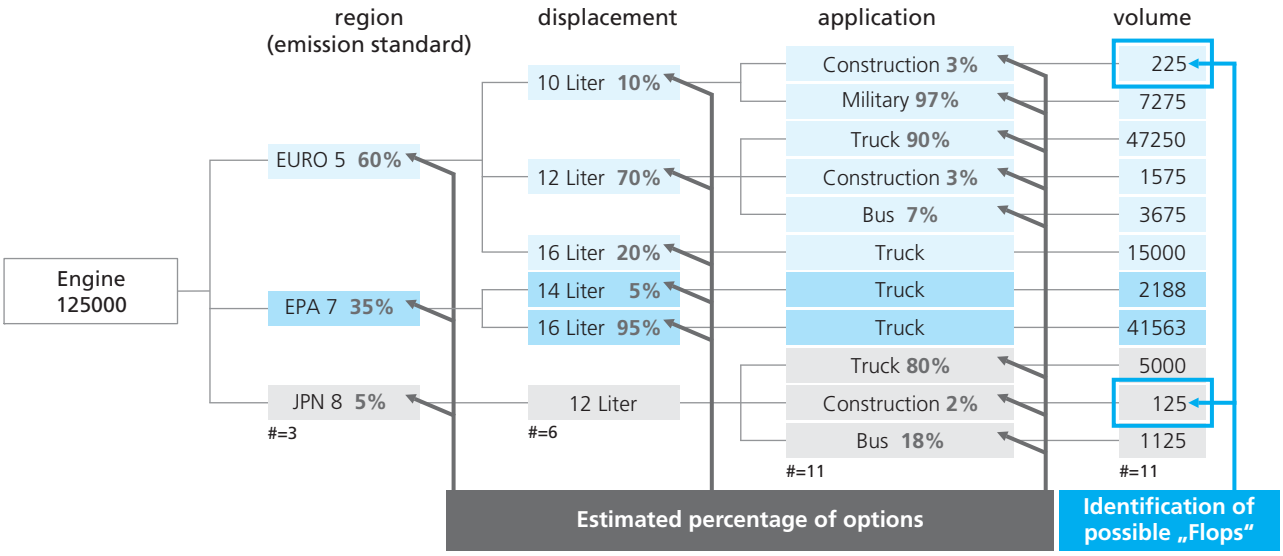

Fig. 2: Example from the automotive industry

first improvements can be implemented. The underlying database represents the basis for the handling of further questions concerning the topic of variant development, such as

- Displaying variants for several components and assemblies: Every component should be justifiable by specific customer requirements. Especially in case of exotic parts it is necessary to support their existence by backing them with an underlying market demand. Additionally, the quantity prognosis should back this up.
- Interdependency will be shown and is made transparent at an early point. For example a cooling device, due to its installation space, might influence the design of other components. This can lead to the need for more tools and therefore for more investments.
- The influence the use of a utility vehicle (construction site, military,…) has on components and devices, should not be underestimated. This begins with the orientation and position of the engine and ends with material-sided strengthened components which could be damaged during intense use in the field.
- Recognizing these relationships at an early stage often leads to problem orientated discussions; because of the variant analysis more facts are exposed. When the number of different components and devices is fixed, the purchasing department is interested in knowing the exact number of component versions (e.g. how many cylinder crankcases, how many pipes for the exhaust-gas return, how many oil trays) in order to negotiate with suppliers.
- For in-house produced parts the data helps in terms of resource planning for the differing component versions. Special attention has to be paid to cases where different variants, resulting in different part numbers, do not necessarily require a different tool/tool-variant. In some cases the variance can also be shown by the assessment of the assembly process.
- The generation of variants during the assembly process turned out to be another very important point of the project. How does the variance develop for half-finished goods throughout their assembly process? How does the combination of components in the final assembly have an effect on the variance in the pre-assembly process? This is highly important when deciding at which production site which volumes should be assembled. Especially in a global environment it is important to determine which site assumes which assembly group and how this affects logistical matters.

Potentials

When thinking of logistics during the transportation of goods and therefore also variants, of the acquisition of tools, of continuous processes which work with low friction losses, the above mentioned transparence plays a role in making potentials accessible. The bundling of characteristic combinations can help to save investments into complete tools while the combination of single options can reduce maintenance of certain variants. As already mentioned before, the variety of a single component has been decreased by 30% due

to bundling options. Other examples with similar potential were identified. Cost reductions concerning the acquisition of tools can highlight how easy savings of millions of dollars can be achieved. The biggest lever is represented by costs that can be avoided beforehand. Costs that are eliminated afterwards by variant management represent a much smaller lever due to the fact that standard tools and other resources have already been bought. These are impossible to get rid of and are described as sunk costs which are additional "dead weight" for the company.

Conclusion

In the case of the underlying automotive engine project the avoidance of unnecessary product variants was highly beneficial. The variance caused by customer requirements was recognized early in the development process and could be reduced to a minimum. The project team was able to point out imminent investments into new tools and machines. It turned out that costs of millions of Euros could be avoided. Although a subsequent reassessment of product variants is not ideal, it might still be necessary. In a global project, as shown in this case, clear and straight forward communication and a continuous flow of information are essential in order to achieve the described transparency, reveal focal points and to be able to perform preventive measures for optimizing the product program. Only if a company overcomes the obstacles lying in the management of product variety on a global scale, will it get closer to its goal of becoming a "Winner of Globalization".

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