



White paper

Value-based product design: The customer's voice in product development

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Management summary

The success of new car models is the result of a balance between the value to the customer and price. All too often, the development of cars and their pricing does not begin directly with customer value, but rather with competitors' cars in the corresponding segment. From these, manufacturers will then derive the positioning, specification and pricing for a new car and calculate the target costs based on an estimation of volumes and defined target margins.

Yet the truly essential question is, how can OEMs quantify customer value of new vehicles, even during the product development process? Because if this were possible, new leeway could be unlocked for OEMs for strategically optimising product and equipment features during their development within their price and target cost framework.

This can be realised if one takes advantage of applying an innovative but pragmatic method in which the customer's voice is „built into“ the development process without having to consult the customer about every single new product decision. For this, Strategy Engineers and Vocatus have developed a multi-stage process: the value-based product design.

This approach develops a “standardised currency” which for the first time allows the customer value to be integrated into the hard KPI system (cost, weight, etc.) of research & development (R&D). With this, R&D receives a valid and directly useable measurement system, which enables the making of clearly faster, more transparent and sustainable product decisions.

And so the product substance can be optimised in each step of product development on the basis of the relationship between customer value and manufacturer costs. Introducing this method contributes considerably to the integration of the customer voice in the decision process of product development.

The article describes in detail this method tested successfully in many previous projects and gives practical examples from current customer projects. It also sketches in concrete terms how “value-based product design” can be integrated into the OEM's processes.

Major trends in the automobile industry require a systematic integration of the customer's voice

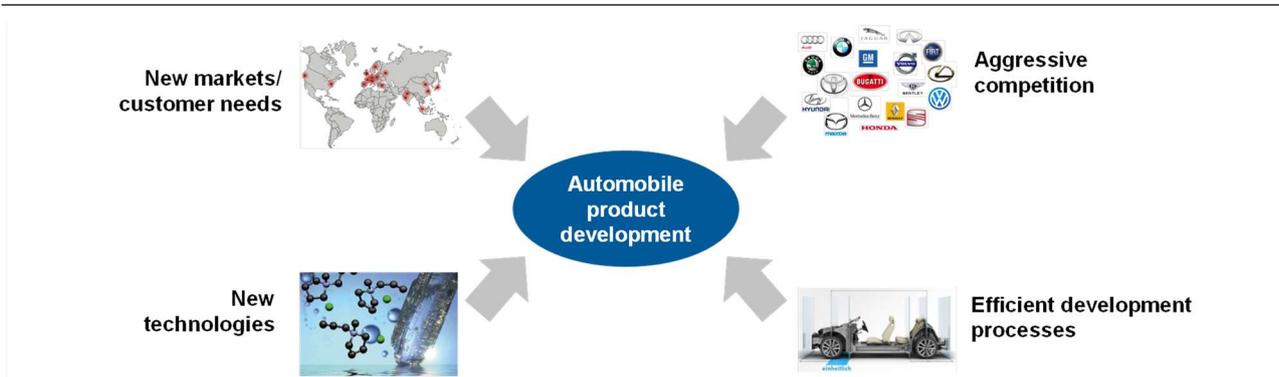


Exhibit 1: Major trends influence automobile product development (Source: Strategy Engineers, Vocatus)

The following major trends (see also exhibit 1) shape the automobile industry and require a systematic integration of the customer's voice in vehicle planning and development:

- **New markets and customer needs:** There is not „one type” of customer. Today's automobiles are becoming more segment specific and their markets are becoming more global. Customers from different cultures and market situations must be provided with ever newer car concepts. And preferences from different regions can sometimes differ explicitly. Often in R&D the necessary information is not available about which product features are relevant in other markets and cultural groups.
- **Competition:** Especially through steadily increasing pressure of competition even more niches will be occupied to which the OEMs must react. These require setting clear limitations and objectives for vehicle specification, in order to appeal to target groups with attractive offers. The available knowledge during development about these new car concepts is often low.
- **Technologies:** Developments from other industries, for example from the area of consumer electronics, must be incorporated efficiently and quickly – sustainable and long-term trends must be differentiated from short-lived hypes.
- **Efficient development processes:** In order to keep the variety of models while simultaneously meeting reductions in the development cycles, all OEMs set up platform and modular design systems which however constrain the degrees of freedom for product differentiation. Here it is critical to hit home with the customer with the remaining levels of freedom.

Customer-developer interfaces as essential challenge

The requirements for product development mentioned above require an approach which can quickly and pragmatically evaluate how the customer reacts to the various product versions and product contents. For every question which has an influence on the product design of a car, a consumer survey or customer study cannot be conducted. This is firstly due to the need for decision speed and secondly due to the wealth of detailed choices, which in total constitute the product substance of the car without being economically expedient.

Our value based approach can be integrated into the product development process without having to ask the customer about every product decision. Additionally it delivers reproducible and transparent results in order to guarantee a high degree of decision stability. The approach consists of four elements which we will further detail below (see exhibit 2).

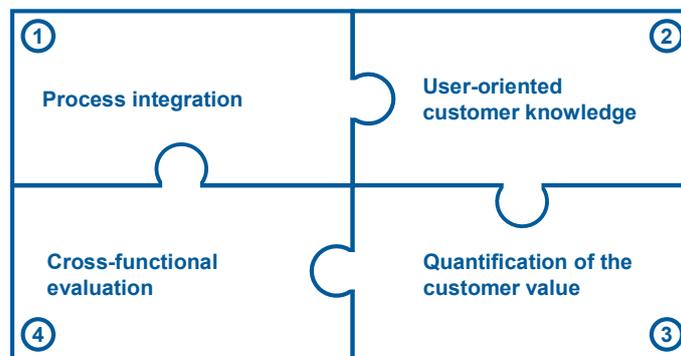


Exhibit 2: Four elements for the integration of the customer's viewpoint in value-based product design
(Source: Strategy Engineers, Vocatus)

1. Process integration

The integration of the „voice of the customer“ in the development process is not a new challenge and there have been many well-recognised methods and approaches. However, in practice these have failed to catch on. The best known method is perhaps “Quality Function Deployment (QFD),” with which customer requirements and product functions are connected with one another in a systematic way. The implementation in the industry however has not been successful for several reasons: implementation needs very high effort, it usually has no natural “owner” in the organisation, and it is only inadequately appropriate to support the communication involved in decision-making at the interface between customer and engineering.

Previous methods for integrating the „voice of the customer“ have failed to gain general acceptance in product development of automobiles

The procedural integration of the „voice of the customer“ is dependent on the phase of the development process (see exhibit 3). If the questions at the start of usually large conceptual considerations are, for example, how technologically innovative or functionally a car should be designed, then the questions will become ever more concrete over time, ever more detailed and varied. During the series development, questions of customer relevance become very detailed and the still vaguely formulated product features listed in

Flexibility in the development process requires that important „customer relevant“ decisions are highly stable

the specification sheets will be backed up with specific measures. That is deliberately scheduled in order to have the flexibility for new framework conditions, for example to be able to react to new offers by competitors. In doing so, there are clearly “cultural” differences to account for between the producers in their respective implementations. While Japanese manufacturers usually consider the earlier defined requirements during the development of a series very strictly, European and especially premium OEMs retain a relatively high degree of flexibility in order to set the benchmark for a newly developed automobile. Here it is even more important that late stage decisions are made consciously.

Even at the end of the development process, customer relevant questions will still arise. As an example, the design of the gas pedal acceleration characteristic for better acceleration response can be mentioned: here, the desired driving characteristics need to be fine-tuned (e.g. sporty vs. comfort). These different questions throughout the development process cannot be answered using the same approaches. The method presented here focuses especially on the questions which must be answered during the early concept phase in the product definition. In this phase the requirements in the specification sheet are codified and the majority of customer related decisions are made, which altogether shape the character of the automobile. Exhibit 3 illustrates the typical questions which arise during the development process.

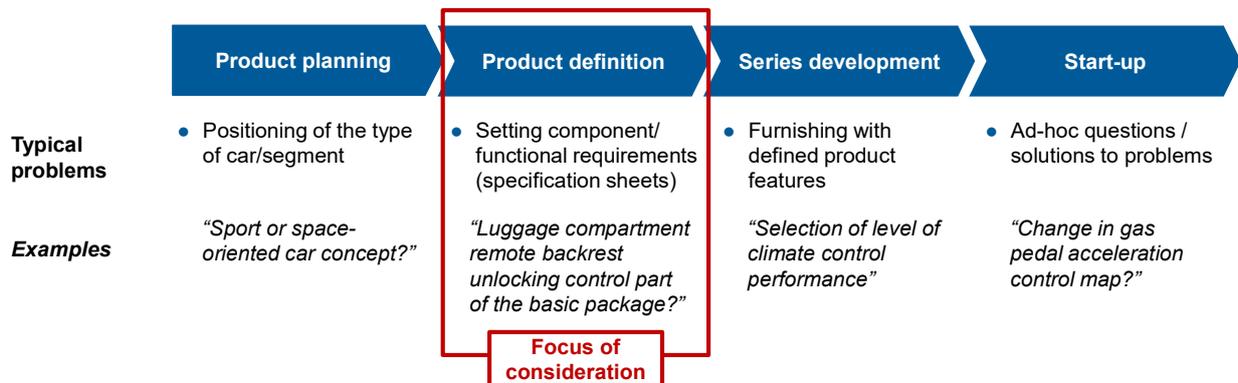


Exhibit 3: Along the development process different problems arise depending on the phase, which make the integration of the viewpoint of the customer necessary – the value-based product design focusses on the product definition (Source: Strategy Engineers, Vocatus)

2. User-oriented customer knowledge

The interface between market/customer and product development is one of the most difficult of the passenger car-OEMs. Those who are responsible in the sales & marketing organisation and want to integrate the customer's voice into the development often lack knowledge about the specific requirements of the engineers. There exists little feeling for the difficulty of deriving concrete technical requirements from the wishes expressed by sales, and what it means to bring these together coherently.

On the other hand operationally responsible (component) engineers do not understand the complexity and necessity to consistently collect the customer's voice through a worldwide sales & marketing organisation. At practically no other interface in the auto-mobile industry is there such a low level of knowledge about the „opposite side“. An exchange of staff could help, but there are few market experts who switch into development positions and even fewer developers who find their way into the sales & marketing. All of this leads to the fact that at the interface between sales/marketing vs. R&D, words are spoken at cross purposes with much lost through the gap, as exhibit 4 illustrates.

At no other interface in the development process is the point missed more often than between sales/marketing and development

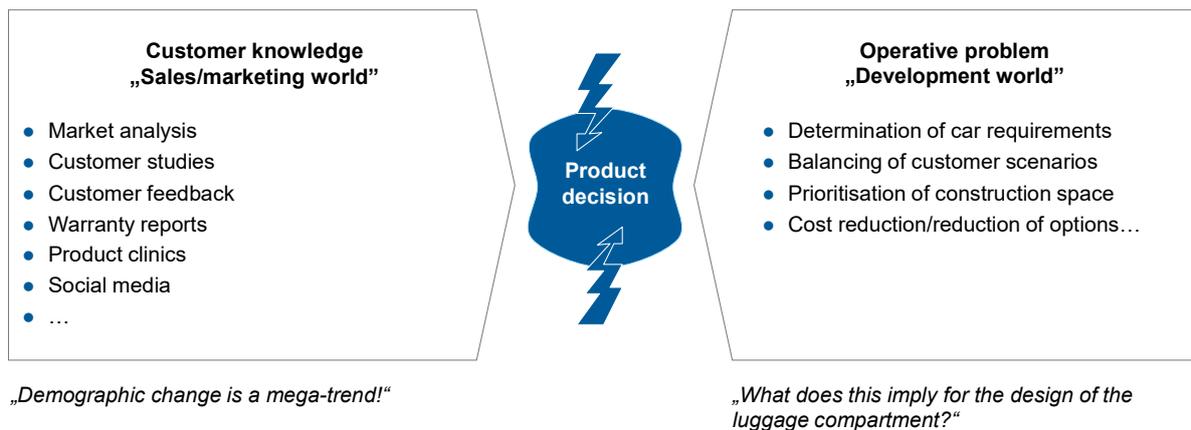


Exhibit 4: Differing focuses of sales/marketing compared to development lead to poor understanding and result in interface loss (Source: Strategy Engineers, Vocatus)

Contributing to the problem are market studies which often are formulated rather abstractly and developers who have difficulty in interpreting the meaning of the results for their concrete work (what does the change in demographics have to do with any implications for designing the luggage compartment?). This often leads development to initiate their own examinations (for example observations of the usage of luggage compartments at a supermarket parking lot) which however do not meet the specifications of market research regarding representativeness and therefore do not satisfy the statistical power needed to support the statement. Results of such studies are not acceptable to those responsible in sales and marketing. The results

are discussions which are emotional and informed by gut feelings, which lead to unstable decisions and to frequent further iterations. The results are acute loss to friction as well as higher complexity due to non-acceptable decisions and changes made too late.

The method introduced addresses these difficulties as it provides the basis for decisions, which can be acceptable to all sides.

3. Quantification of customer value

The work of developers is controlled by a set of quantitative KPIs. In focus here are the costs (production costs, investments, costs of tools, etc.) or quantitatively easily collectible indicators for quality (guarantee costs, breakdown frequency, etc.). These KPIs are directly integrated in the target system of the responsible engineer. Quantified targets for the customer value of a product still do not exist. These are available qualitatively in the form of overall product requirements. Because of their limited measurability, decisions are therefore often made on the basis of measurable targets such as for example costs, weights, timing or package. The customer value, therefore, will sink systematically to a lower priority. Therefore, the objective must be to install a “hard” measurement system, which accommodates the integration of the customer value as a decision quantity into the product definition and product development.

An additional demand for quantification of customer value comes from the importance of making “trade-off decisions” during product development. With target costs being defined, the budgets must be employed so that the maximum customer value can be achieved. Decisions result from these, such as, for example: What importance does the luggage compartment design have in comparison to the acceleration, to the operating concept or to the driver assistance systems? Simply said: for this car concept, does the customer rather desire 20 litres more luggage compartment room or rather a motor with 20 HP more performance?

The basis for a customer value measurement system of this kind should ideally be supported with an appropriate customer study. This study must satisfy two essential requirements:

- **Unified “currency” for the engineers:**
The customer value must be quantified in one unified “currency” (for example a point system), which makes the rating of various product features comparable and which thereby can be integrated into the existing KPI systems.
- **Features must be translated into one understandable language for customers:**
Product features must be presented to the customer for evaluation as they would experience them in a real purchase decision. Only then can the customer provide a valid evaluation.

Since the quantified value to the customer in development is often not available, it is systematically prioritised lower compared to the costs, weights, quality etc.

In order to make the best possible „trade-off“ decisions, the customer value must be quantified.

The most valid measurement of the customer value is one which most closely reflects the actual decisions of the customer in reality. An evaluation using value dimensions which are too abstract or too rigid („is driving performance more important than economy“) is to the contrary less expedient. Two examples shall be discussed in the following:

- **Too abstract:**
What customers, for example, understand “driving performance” to be can be very different from what engineers are considering: From experience we know that when customers think of driving performance they typically include attributes like fuel consumption, driving comfort and safety (see exhibit 5).
- **Too rigid:**
Product features do not necessarily influence only one, but rather multiple technical product attributes (for example, a hybrid engine on „efficiency“, „sportiness“ and „environmentally friendly“). A too rigid classification of product features for the attributes is hardly reasonable, especially where it involves a new concept such as electromobility.

The following result of one of our customer surveys shows which value aspects of the attribute “road performance” the customer understands. This emphasises the need of asking the right questions so engineers and consumers have the same understanding when evaluating product attributes.

Acceleration, speed, horsepower	62%
Fuel usage, distance	18%
Longevity, reliability	13%
Road performance, handling	11%
Driving comfort	7%
Safety	6%
Mileage per year	4%
Acoustics	3%
Driving dynamics	3%

Exhibit 5: Compact and midsize car drivers do not necessarily understand “driving performance” in the same terms as the developers. (Source: Vocatus customer survey)

One achieves the best results through translating technical requirements into equipment configurations which the customer can compare, as he would if he were using a car configurator on the internet or a template on-site at a dealer (for instance: which equipment package would you choose: the xenon light package with adaptive curve lights and an automatic lighting system, or rather remote control and programmable auxiliary heating?). This means the customer must be forced to do “trade-off-decisions”

The best results are delivered by customer studies which realistically model the “trade-off” decision process of the customer.

With the maximum difference scaling (MaxDiff), a conjoint variation, market research has a proven and simple to implement tool available with which the customer can make a series of such choices regarding car configurations:

Most attractive		Least attractive
<input type="radio"/>	Split-fold backseat, level load compartment floor	<input type="radio"/>
Most attractive		Least attractive
<input type="radio"/>	CD radio with navigation system and 6 speakers	<input type="radio"/>
<input type="radio"/>	Xenon lights with LED day and adaptive headlights	<input type="radio"/>
<input type="radio"/>	Leather, heated seats	<input type="radio"/>
<input type="radio"/>	Automatic climate control with zone regulation	<input checked="" type="radio"/>
<input checked="" type="radio"/>	Fuel consumption (6L/100km)	<input type="radio"/>

Exhibit 6: With the conjoint “maximum difference scaling (MaxDiff)” procedure, customers make a variety of choice decisions, as they would arise in the course of a purchase (Source: Strategy Engineers, Vocatus)

All tested equipment measures shown in exhibit 6 have been translated from an equivalent technical requirement of engineering. MaxDiff results are then calculated and deliver concrete values on one unified metric scale. This way it becomes clear to both the developer and product manager how the component development and product definition exert their influence on the vehicle substance and thereby also influence the value to customers. With the quantified customer value, the following essential questions can be answered:

- What additional value will be generated, if an additional feature in the product concept is incorporated?
- To which value dimensions of the vehicle does this feature contribute (e.g. cornering ability, interior flexibility)?
- Which loss in customer value will be acceptable if a feature were removed from the concept?

When applied systematically, an extensive library of customer knowledge across car segments and features is created. Also very specific development questions (for example, „Should a ‘remote backseat unlock’ be placed in the equipment level of the model series?“) can then be answered in light of available customer knowledge, for example through:

1. **Classification into affected vehicle attributes**, where those features to be measured make their contribution (for example „Remote backrest unlock “ into „ease of use“ and „interior flexibility“)
2. **Determination of the maximum customer value** of the vehicle attribute, which can be reached through this feature

Customer studies which describe the entire vehicle always require an interpretation of results with respect to the concrete problem definition

3. Calibration of the customer value through weighting of the highest achievable customer value of the attribute. Result is a realistic impact of the assessed product measure from a customer perspective

The classification into affected vehicle attributes (1) usually takes place through expert assessment. For the identification of the maximum customer value (2) along with empirical data from the study, analogies to possibly previously executed or externally referenced studies can be made, drawing on, for example, the New Car Buyer Study (NCBS), JD Power Initial Quality Study (IQS), or the Automotive Performance, Execution and Layout (APEAL) Study. For the calibration of the customer value (3) clear, transparent rules are used to evaluate the impact of the assessed product measure. Aspects to consider are, for example:

- Is the **customer perception** clear, in other words, how vividly does the customer perceive the feature?
- Are **standards** met, that is, does the customer expect to encounter this feature in the segment under consideration?
- In this segment, is it a unique selling proposition, in other words, can we excite the customer with it?

In this way, the achievable customer value can be calculated, also for concrete product features, as exhibit 7 illustrates.

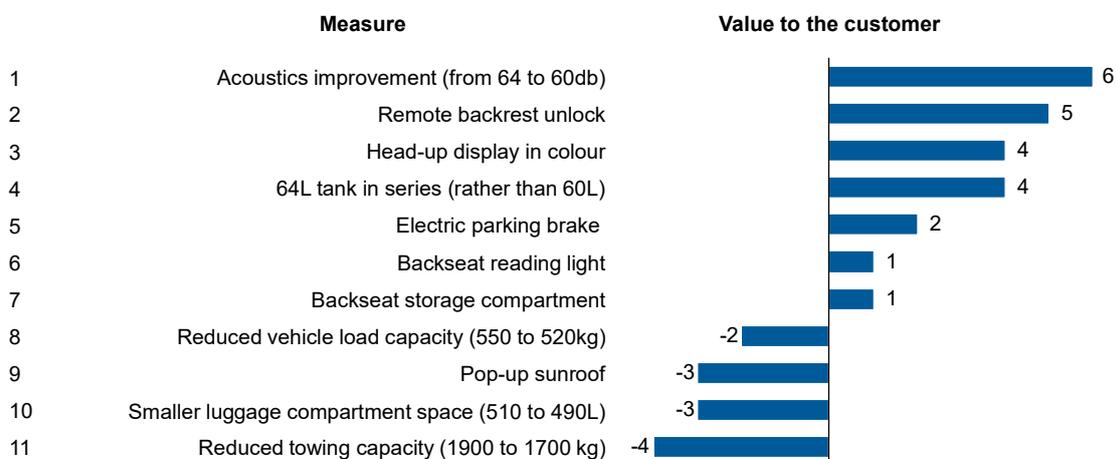


Exhibit 7: Value-based product design allows specifications to be quantified in terms of concrete benefit values from the customer's point of view which can then be brought into an unequivocal rank-order (Source: Strategy Engineers, Vocatus)

4. Cross-functional assessment

The (MaxDiff) customer survey described above ideally provides the basis for the assessment, in that it introduces a "currency" for the customer value by quantifying vehicle attributes from the customer perspective. Furthermore, for a comprehensive assessment of product measures, additional information which is available in the company should also be taken into consideration. This information is often found scattered in very different places:

They exist in different departments with different roles and responsibilities, for example:

- **Central market research:** Responsible for general, representative customer surveys and product clinics – usually commissioned by sales/marketing or model series
- **Sales/product marketing:** Coordination of the demands from various countries within the sales organisation, usually in product determining core markets
- **Quality:** Collection of quality field data or studies (for example JD Power IQS/APEAL)
- **Competitor analysis:** Consideration of the concepts of the competition in order to support the requirements definition
- **Central units for requirements definition within R&D:** consolidation of market-side legal and technical requirements of the product concept

Customer studies should be interpreted by internal “customer experts”

In order to increase the usability the information owners (the “customer experts”) must be brought together directly with the users (usually product planners and engineers). That means the specific question of whether, for example, unlocking the backseat rest from the luggage compartment for a specific car model can bring an especially high value to the customer, must be discussed directly with the relevant “customer experts.”

The methodical approach in value-based product design is to bring these roles together in a cross-functional “customer-expert” team. The alignment can but does not have to be in a physical meeting. Important is that all relevant customer information is shared and understood to come up with a joint assessment. Exhibit 8 shows the possible composition of such a team.

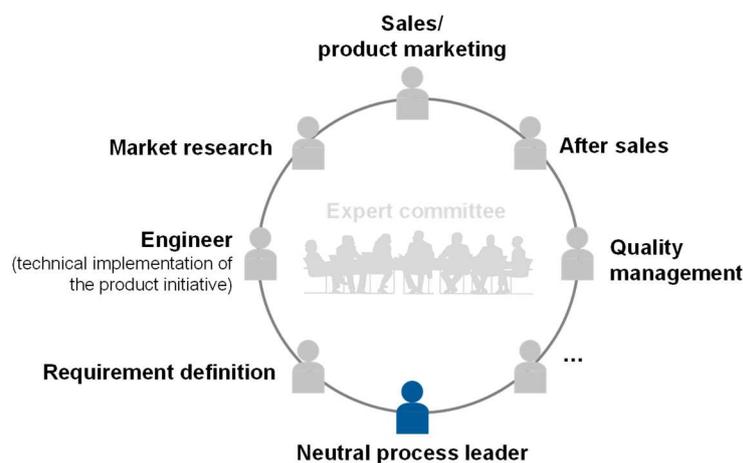


Exhibit 8: For the specific engineering question a cross-functional expert team interprets internally available information from the viewpoint of the customer

Since every internal customer “advocate” must contribute valuable knowledge, the institutionalisation of cross-functional evaluation teams is highly expedient. In addition, the understanding at the interface between customer and development will be strengthened. Through the operative work valuable

informal relationships emerge at working level. Furthermore, through the inclusion of different company departments a high decision stability is given.

In order to assure that the discussion is not characterised by individual opinions, a neutral process leader (litigant) is necessary, seconded e.g. from the vehicle line organisation. Different places for these roles are possible here (for example organisation of a series, development/management of requirements). He must make sure that only those matters will be introduced to the expert team which have the required maturity in terms of:

The process leader needs deep knowledge of the current state of development

- **Technical maturity:** The product measure must be able to be integrated into the product concept. It must be possible to realise the change of concept within the given milestones of the development process.
- **Transparent effects on the customer:** The effects on the customer must be clearly and qualitatively worked out (for example, the improvement of the interior flexibility through a remote backrest unlock).

The product measure for which the customer value would be quantified, can be, for example, contrasted with their manufacturing costs in a cost/value portfolio, as clarified in exhibit 9.

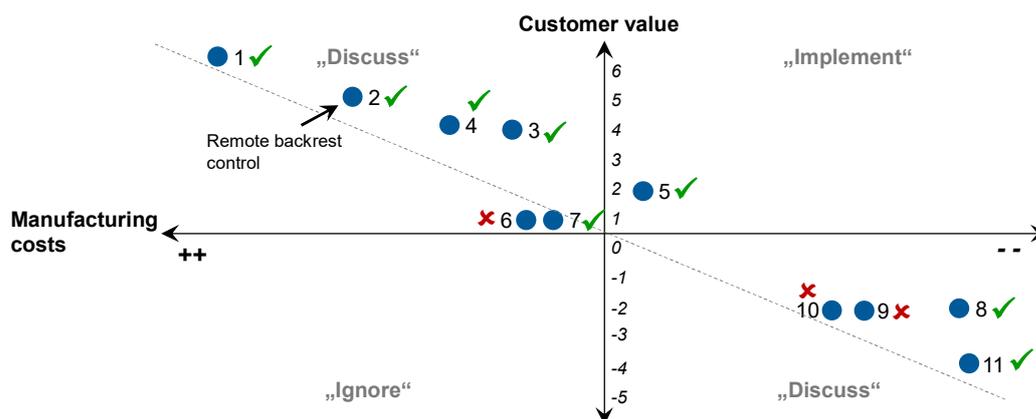


Exhibit 9: As preparation for the decision, the quantified product features from the customer's point of view will be compared with other relevant key numbers, such as for example the manufacturing costs (Source: Strategy Engineers, Vocatus)

Typically measures in the top left and bottom right corner are discussed in prioritisation and balancing processes, i.e. typical value-up or cost-down measures. Product measures with add-on cost and reduced value should be ignored (bottom-left). Measures in the top right corner with increased customer value and reduced cost should of course be implemented (unfortunately, those do not occur very often). This transparency gives the product manager the possibility to optimise (balancing the contents of the product) the customer value of the vehicle, under consideration of the target cost, by leaving out less useful features and adding more useful ones.

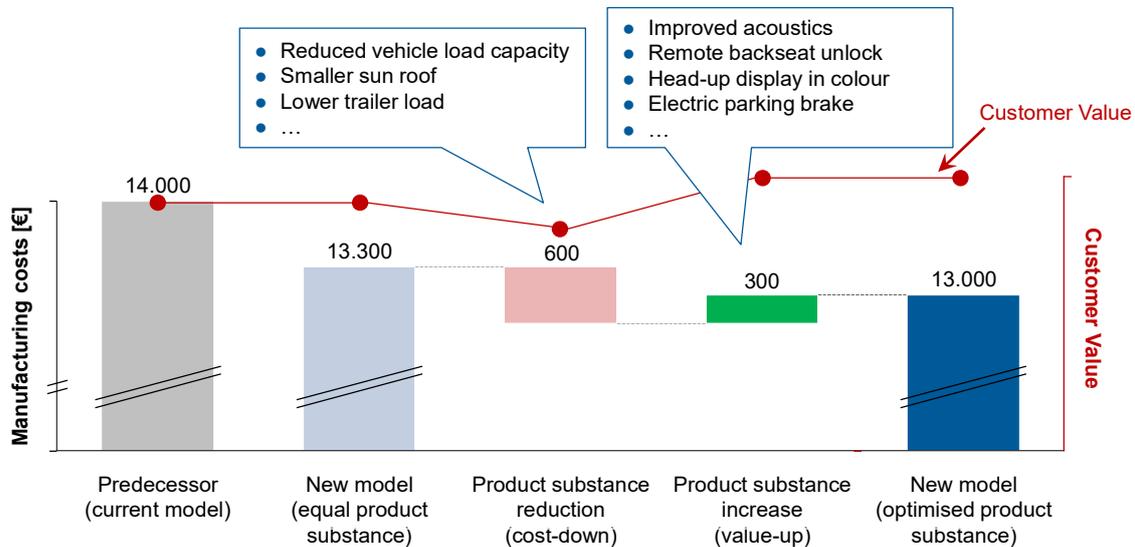


Exhibit 10: The customer value is built into the development system and so the product substance is comprehensively optimized (Source: Strategy Engineers, Vocatus)

The result is the optimal balance of customer value with respect to development goals such as manufacturing costs

Thus, the customer value of the measurements will be integrated into the monetary target system and into the development process, and will be directly compared with the corresponding manufacturing costs. In the end, this results in the best possible relationship between customer value and costs.

Path to implementation

Sustainably anchoring the customer's voice in the development process is a process involving the four previously introduced elements

1. **Process integration** of the customer's voice in existing processes
2. **User-oriented customer knowledge** as a transmission belt between sales/marketing and engineering
3. **Quantification of customer value** from product contents
4. **Cross-functional assessment** for decision stability

What at first glance seems to be the higher effort required for decision making is compensated for with the great advantages of high decision stability.

However, especially the implementation is often a long-term change process. The tendency to fall back into „old“ approaches is high and when in doubt, also seems less risky for those involved. Here the support of management is needed: It must provide space for the systematic incorporation of the voice of the customer in the development process.

The advantages of the methods introduced here will be, however, directly observable by all parties involved. This is everyone who significantly shapes the product along the development process, meaning especially the responsible engineers, the vehicle line organisation as well as sales & marketing.

Despite the extensive institutionalisation in our applications we were able to achieve very concrete short-term effects with the approach:

- Lowering of the development costs through early identification of which, from the customers point of view, is the best solution: avoidance of parallel development
- Avoidance of expensive changes through high decision-making stability and transparent decision factors
- Resolution of overlapping divisional and departmental conflict situations through cross-functional expert teams

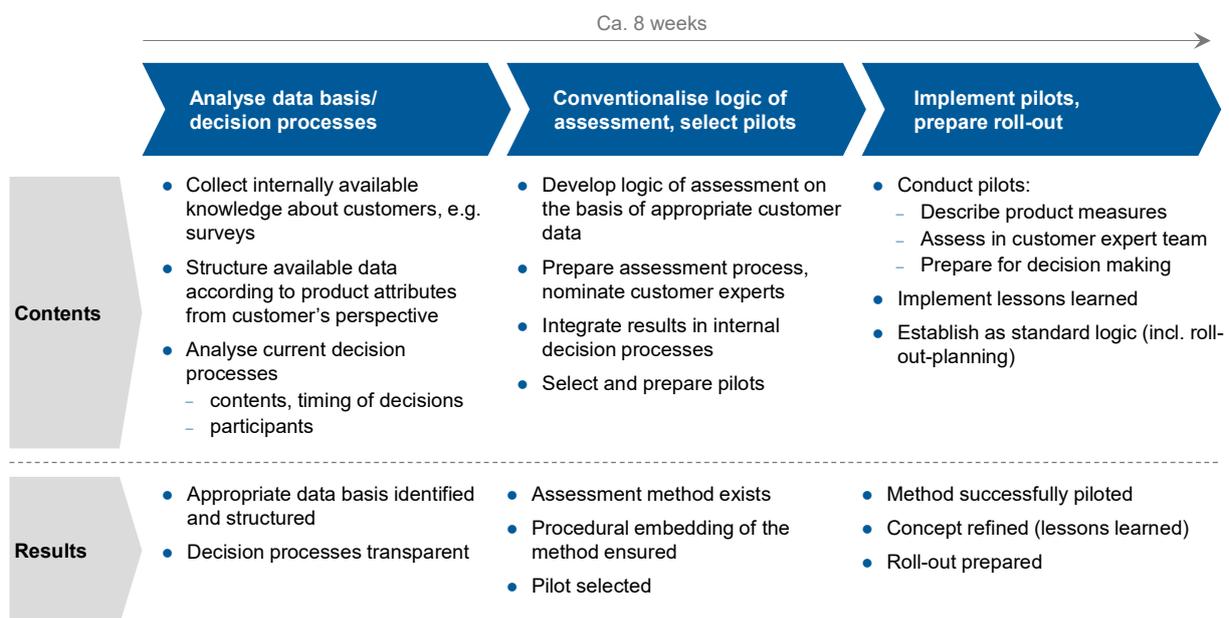


Exhibit 11: Depending on the data basis, value-based product design can be piloted for concrete car projects within 8 weeks (Source: Strategy Engineers)

The implementation generally happens through piloting vehicle projects. The effort in doing this is dependent on the availability of customer information for the respective matter in question. Exhibit 11 shows a possible project.

1. Analyse data basis/decision processes

In the first step the available data basis will be analysed. Afterwards it will be transparent, how far the available data can support the upcoming decisions to be made. At this point, it can be examined in the project team whether the insufficient availability/limitation of data make it necessary to collect further data. Additionally, it will be established at which point in the decision-making process the new method should be piloted.

2. Conventionalise the logic of assessment, select pilots

Together with the expert team, the logic of the assessment will be developed, the procedural embedding will be discussed, and the product decisions to be assessed will be established.

3. Implement pilots, prepare roll-out

The defined product measures are prepared and evaluated in the customer expert team. The results will be played out to the respective decision committee. The experiences from the pilot will be discussed with the project team („lessons learned”). Based on this a roll-out plan for further implementation can be compiled.

As with every method it is crucial, that the „pure doctrine” is not brought to bear; rather the existing situation in the respective company should be taken as the basis and the approach should be adapted accordingly. Existing and well-practiced processes can be integrated. Existing decision committees should be used in order to achieve the quickest possible acceptance of the new approaches.

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About Strategy Engineers

Strategy Engineers is a leading strategy and management consultancy with a focus on the automotive sector and closely related industries.

From offices in Germany and China, Strategy Engineers supports its clients in business and growth strategies, product optimizations as well as in productivity improvements in the fields of research & development, operations management and sales, marketing & after-sales.

As a member of the AVL Group located in Graz, Austria, the largest independent engineering services provider to the automotive industry worldwide, Strategy Engineers offers a unique combination of distinct analytical consulting skills with comprehensive, in-depth technical and technological expertise.

Once again after 2014, Strategy Engineers has been awarded as “Beste Berater” in 2015 by Brand eins and Statista. Within the categories “Automotive & Supplier” and “Operations Management” Strategy Engineers was ranked in one of the top places of German consultancies. Furthermore a third category was gained with “machinery & plant engineering”.

This conclusion was reached by a statistical evaluation conducted by Brand eins and Statista on the performance of 15.000 consultancies in total. With more than 2.900 questioned clients, executives, project leaders and partners this survey represents the biggest one within the German consultancy market.

For further information about Strategy Engineers, please see:

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About Vocatus

Vocatus is an internationally active, innovative market research and consulting company and is the leading institute in the area of psychologically based decision research. We advise clients from the automobile and auto-supplier industries covering all phases of the customer value-based product development.

Vocatus has received many national and international awards for its innovative studies and practical concepts. As an internationally competent project partner, Vocatus supports clients in more than 80 countries worldwide.

For further information about Vocatus, please see:

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