

Active customer roles during the innovation front-end: theoretical foundations and managerial implications

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The importance of customers as external innovation resource has been recognised in theory and practice for a long time. All the more in today's diverse and dynamic business environment companies engage in a lot of different activities to involve their customers during innovation processes. Unfortunately many customer integration efforts take a rather limited view on active customer roles during the front end of innovation - being confined to the well-known lead-user approach. This study focuses on the question of how actively integrating customers into the early phase of the innovation process can be accomplished efficiently and effectively. The initial analysis describes strategic fundamentals for early active customer integration and distinguishes it from other approaches to involve customers in the innovation process, such as market research, customised product configurations, and general customer orientation.

The purpose of this paper is to develop a conceptual model of early active customer integration into the front-end of the innovation process. In our analysis a framework is developed and discussed leading to four new customer roles enhancing the lead-user approach - namely 'opportunity sensor', 'complementary specialist', 'specifier', and 'selector'. On this foundation respective characteristics and managerial challenges of these early customer roles are described leading to a conceptual integration model.

1. Introduction

The positive influence of an active customer involvement during the innovation process has been demonstrated with several empirical studies (cf. von Hippel 1988; Bacon, Beckman 1994; Murphy, Kumar 1996, 1997; Gruner, Homburg 1999; Kristensson, Magnusson et al. 2002). Customer integration into the innovation process leads to a more successful product portfolio which is necessary for profitable growth in the marketplace. Especially during the early new product development (NPD) activities, the so called front-end, where up to 85 percent of the resulting total cost for NPD are assigned (Gebhardt 1996; Buerger, Zeller 1997), customer integration can lead to increased effectiveness of innovation activities. This customer integration into the innovation front-end has been extensively investigated by Eric von Hippel (cf. von Hippel 1976, 1977, 1978, 1986,

1988). Von Hippel's lead-user concept focuses on customer integration into R&D activities for new product idea generation and remains the empirically best validated concept in the field. However, it does not explore the full innovation capability from the customer which is beneficial to NPD beyond the generation of new product ideas.

This study shows that besides the lead-user approach there are other relevant modes of customer integration into the innovation front-end. From a strategic perspective, manufacturers' goals and objectives and their influence on the management of a specific mode are described. We therefore look at roles customers can be assigned to and - closely connected - to contributions they will deliver. Our findings lead to a typology and corresponding managerial implications for active customer integration.

For the following, a special focus will be put on the

goals and expectations that determine the manufacturers' strategy to integrate customers. So far there are no specific studies available dealing with the effects of expectations on customer integration. There is literature focusing on the outcome to be expected from the integration, however mostly on a generic, unspecific level and without looking on the managerial implications. We will show that manufacturer goals and results are determining factors to differentiate between specific modes of active customer integration.

Research methodology

The research procedure behind this study can be described as an iterative learning process considering input from the empirical as well as the theoretical side. The experimental nature of this research requires a qualitative case study approach so that we may gain a holistic understanding of the underlying cultural systems at work (Stake 1988; Yin 1994).

Parallel to this side the theoretical part is based on a literature review leading to more understanding of the identified problems. In addition scientific theories and hypothesis, complementing these original findings, enabled to address the research questions in a thorough and unique way. We found that there are hardly any studies dealing specifically with an early and active role of customers during the innovation front-end.

Based on a theoretical foundation the collection of empirical data took place in two stages. Firstly, in the context of research projects with R&D-intense companies from Switzerland, Germany, Austria and Liechtenstein 67 interviews with R&D managers had been conducted at 21 companies to study real-life problems related to active customer integration.

Secondly, in-depth case studies of innovation leaders - already practising active customer integration successfully - highlighted relevant characteristics of the integration process and demonstrated how active customer integration is managed on the strategic as well as organisational level. That is, we study cases in detail to attain an in-depth understanding of the natural setting, the complexity, and the context (cf. Punch 1998).

The selected companies spread across various industries and range from SME to large multinationals. By maximising the differences among the cases, we control for idiosyncratic influences in each case and provide at least some basis for generalisation. In addition, similarities in management practices across diverse customer integration activities indicate an existing relationship between practice and outcome (cf. Lynn, Morone et al. 1996).

Data collection for the case studies took place during 12 semi-structured research interviews with senior representatives from R&D, marketing, and product management. The interview data were complemented by desk research and analyses of corporate and annual reports, company presentations, and company journals. In follow-up sessions with selected interview partners, we validated our findings and interpretations for each company.

2. Landscape of customer integration research

Customer closeness, involvement, and integration constitute pre-eminent themes throughout the current business world and literature. To cluster the existing research approaches, we use the term "customer" to apply not only to the current customers of a company's products but also to competitor's, untapped, and lost customers (Dahan, Hauser 2001). Furthermore, we focus on the direct link between R&D and the demand side of the market by explicitly excluding methods and procedures that may be applied during the front-end as part of the marketing process.

As a backbone for our approach, we use a simple funnel model. Assuming a high degree of innovativeness and using a broad conception of customers' roles, we develop a generic overview of different approaches to integrate customers during the innovation process (Fig. 1). In both research and practice, the borderlines between these approaches are often hard to identify. However, for the simplicity reasons, we assume a strict separation.

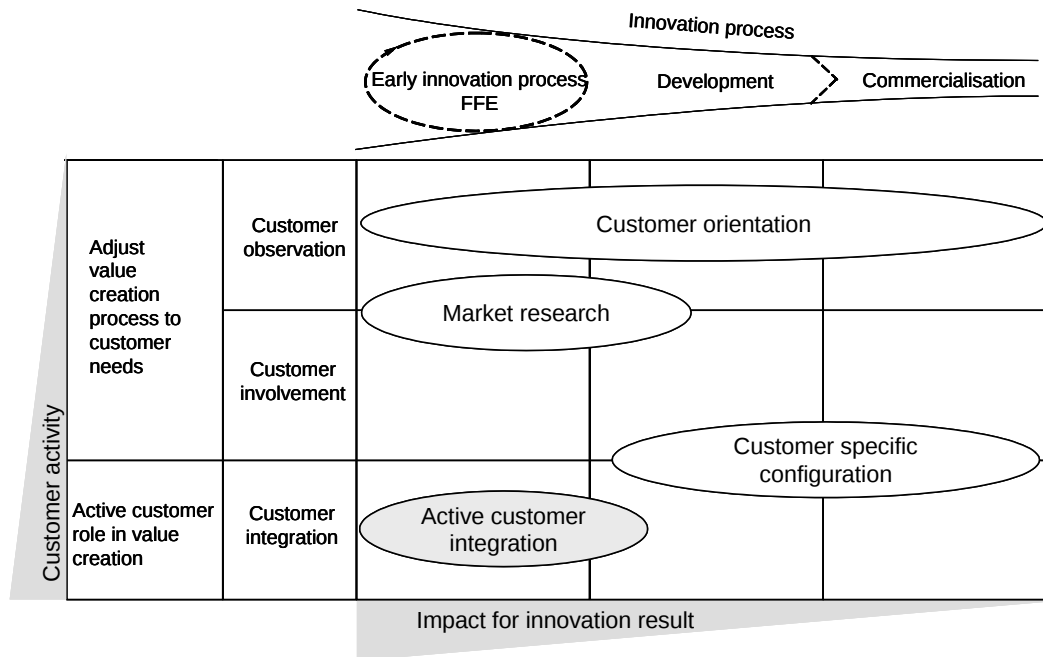


Figure 1. Framework of existing approaches to capture customer demand.

Market research

Although customer interaction plays an important role during the entire course of the innovation process, its relevance for the very beginning of business activities is paramount. Therefore, an early understanding of market conditions and customer characteristics is crucial for the success of any business (cf. Ortt, Schoormans 1993). Most companies undertake marketing activities from the input side of the system, which extends from generic market research to highly specified market intelligence tools.

The underlying purpose of market research is to collect and use information about market opportunities and customer needs, or more specifically, knowledge about customers (Ortt, Schoormans 1993). Thus, methods employed to obtain and use market information, or market learning, play a key role in every successful NPD project. However, we do not discuss such attempts to develop and deliver customer-oriented products and services, because our focus rests on the R&D department and the possibilities for early customer contacts.

Market research remains an important standard activity that should not to be replaced by but rather supplemented with early and active customer integration. Its activities support the beginning of the innovation process and play important roles in the selection of specific customers for the following integration modes.

Customer-specific configuration

In addition to regular output-side marketing methods, companies are recently tending towards configuration tools to adapt product features to specific customer needs. Based on the goal of developing customisable products for user innovation, this process enables the realisation of individual customers' preferences. Because such

customisation takes places relatively late in the innovation process, it is mostly limited to configuring existing modules or style features from standardised product platforms. Innovation, especially that on a technological level, normally takes place earlier in the process.

Customisation instruments range from platform management aimed at enabling cost-efficient product variations to mass customisation in business-to-consumer (B2C) markets (Krubasik 1988; Piller, Stotko et al. 2003) and user toolkits for innovation (von Hippel, Katz 2002). Underlying those approaches are new IT-based tools that facilitate customer integration. Toolkits for customer innovation enable users to complete a series of design cycles that lead to their own products (Seybold 2001; von Hippel 2001). With such manufacturer-developed, IT-based toolkits, customers can create their own product configuration within a given solution space. Coupled with information about useful components and modules, as well as production limitations, these toolkits can eliminate costly, time-consuming iterations between manufacturers and customers. However, only certain markets and products qualify for this revolutionary approach.

Closely related and already widespread (though limited to B2C markets), the mass customisation approach also enables customers to create specific product configurations through flexible production systems, modularised product designs, and deeply linked configuration tools (Piller, Stotko et al. 2003).

Customer orientation

From a more generic point of view, customer orientation comprises the basic attitude toward the customer that brackets the entire innovation process, which Peters and Waterman (1982) define as over-commitment to some

form of quality, reliability, or service. Because this approach includes the whole product lifecycle and requires a specific manufacturer mindset, it becomes a necessary prerequisite for all other modes of customer involvement. The main focus, as exemplified in the relationship marketing approach for business-to-business (B2B) markets (cf. Krapfel Jr., Salmond et al. 1991; Kotler 1999), rests on traditional business goals and not specifically on product innovation aspects.

Homburg (2000) argues that closeness to customers has to be realised both during the value-offering process and the actual interaction with customers. Customer relationship management (CRM) represents an IT-based manifestation of this idea that enables close contact with customers during the product lifecycle through collated information from all relevant sources within the organisation. In addition to this direct link to specific customers, a market orientation serves as a general focus on the demand side and exemplifies the significance of customer orientation for marketing activities. A market orientation consists of three main components, namely, the degree to which a business unit (1) obtains and uses customer information, (2) develops a strategic plan based on that information, and (3) implements the plan to respond to customer needs (Ruekert 1992). Thus all airline loyalty programs are for example manifestations of customer orientation.

3. Typology for result-oriented active customer integration

The principal goal behind active customer integration is the improvement of a company's innovation success rate amongst increasing R&D-expenditures and high new product failure rates. The manufacturer expects advantages outweighing possible disadvantages coming out of customer integration (cf. Kirchmann 1994; Brockhoff 2002). Existing studies list numerous advantages on the macro level that can be clustered into two paramount strategies as depicted in Table 1 (based on Kirchmann 1994; Gruner 1997).

<i>Type</i>	<i>Intentions</i>
Effectivity-driven strategy	Risk minimization by a reduction of risk and failure Insights into product usage and customer know-how Optimization of quality and technological performance
Efficiency-driven strategy	Reduction of R&D- and production-cost Time saving by reduction of innovation process duration, increase in number of projects, and knowledge synergies

Table 1. Types of strategies for customer integration.

The micro level however leads directly the focus of this paper: Defining the outcome of customer integration as specific contribution for the innovation process (Bruce, Biemans 1995) brings forth the following potential results:

- Generation of new product ideas
- Availability of information regarding customer needs
- Feedback to concepts and prototypes
- Aid during development
- Assistance during innovation-marketing

We will use these potential results as a starting point for our framework. The assistance during development as well as innovation-marketing are part of customer orientation and therefore outside the frame of early active customer integration.

Taking into consideration different phases of the front-end we derive four main goals for active customer integration, namely to discover new opportunities, to support the in-house ideation part, to define the specification, as well as to select and refine most promising concepts. We gained these results based on our extensive studies in the field of active customer integration and will illustrate each direction with one prototype case study.

Using manufacturer goals and customer contributions as the determinants, we have developed a basic framework for active customer integration, which we use to identify the following distinct customer roles: (1) opportunity sensor, (2) complementary specialist, (3) specifier, and (4) selector.

Figure 2 gives an overview of these customer roles and relates them to the lead-user approach. The lead-user (von Hippel 1976, 1988) appears in the middle of our framework, because it represents the prototype of customer integration. In the lead-user approach, customers are selected to generate new solutions on the basis of their innovative need profile; that is, they are ahead of the main market. In addition, they must show a strong interest to get their problem solved. In some cases they possess also technological expertise, demonstrated by their ability to develop their own prototypes.

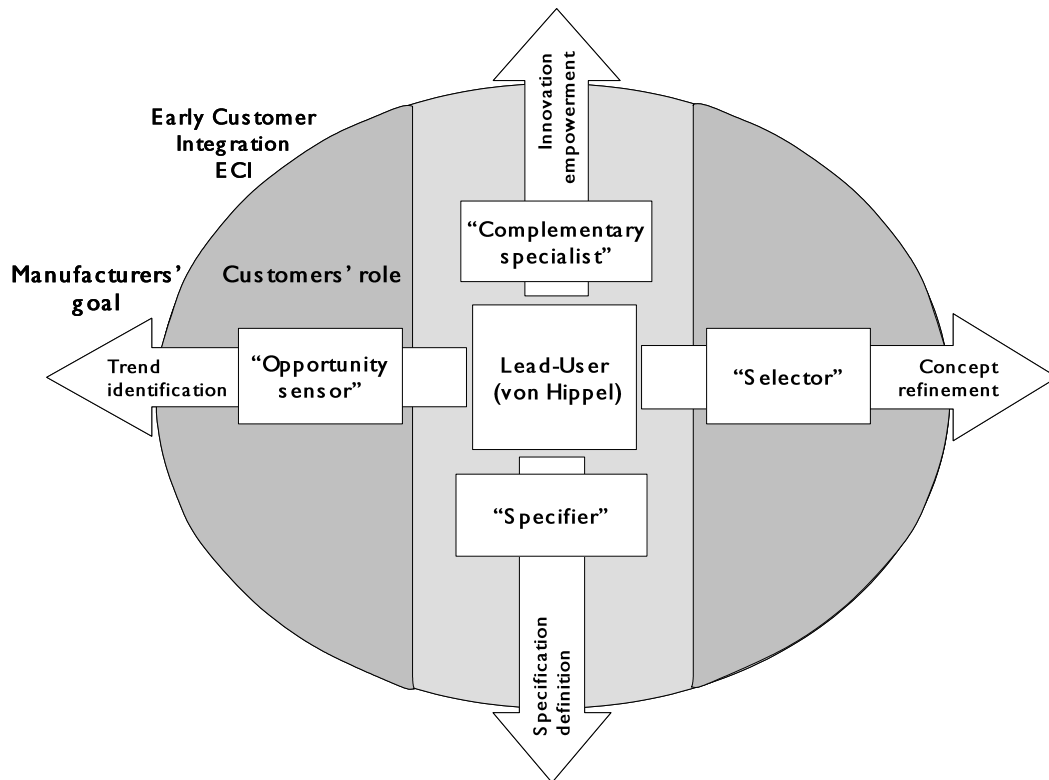


Figure 2. Strategies and customers' roles for active customer integration.

Opportunity sensor

This role focuses mainly on the problem identification or idea generation part of the innovation process, i.e. focussing on trends and scenarios possibly leading to new opportunities and chances. The type of knowledge involved is market-related and tacit. Depending on the concrete integration set-up the knowledge creation mode can be both acquisitive (e.g. specifically collecting customer knowledge about new competitor offerings) or transforming (e.g. jointly developing new scenarios with customers). In this active customer integration mode the specific contributions the customer delivers - in addition to his needs which are defining his basic role as customer - are information about latest trends, new technologies, or new market developments.

An example for this very early active customer integration aimed at new business opportunity identification is the approach taken by the Creative Center of Bayer Material Science in Germany. Already at the very beginning of its innovation process, at the development of scenarios, selected customers are involved to adjust scenarios developed at Bayer with such coming from the customers. This approach is applied at large customers, such as German car manufacturers who deploy sophisticated methods for long-term product planing. Also the next process steps feature intense customer integration. After the scenario development roadmaps - at the beginning generic then focused on technology - are built up in joint meetings with customers, often facilitated by an external expert. For the management of the Creative Center the key for success in active customer integration is the establishment of a win-win situation by purposely offering valuable information

to the invited customer in exchange for their own input. The goals are to identify new developments in the market environment as well as market potentials (at this point of time in a wide and generic sense) during the scenario development and possible future technology platforms and technology overviews during the roadmap evolution. At the end of this early innovation stage at Bayer Material Science stands the hand over of a standardised feasibility study for a specific new project to the respective development group.

That means that even before the real development of a polymer product starts an intense contact and exchange with customers - in this case end of the line customers - takes place. This ensures a market focused set-up of the innovation process from its very beginning.

For the next three roles the main focus lies on the further development of ideas and the drafting of problem solutions. Innovative leading edge customers are integrated to deliver highly specified technological knowledge besides their inherent proficiency regarding their needs and requirements. Here joint creation of new knowledge is key and requires customers that are sensitive for this co-creation approach.

Complementary specialist

The main asset of these complementary specialists is explicit knowledge in a field complementing the core competence of the manufacturer. They can be found both for specific market knowledge and product related expertise in fields such as styling or production. The focus lies mostly on the combination and thereby conversion of existing tacit knowledge to create

innovative solutions pushing the envelope of the manufacturers own innovation capabilities.

On the product-related level Zumtobel Staff from Austria gives an excellent example. This internationally renown specialist offers innovative lighting solutions in all areas of application of professional interior lighting such as offices, industry, and retailing. Zumtobel Staff's innovation strategy is marked by the rapid implementation of state-of-the-art lighting technology into mature systems, and the transfer of the latest scientific findings to sophisticated lighting solution concepts. Thanks to this strategy, the organisation has become an expert partner to architects, lighting designers, electrical consultants, and facility managers. In collaboration with internationally leading architects and designers, a number of new systems for a wide range of application areas has been created, which are set to account for substantial proportions of turnover in the next few years, such as „Lighttools“ – a miniaturised modular lighting channel. The close co-operation with architects and lighting designers means an integration of complementary experts. Both groups represent no direct customers for Zumtobel Staff however they are significantly influencing the buying decision (directly or indirectly). So they are part of the downstream value chain and hold special complementary knowledge, namely styling and integration capabilities. Organisationally the management of the integration process is located in a special group called strategic partner development. It is stuffed with specialists that are on one side mobile and international to work locally at customer' office locations and on the other side closely involved in the Zumtobel innovation process. Zumtobel's main goal for integrating selected architects and designers is the joint generation of highly innovative lighting products. Only the combination of Zumtobel's technological expertise with the partner's design, styling, and project realisation competence enables the innovative solutions. A very important criteria for the partner selection is therefore his proven ability to accomplish common project plans. Even more important however is the potential to turn these customised innovation into standard products and reap profits on a larger scale. So architects and designers are complementary specialists leveraging Zumtobel's own innovation power.

Specifier

Besides the complementary knowledge roles described above there is one more specific role grounded on the integration of customers with deep expert knowledge right in the manufacturer's competence field. This enables the customer not only to push and steer innovation via the product specification but also to take the leading role in the integration process (from the customer's perspective the same process could be seen as supplier integration). The required level of knowledge exceeds the one typical for the lead-user approach and limits the number of cases where this approach may be applicable.

A typical example for this active customer integration

mode is given by the European satellite manufacturer EADS Astrium and its main customer the European space agency ESA. EADS Astrium is a world leader in the design and manufacture of satellite systems, with business activities covering civil and military telecommunications and earth observation, science and navigation, space equipment and associated ground infrastructure. EADS Astrium offers a total communications system capability, from system design and integration, satellite and payload manufacture, launch and in-orbit operations to the ground control and communications networks. A key prime partner for ESA's major scientific programs, EADS Astrium has established a world-renowned expertise in the highly specialised field of space science. EADS Astrium designed and built ESA's latest ambitious space exploration craft, Mars Express, for the first European mission to another planet. The ESA employs highly qualified specialists in the field of satellite systems very similar to the experts working at EADS. This leads to very close co-operation during the early phases of new missions. Based on first mission sketches and official application documents filed by EADS (as answer to an official ESA tender) the innovation is driven in mixed teams during the specification definition phase. In theory ESA specifies and selects fitting solutions out of those presented by EADS – in reality however, enabled by the high level of specialist knowledge on the customer side, a co-creation process takes place. EADS even hosts EAS engineers in its R&D facilities to support this process. Once the specification is finished by defining specific module technologies and parameters EADS takes the leading role in realizing the spacecraft or instrument together with its network of partners and suppliers.

Selector

Ending the front-end of the innovation process are procedures necessary to feed new concepts into the real development process. At this stage an integrated customer can build on his user experience with existing products and help in selecting and refining promising product concepts. Tacit customer knowledge is converted into feedback and increases the manufacturer's chance to develop a successful new product.

Hilti based in the Principality of Liechtenstein, demonstrates this type of close solution-driven customer interaction. The Hilti Group is a world leader in developing, manufacturing and marketing added-value, top-quality products for professional customers in the construction industry and in building maintenance. The product range covers drilling and demolition, direct fastening, diamond and anchoring systems, firestop and foam systems, installation, measuring and screw fastening systems as well as cutting and sanding systems. The basic company principles are commitment to excellence in innovation, total quality, direct customer relationships and effective marketing. Out of the more than 14,500 employees, two-thirds work directly for the customers, in sales organizations, engineering and customer service. The business unit Diamond systems

successfully executes active customer integration with “selector” customers using two sequential methods. Relatively late in the front-end when different concepts have already been developed by the internal R&D (however based on Hilti’s exceptional market closeness) so called “focus groups” are utilized. Based on statistical information provided by market research customers are invited to join a interdisciplinary group of Hilti specialists to discuss and rate different concepts. Based on their application knowledge and experience the customers play an active role and – in contrast to traditional focus groups – are part of the team discussing and selecting the best concept. Also in the following step the Hilti internal term does not explain the actual procedure. The so called “lead-user” workshops differ significantly from the classical lead-user definition and instead clearly exemplify subject “selector” role. Outstanding top-partners (defined as valuable customers treated with special service offerings) are invited to comment on and try out the specific solution that has been developed based on the previously selected concept. The goal here is to receive specific feedback in order to apply changes before the solution is finalized. In Hilti’s terms the focus groups are aimed at defining the right value proposition and the lead-user integration is focused at confirming that propositions.

contributions customers can make to new product development, active customer integration takes place at different stages within the front-end process and with different objectives, intensity and layout. Depending on the respective manufacturers’ goals (i.e. expected output) four modes of active customer integration can be distinguished, manifested in specific customer roles. This framework of goals and roles has been used to take a closer look at respective characteristics and managerial challenges of customer roles during active integration. Taken together, this analysis indicates that while active customer integration can improve the effectiveness of the innovation process by enabling powerful new knowledge creation, its concrete deployment calls for careful consideration of the whole process set-up and execution.

Our findings fit to the broader context of an open innovation paradigm (Chesbrough 2003) making cooperative innovation processes the imperative for success in today’s challenging business environment. This trend will further increase not only with customers but all types of external entities.

4. Conceptual active customer integration model

This first analysis does not address the issue of concrete design elements of the customer integration process to realise distinctive roles. However we came up with a first conceptual integration model built around the design areas of integration structure and interaction process (Fig. 3).

First of all the manufacturer has to take the basic strategic decision towards active customer integration. Based on the occurring circumstances he then selects the respective mode and according customer role. In the following the design of the integration process has to be worked out based on key layout elements and parameters. Those relevant layout elements are to be developed in future research. Among the relevant contingency factors to be considered will be the respective market environment, the competitive situation, the product specificity, the level of used technologies, customer characteristics, as well as the in-house innovation culture.

Summary and future directions

Different ways to involve customers into the innovation process can be identified. Fitting to the specific

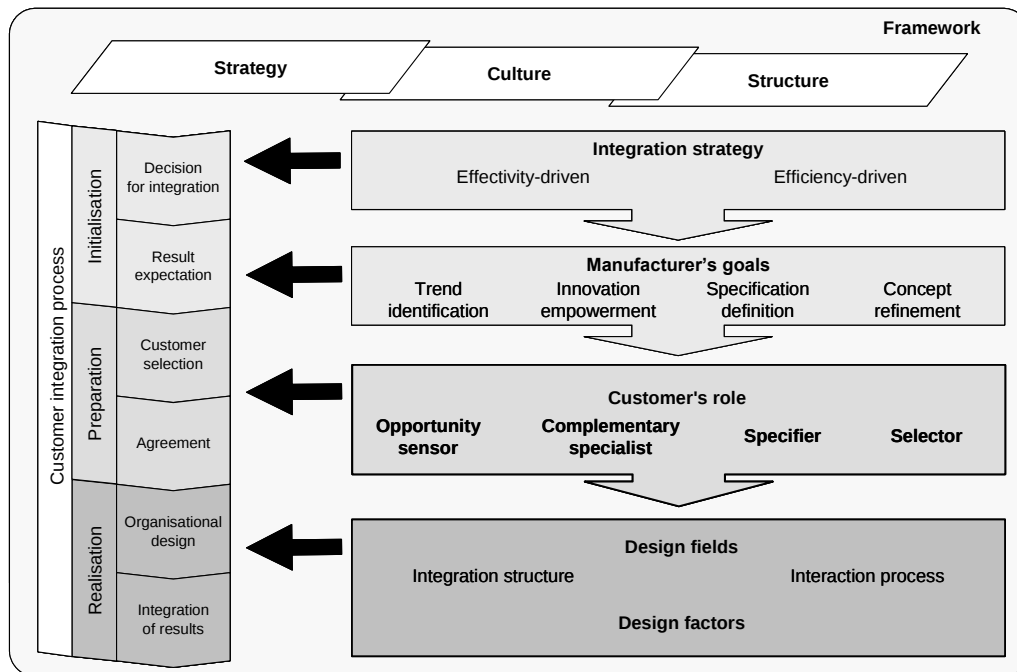


Figure 3. Conceptual customer integration model.

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