Do You Really Know Your Customers' Needs? -the application of PMOIM in Shacman[1] in China

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Introduction

With its 1.3 billion people, China now becomes the world's second largest economy and manufactures over 50% of the world's products. Chinese products have been indispensable not only to the life of the Chinese, but also to the lives of those living outside of China. However, the world has been reeling from daily accounts of defective "Made in China" products. Assembling the breakthrough products designed elsewhere, combine with reverse engineering and imitation, turned Chinese products signifies cheap, high product homogeneity, along with low degree of innovation, and therefore caused the inevitable price competition. Nowadays, in an environment of accelerating technology and short product life cycles, China needs to build an economy that relies on continuous innovation rather than imitation.

The commercial success of innovation depends upon how well the market opportunities have been identified, analyzed, and satisfied (Dougherty, 1990, Lilien and Yoon, 1989). Accurate understanding of customer needs of target market has been recognized of greatest strategic value for developing successful new product, especially in the early stages of the NPD process (Cooper, 1984). The concept of market orientation holds that the primary ability for an organization is to internalize the marketing concept as a critical organizing principle

[1] Shacman, the brand name of Shaanqi for its overseas market. Due to its pronunciation resembling to the words "Shark Man", meaning almighty, powerful, it enjoys a marvelous reputation among its overseas dealers and end users. The author of this case has been invited to participate the company's annual symposiums of overseas market for interviewing of the most representative dealers and end users all over the world.

(Baker and Sinkula, 2005). A vast of researches indicates that the collection and use of market orientation insight, now more than ever, has been recognized as a core competency for innovation(Jaworski and Kohli, 1993, Kohli and Jaworski, 1990, Narver and Slater, 1990, Slater and Narver, 1995, Slater and Narver, 1998). In addition, Narver et al. (2004) argues that responsive and proactive market orientation are the two essential sets of market orientation. According to the marketing and innovation literature, firms possess a strong proactive market orientation can identify the latent needs of customers more effectively and efficiently than competitors, which may translate into successful new product and yield superior customer focused innovation (Atuahene-Gima et al., 2005, Narver, Slater and MacLachlan, 2004). The proactive market orientation insight has called for more than traditional market research.

Despite the prevalence and importance of proactive market orientation to innovation, there is a need to bridge the market and the front-end phase of new product development by identifying a great many customer needs down to those key, make-or-take successful ones. This requires a fast and accurate research methodology, one that identifies the most valuable expressed, especially latent customer needs and translates them into successful new products.

Lead users is proposed as a useful method to involve lead users in the process of new product development and use their knowledge for understanding customer needs and generating new product ideas based on those needs (Eisenberg, 2011, Herstatt and Vonhippel, 1992, Schreier and Prugl, 2008, Urban and Vonhippel, 1988, Von hippel, 1986). Some literature proposed empathetic design to observe the actual behavior of customers experience a product directly in the field, like what they do and don't do, to capture the latent needs and yield to superior products (Leonard and Rayport, 1997, Thomke and Nimgade, 2000, Zomerdijk and Voss, 2011). However, a clear understanding of how can successfully adopt the whole process of identifying, evaluating and translating customer needs into innovation within an industrial organization is still limited.

This paper specifically aims to extend the proactive market orientation and new product development theory by proposing a new approach to accurately identify latent needs and develop new product insights gleaned from observing how customers experience a product. The key research questions are posed. How can opportunities in traditional products be

identified and evaluated? How can a large number of customer needs and inspirations from deep insights to be handled? What effective practice exists for involving customer experiences in identifying and developing new products innovations?

The paper is structured as follows. First, previous research on proactive market orientation and new product development is discussed and connect to the present study's proposed approach. Then, the proactive market oriented innovation methodology is presented, after which a deep case study of heavy trucks and its new product concept design are analyzed. This paper concludes with a general discussion, managerial implications, limitations, and future research.

Literature review

Market orientation and innovation

As far back as 1954, marketing and innovation have been viewed as the only two basic and essential functions of any business enterprises (F.Drucker, 1954). In 1990, Kohli and Jaworski articulated a theory of "market orientation" which they defined as the organization-wide intelligence generation and dissemination, and response to current and future customer needs. Since then, the importance and benefits of market orientation in the development of innovative products were well acknowledged in the marketing literature. It is common view in marketing that market orientation could enhance successfully innovativeness, because it places on understanding and satisfying customers' needs at first (Narver, Slater and MacLachlan, 2004, Slater and Narver, 1995, Slater and Narver, 1998). It has been repeatedly argued that market-oriented firms are more likely to develop new products and services that offering unique benefits and superior value for customers as their capabilities permit them to sufficiently and accurately identify and quickly respond to customers' needs(Jaworski and Kohli, 1993, Pelham, 1997). Just as importantly, they are more likely to develop innovations that accepted by customers without a high transition costs (Atuahene Gima, 1996). Therefore, firms with strong market orientations are more likely to discover and to respond to new product opportunities than firms with weaker market orientations(Baker and Sinkula, 2005).

According to the literature, market orientation usually includes two essential sets of behaviors: responsive and proactive market orientation(Narver, Slater and MacLachlan, 2004). Responsive market orientation concerns a firm's attempt to discover and understand the expressed needs of customers in their served markets and to satisfy those needs by developing

new innovative solutions. Expressed needs, can be articulated by customers, are well-known and widely understood by competitors within a market. While Proactive market orientation, in the other hand, are committing to identifying and understanding the latent needs of customers, as well as satisfying the needs by producing innovative products and services. Latent needs, which are unable to known about and articulated by customers, are not obvious to competitors, or even customers, but nevertheless present and unmet within a market. In particular, there is no single best practice for conducting market orientation but rather a set of approaches from which to select based on the objectives and focus of the innovation. A brief discussion of market orientation and innovation methodologies is as followed.

Responsive Market Orientation and Innovation Approaches

Typically, responsive market orientation often use such traditional market research methods as surveys, in-depth interview, and focus group, to enhance the understanding of their customers' wants and perceptions from existing products and services. These methods are suited for exploratory research, as the nature of questions (for example, in a survey) or open-end questions (for example, in an in-depth interview and focus group) can be captured, but not fitted to be qualified and generalized. These methods, which focus on exploring customers' articulated needs, have been designed so that customers are likely to response based on their previous experience with a product. Accordingly, these market research methods have been recognized as responsive market orientation. Traditional market methods are powerful in exploring customers' expressed needs and may also develop close relationships with important customers to gain deeper insight into those customers' desire(Slater and Narver, 1998). However, merely asking customers what they want will not be sufficient to result in competitive innovation (Jaworski and Kohli, 1996). Satisfying customers at only this level of benefits will result in the price competition as customer can articulate their expressed needs to one and other businesses. In addition, as customers have difficulties articulating their latent needs beyond current consumption experience(Christensen et al., 2005), which limits the opportunity to provide new insights and thoughts that lie outside the prepared interview guide or questionnaire(Witell et al., 2011). Therefore, other methodologies that emphasize learning about market from accessing more to customers latent desire must be utilized (Lynn et al., 1996).

Proactive Market Orientation and Innovation Approaches

In order to avoid the limitations of responsive market orientation, a firm must shift their focus beyond customers' expressed needs to latent needs, which requires a firm turn to be more

proactive market oriented. Proactive market orientation firms will of course satisfy expressed needs, the most importantly, they commit to identifying and understanding the latent needs of customers. It would be beneficial for the focal firm to first uncover unmet needs within existing or new market segments. By doing these, Proactive market oriented firms could thereby develop superior benefits that differentiates the firm from price competition and increase its competitive advantage. Although proactive market oriented firms take use of many of the same traditional market research approaches as responsive market oriented firms, they combine these with other methods，such as working closely with lead users and conducting empathetic design by direct observation(Atuahene-Gima, Slater and Olson, 2005, Leonard and Rayport, 1997, Narver, Slater and MacLachlan, 2004, Slater and Narver, 1998, Von hippel, 1986).

The lead user method is cited as a proactive research technique because the lead users are actively engaged in the innovation process. The firms work closely with lead users, who are the customers experience needs months or years ahead the majority of the market and stand to benefit substantially from product innovations, could help product innovators become aware of problems and needs that form the target of new product concept and facilitate significant benefits. (Eisenberg, 2011, Herstatt and Vonhippel, 1992, Schreier and Prugl, 2008, Urban and Vonhippel, 1988).

Proactive market orientation can also be accomplished by direct observation of customers using existing products or services in real situations, such as empathetic design (Rifkin, 1994). This research approach could acquire insights about customer needs that cannot be obtained from traditional market research(Leonard and Rayport, 1997) and support design team in building creative understanding of customers and their everyday lives aiming to increase the likelihood that the new product or service designed to meet customer’s needs(Koskinen and Battarbee, 2003, Kouprie and Visser, 2009). Researchers have acknowledged the value of observing closely customers’ experiences in context(Brown, 2009) and considered empathetic design is most valuable in the early stages of NPD, when product opportunities need to be identified and product concepts developed (Koskinen and Battarbee, 2003). A five-step process (observe your customers, capture data, analyze and reflect, brainstorm for solutions, and develop prototypes) has been proposed briefly (Leonard and Rayport, 1997), a number of tools and techniques have been presented (Fulton Suri, 2003), and a set of industry practices have been studied (Gustafsson et al., 1999, Kelley, 2001, Nelson, 2001, Thomke and Nimgade, 2000) in order to help innovators to “walk the users walk” by providing products that fit

customers' needs. However, a clear understanding is still lacking of how others can successfully implement empathetic design within an industrial organization.

The Proactive Market Oriented Innovation Methodology (PMOI)

The integration of proactive market orientated concept with ethnography innovation research method can be represented by a five step methodology, which we called as proactive market oriented innovation methodology (PMOI). PMOI is specifically designed to be applied at the front end of the new products and service development process. PMOI is attempt to help management to gather, interpret, and apply potential critical customers' needs information gleaned from observing their experience of the product in their everyday life so as to rapid prototyping new innovations and to bridge the gap between researchers and designers and customers as well. That is to say, PMOI, the important source of customer needs and innovation ideas for firms, intends to present a fast innovation approach which will enhance new product and service success by satisfying both expressed and latent needs of customers which are identified through observation. In this section, we will illustrate the five successive phases of the method.

Phase 1: Collect raw data from customers

The objective of the first step is to collect and archive adequate original data of customer behaviors that experiencing an existing product and service. The primary problem to solve is to ensure who is the object that should be observed in order to reveal most of the customer needs. For many products, only a portion of customers are real end users while the others are actually buyers. A real world paradox exists in many industries that, those buyers, who make the purchasing decision, hardly have the first hand experiences of the products, whereas the end users, who actually use the product, don't have the right to decide which product to buy. In this case, end users of actual product experiences in all situations and buyers of purchasing behaviors in normal routines should be observed simultaneously. Therefore, End users and buyers are the most important information sources of raw data which can help to reveal vital details of customer needs.

In addition, since PMOI method emphasizes observation over inquiry, IDEO has been adopted in the research, because full videos that film the whole process of end user's using as well as buyer's purchasing are the suggested approach to capture sufficient data from

customers. Video can capture subtle and fleeting body language that may convey large amounts of information and store it for future review and analysis(Leonard and Rayport, 1997). Multiple viewing of video recording can facilitate the identification of latent needs and be useful for capture different aspects of customers' environment. It is also useful for documenting observations as raw material and brings observers "up to speed". Besides, since most innovative idea of PMOI is gleaned from visual, auditory, and sensory cues, rather than response to questions, full video recording of customers can be either completely passive, without any direct interaction with the customer, or can be more active, like working together with the customer or interviewing the customer.

Participant

Data collection step is conducted with the help of a camera crew, who may be either an external consultant who familiar with the product or a trained internal employee who belongs to the innovation project team.

Video shooting procedures

The standard shooting procedures for shooting end users' behaviors and buyers' purchasing behaviors are established respectively (see Fig. 1). This procedure includes an opening introduction, some rules for shooting environment and experience, and closing.

Subjects	End Users	Buyers
Opening introduction	● Self-introduction of filming personnel ● Explain shooting objectives to get end users' agreement and eliminate their scruples.	● Self-introduction of filming personnel ● Explain shooting objectives to get buyers' agreement and eliminate their scruples.
Environment Shooting	Working environment ● Shooting the real environment where the product is using	Sales field environment ● Shooting exterior of the store, internal decoration, status of the salesman and the other details of the environment where the customer purchases.

Experience Shooting	Using experience ● Shooting the whole process of end users using the product in their actual life. ● Communicate with users in time of need to obtain more information about their experience.	Purchasing experience ● Shooting the whole process of buyers purchasing the product. ● Cover as many details as possible, especially interactions between customer and salesman, such as what the customer really cares during the purchasing and how the salesman makes the sale promotion.
Closing the shooting	● Thank for user's cooperation ● Send a gift	● Thank for buyer's cooperation ● Send a gift

Fig. 1 The standard procedure for customer behavior shooting

The whole procedures, especially the rules for shooting environment and experience, help to improve the effectiveness of shooting and provide a quality guarantee for completeness and consistency of videos. Besides, in order to ensure the authenticity of the data, the shooting personnel should never interrupt customer's behavior.

Output

The output of this data collection step is a set of full videos about customers' using and purchasing behavior. All of these raw videos are archived into catalog and dated and labeled for easy identification and later analysis.

Phase 2: Interpret customer' experiences into customers' needs

After finished video collecting, an interdisciplinary interpretation team is established to working on the second step which is building a creative understanding of customers and their everyday lived and interpreting these customers' experiences into customers' needs statements. The critical task of making implicit underlying customer needs explicit is approached through observing how end-users and buyers experience their products in their day-to-day context. This step is intended to: (1) comprehensively identify and understand customers needs, especially the latent needs, to make sure no critical need is neglected; (2) ensure that the new

product concept prototyped later is concentrated on these encapsulates latent customer needs; (3) develop a common understanding of customers' needs among members of the interpretation team.

Participant

Consider that multiple analysts may translate the same notes into different needs (Griffin and Hauser, 1993); furthermore, differences in personality, education, and training predispose different people to extract very different information when observing the exact same situation. Therefore, the best approach to capture the most critical information is to set up an interdisciplinary interpretation team. The project manager, the engineers, the marketers, the designers, the manufacturing executive, and researcher, who have expertise in different discipline, all should take participate in this interpretation team. Specifically, they share some common characteristics, such as rich experience, open-mindedness, and innovativeness, and these will be essential source of idea generation throughout the life of innovation.

Customer needs interpreting session

The objective of the customer needs interpreting session is to identify customers' needs comprehensively and translate them into needs statement correctly through observing filmed customer behaviors and brainstorming ideas about latent customer needs. All members of interpretation team are invited to attend the session. Generally, the process of customer needs interpreting consists of a series of sessions, and each session takes about 3-4 hours. A typical agenda for a customer needs interpreting session is presented in Fig.2**(Just work as a sampling agenda**) .

Time	Part	Content
9:00	Presentation	● Objectives for interpreting session ● Procedure of interpreting ● Rules for engagement
9:30	Observation and interpreting	● Watch the video ● Observation on customer (observing, listening to, speaking out and thinking) independently ● Translation individual observation into customer

		needs statement
10:00	Brainstorming	● Observation on customer repeatedly ● Group discussion on identified customer needs ● Brainstorming for working out more latent needs
12:30	Conclusion	● Output ● Conclusions

Fig. 2 agenda for customer needs interpreting session

The first part of the session aims at presenting a common understanding of how to observe customer behaviors and convert them into customer needs, which include the objectives, procedure, and rules of interpreting.

In the second part of the session, members are assigned to watch the video together while discover customer needs by themselves. The video is projected with every few minutes for internal pause. During this process, members work on their own exploring the opportunities to improve customer experience. They observe what customers do and do not do, listen to what customers say and do not say, speak out how they would feel if they were the customer, and think carefully about what customers really want to stand in customers' shoes. After that, they translate their observation into insights and insights into terms of customers' need statement that will improve the product and customer lives. In addition, their findings are recorded for brainstorming later.

In the third part of the session, the interpretation team is asked to work further on discussion identified customer needs and to brainstorm more undiscovered latent needs. Brainstorming will be very valuable for innovation if it has specific rules. And here, to enable each member to express freely about what they discovered, the rules are made followed Osborn (1953), which are defer judgment, encourage wile ideas, stay focused on the topic, and build on the ideas of others, share ideas as a team, hold one conversation at a time, be visual, and go for quality. The rules are better posted on the wall. When brainstorming, members draw on

previously identified customer needs to generate new ideas. Moreover, members can watch the video repeatedly at any time they need to enable their better observing of customers. In this case, the interpretation team would brainstorm for more ideas which hidden in the video.

In the last part of the session, the interpretation team presents the outcomes of a list of customer needs statements that they observed and interpreted.

Rules of engagement for interpreting

When interpretation team members are trying to interpret customers' behavior, they should go beyond putting themselves into customers' shoes. The following "rules of conduct" (see Fig. 3) can help to prompt their observation by better understand customer.

- Enclosed leaderless group discussion
- Observe video repeatedly and write down customer needs immediately
- Focusing on identifying latent needs
- Figure out not only what customers think and do, but why
- Express customer needs in term of what the product has to do

Fig. 3 Rules of engagement for a customer needs interpreting session

- **Enclosed leaderless group discussion**

The interpreting session is conducted in forms of enclosed lead-less group discussion. Enclosed space is to make sure that the whole discussion process is never undisturbed by any external affairs. While leaderless is because of that interpretation demands creative interactions among members within a non-hierarchical team. This team is respectful of its diversity, and every participant's point of view is equally valuable and cannot be criticized. All of these are designed to enhance the flexibility, brainstorming and creativity of participants.

- **Observe video repeatedly and write down customer needs immediately**

The interpretation team members are arranged to watch every video repeatedly to help them immerse into customers' experience in order to avoid missing important information. And during observing, every member is assigned to take the handwritten notes while brainstorming for customers' needs. Every member should strive to capture the needs that

customer described verbally or behaviorally and write them down immediately to ensure that no information is missed. These notes can be used as critical idea source to create the database of customers' needs for a firm which plays an important role in new product prototyping and developing.

- **Focusing on identifying latent needs**

Expressed needs are the statements that customers made which can be directly written down while observing. While latent needs, since they are hardly described by words, are the interpreted statements as the results of observers' constantly aware of the nonverbal message provided by customers' behavior. Therefore, the interpretation team should focus on identifying these latent needs of customers. Through observing, the appropriate and critical information of customers' latent requirements can be identified, while the irrelevant is pared back. Besides, other evidence that may be related, such as working and purchasing environments, might contain further information that leads to a more in-depth understanding of the attitudes and values of the customer and provide clues that can help to create a new product that resonates with customers' preferences, should be identified as well.

- **Figure out not only what customers think and do, but why**

Insightful observation combines elaborate watching with occasional well-chosen "why" questions to capture the underlying psychology of a person's interactions with products. Therefore, the interpretation team should not only focus on observing nuances of customer behavior but also strive to find out incentive and emotion. There are some trigger questions that may help addressing the "why" thinking, like what customers have done, and why; whether customers satisfied with the existing product or not, and why; what improvements have customers made to the product, and why; what problems have customers encountered; and what is the optimal product and environment that customers need most, and why.

- **Express customer needs in term of what the product has to do**

Customers often ask for a new solution or technology when describing their demands, however, they have real needs that should be addressed. Therefore, interpretation team members should take identifying customers' needs as the primary target and commit to suppress preconceived hypotheses about product solutions and technologies. So specifically,

when a customer mentions a product solution, the interpreter should probe for the underlying needs that customer believes the suggested solution would satisfy, and then express them in terms of what the product has to do, not in terms of how it might do it.

Phase 3: Structuring customer needs

After the interpreting session, a large list of detailed statements of customer needs is documented, but chaotically and disorderly. It is extremely difficult to directly use this excessive information to innovate. For instance, the product development team has difficulties to deal with this huge customer needs list by examining item by item. For this reason, the objective of the third step is to classify all customer needs into hierarchical list and then divide them into different levels in order to provide the organized innovation ideas for product concept design. This step is conducted within the interdisciplinary interpretation team as well. If so, the team members could return to analyze and organize these customer needs into a structure based on their observation and understanding of customers.

This procedure is split into three main stages:

Step 1: Cluster customer needs into attributions of the product

Firstly, since most customer needs statements are expressed as attributes of a product, a clustering standard, that cluster the needs according to the product characteristics they described, is formulated. Next, the interpretation team is split up into small groups which members have the similar discipline, and every group is asked to work on analyzing each statement that assigned to it and clustering the critical issues according to the attributions distinguished (e.g. product quality, product cost, usability etc.). And for the other small amount of needs which are not cleanly expressed as any attribute of product, they cluster them into some new categories (e.g. marketing strategy, service quality, profit mode etc.). Thirdly, after each group has completed its work, a plenary discussion on clustering issues is held. And at last, the final results of customer needs clustering are presented. These results provide a preliminary classification for analyzing and documenting customer needs.

Step 2: Classify customer needs of attributions into hierarchy

After customer needs have been clustered into attributions, the interpretation team is subdivided into small groups once again, which are assigned to analyze the customer needs

item by item within the related attribution and then combine, summarize and describe the needs into new statements list of a hierarchy. This new statements list is characterized by a set of primary needs, which are top-level and the most general needs statements of product attribution that set the strategic direction for new product; and each primary needs is further consist of a set a secondary needs, which express the needs in more detail that indicate specifically what should be done in order to satisfy the corresponding primary need. Next, whole team works on integrating each group's classification results and finally forming a complete hierarchy of customer needs, which presents a secondary level of classification for analyzing and documenting customer needs.

Step 3: Assign levels of customer needs in the hierarchy

Griffin and Hauser (1993) state that customer needs generally come in three levels: basic, articulated, and exciting. Basic needs are what a customer assumes a product will do. Customers are less likely to tell about the basic needs, while they will be very dissatisfied if the basic needs are absence since they are expected. Articulated needs are what a customer will tell that he, she, or they want a product to do. Customers are content if this level is fulfilled. Exciting needs are those latent needs that producers develop themselves. If exciting needs are fulfilled, it would delight and surprise the customers. Moreover, both basic and exciting level can also be divided into different levels according to the surprising degree for customers, as well as the economic feasibility and technological feasibility of realizing the customer needs.

After the hierarchy of customer needs has been set up, interpretation team begins to work further on dividing these needs into basic, articulated and exciting levels. Through plenary discussion about the need statement of the hierarchy one by one based on member's understanding and expertise, the levels of needs are analyzed, determined and marked. And after these, the ultimate levels of every customer need of the hierarchy are assigned last, which provides the third level of classification for analyzing and documenting customer needs.

The three levels of classification that illustrated above form the final structure of customer needs. This structure is the critical idea source for designing products. It also provides the

information on the relative importance that customer place on different needs. The basic and articulated needs are the requirements that must be contented, otherwise customers will be very satisfied, and manufacture competitiveness may also be affected. These needs have higher priorities for customers than do exciting needs. This structure of priorities enables innovation team make trade-offs to design the new product concept in the next phase.

Phase 4: Quick early prototype of new product concept

Once the idea structure has been built, a quick early prototype often occurs. Quick early prototyping is the process of developing physical or virtual representations of the product concepts along one or more dimensions of attribute to communicate ideas with others and test their feasibility in a very short time. The quick early prototypes are a critical part of the PMOI process because of two reasons: (1) prototypes generate results faster and embody rough approximations of the concept of new product; (2) prototypes enrich the communication within the interpretation team as well as with other individuals, such as top management, extended team members, suppliers and customers. The objective of this step here is to develop the goal-directed prototypes of the user-centered product concepts rapidly based on the identified and organized customer needs, especially latent needs, and then to place these prototypes in front of other individuals, like top management, to estimate their functional value.

Participant

This quick early prototyping process, still, needs a multiple-disciplined team, with a part of members have participated in the second and third step ahead, and the others to be fresh new experts. Members who has the experience of interpreting and structuring customer needs would possess a better understanding of customers, and could therefore innovate and prototype by focusing on these requirements much easier. While the new experts, who bring many new ideas to the process of concept designing and prototyping, will help to improve the effectiveness and innovativeness.

Quick early prototyping procedure

This section presents a three-stage procedure for quickly developing early prototypes of new product concepts during the PMOI method.

Step 1: Prepare for quick early prototyping

A quick early prototyping will be carried out through both plenary and subgroups discussion. The choice depends on the degree of prototyping progress. Experience suggests that a quick early prototyping requires a three days session, at least, where the team can work in plenary as well as subgroup discussion. In this case, a pleasing and undisturbed place is required.

Before the prototyping, a common understanding of how to rapidly prototype new product concepts based on the identified customer needs is presented. After that, the team is split up into subgroups, which are asked to work on developing new product concepts and produce both simple and complete prototypes.

Step 2: Quick early prototyping in subgroups

Since identified customer needs have been structured into three levels (basic, articulated and exciting), and each level is constitutive of a set of primary needs and secondary needs, members in subgroup are assigned to study on these customer needs as a prior work in order to enhance their comprehend understanding of customers.

And so the next thing to do is subgroups start to design the new product concepts. Firstly, they discuss the objectives of new product development to determine the new product direction based on focusing on target customer needs as well as considering about technologies and market perceptions. Secondly, they come into design the new product concepts that aim at realizing the objectives. Here, a product concept is composed of a basic product and a set of alternative product packages. The basic product, which consist of the basic and articulated customer needs, is the “meat and potatoes” that satisfy the vast majority of the target market. While the product packages, which are further characterized by the exciting needs that at different levels, is designed to satisfy the personalized demand of different customers and to create more profit for companies. According to the objectives and product positioning determined above, subgroups discuss with each other to plan the concept of their basic product and alternative packages by arranging the critical customer needs to the packages they pertain to. The new product concept is formed after they enrich the detailed description of the basic product and alternative packages.

Then lastly, subgroups work on prototyping the new product concepts. The purpose of the

early prototype is to make sure whether an idea has functional value. Therefore, subgroups should consider about the degree to which the final product is to be approximated. Moreover, on account of the fast, rough and cheap features of concept prototypes, members themselves could create the early prototypes through readily implemented approach, such as doodling, drawing, and modeling; or from easy-to-manipulate materials, like cardboard, plastic, and foam core, to build the prototypes that show the highlights of essence of a product concept.

This step will take members about one and a half day.

Step 3: Plenary presentation and prototype modification

After subgroups have completed their quick early prototypes, they are asked to make a presentation about their design in front of other team members. Each subgroup demonstrates and clarifies its new product concept and early prototype in turn, and gets feedback from other subgroups instantly. As because of that a good prototype is like an exhibition for a particular point of view, it would make it much easier to exchange ideas and accept new ideas. This plenary discussion helps to provide a platform on which members from different subgroups could communicate with each other thoroughly and efficiently. This discussion takes about half a day.

After this plenary discussion, subgroups go back to modify their new product concept and early prototype according to the feedback they received. This process takes about another whole day time.

By the end of phase four, through deeply communication with other members, the team would have a rough functional prototype of a product concept and a general ideal of the manufacturing strategy to be utilized.

Case study – The heavy truck project in Shacman[2]

Project background

Shacman, is a state owned automobile manufacturing company headquartered in Xi'an, China. Founded in 1968, lifetime currently employs approximately 35 thousands employees.The company manufactures various products that cover off-road vehicles, heavy-duty trucks,

[2] Shacman, the brand name of the heavy duty truck of ShaanQi for its overseas' market. Since its pronunciation resembles that of "Shark Man", meaning powerful, almighty, it enjoys high reputation and good image among the international dealers and end users.

medium-duty trucks, light-duty trucks, large and medium-sized coaches, minivan, new energy vehicles, and so on. In 2011, Shacman sold 315,000 units different types of vehicles, with 15,000 units heavy duty trucks exported, and a total value of exports 426.04 million dollars. Among these products, heavy duty truck is the best seller and has been sold to more than 80 countries around the world. Shacman has more than 300 people working on research and development, on which it invests quite a substantial US dollars each year[3].

At the heavy truck division in China nowadays, while many firms pondered new ways to retain their market share, it was still not clear about what were the critical customer needs that should be satisfied first. At a time when a majority of truck producers started giving away their profit in turn for market share, Shacman expected to avoid being caught up in the battle of price. As a consequence, Shacman determined to compete within the field with a new product that would exceed current heavy trucks by offering several new features that customers desired. In order to do so, the heavy truck division of Shacman began to seek an entire new approach to sacrifice the emphasis on innovation and design to meet customers' requirements.

PMOI method practice in Shacman

In 2012, Shacman started a project to develop its new generation heavy trucks in order to gain more market share and improve its profit margin. Shacman wanted to develop a dramatic product platform based on a comprehensively understanding of customer needs that developed through an in-depth research with customers. For this purpose, the project adopted PMOI method to begin with new concept design in the early stage of the new product development. An innovation team was formed of key innovation managers and ten engineers. Because of their experience with PMOI, the authors were invited to participate directly in the project. The project has four main phases:

1. Collect raw data from customers of heavy truck

Since there is little data existed on customer preference within the firm, Shacman therefore decided to start creating its own observational database. To fully understand how customers interact with heavy truck products, the innovation team determined that it was important to

[3] Fore more information of Shaanxi Heavy Duty Group and the overseas market operation, please refer to the concerning appendice.

observe using behavior by end users within their working environment to see their practice and habits, as well as purchasing behavior by buyers within their purchasing environment to see how they choose the truck to purchase and how they perceive the competitive product. Thus, the team decided to use the research approach which combine direct observation with videos (IDEO Approach). An observation team, which included at least one member who possessed heavy trucks knowledge and experience, was selected to deal with the complex techniques and unique culture of the target customers.

Prior to conducting fieldwork, the observation team took in a training process, including the use of a video camera and the content of customer behavior to be observed, targeted to collecting high-quality data from customers. Next, a systematic process was designed to record the respondents' selection and interaction of heavy duty trucks and also to achieve an in-depth understanding of their behavior in actual situations. According to this process of observation guidance, the team began with the introduction to explain to respondents why and how to videotape their experiences of heavy trucks. After that, the team started to shoot the actual working and purchasing environment where customers experienced at, and then to shoot the entire process that customer interactive with the heavy truck. For end users, the video covered the variety of observation opportunities inherent in the field research: drivers, their truck (brand, appearance, interior, and modifications), and their cargo status before the truck start-up; the whole driving process to delivery destination (including driver getting on or off, starting, braking, and parking operation process, etc); as well as unloading process of goods after arrived at destination. While for buyers, the video started with customers entering in the store, following their entire shopping process, and ending with their purchasing the truck. Finally, the team thanked customers for their help and cooperation. This standard process helped the observation team to collect sufficient raw data that contained the critical information of customers' motivation, attitude and values regarding to heavy truck products.

During this phase one, the observation team had collected an enormous amount of 114 videos, which had a total duration of 1560 minutes from Shacman's main markets in China, such as Shaanxi, Fujian, Shanghai, Henan, and other provinces. Among these, 105 videos, which total length was 1372 minutes, recorded the entire using process of heavy truck drivers. While only

other 9 videos, the total length of which were 187 minutes, acquired the entire purchasing process of customers who was willing to buy a heavy truck because of that buying behavior usually happens occasionally. All of these videos were archived afterwards for later analyzing and interpreting.

2. Interpret customer' experiences into customers' needs

In phase two for Shacman, interpretation process was a scheduled period of time intended to observe customer experiences in their natural environment that recorded in the videos gathered in the first phase, to identify customer needs and gain insights for new product development that would attract more customers. Specifically, the objectives of this phase included: (1) identify underlying customer needs relating to the choice of a heavy truck and to the preference of one brand over another; (2) identify unmet latent needs associated with the customers' entire using experience; (3) understand attitude and motivations for all aspects of heavy truck experience and seek opportunities to deliver superior value for customers. Accordingly, a multiple-disciplined interpretation team was selected from the firm and was then divided into three subgroups, which had up to 15 members invited from marketing, manufacturing, research and design, and engineering departments to conduct the interpreting sessions.

Following the agenda and rules of engagement for interpreting session, 3 subgroups spent approximately a total of 11 days finished researching on observation and interpretation of all the videos. Among them, the longest interpreting session lasted for 340 minutes, while the shortest was 31 minutes. During every interpreting session, members were actively engaged in carefully observing customer behavior and interpreting into statements of customer needs, as well as brainstorming for more latent needs and aspirations. By the end of phase two, a total of 8468 items of detailed statement of customer needs were finally identified, and the team thus became aware of customer needs profoundly, which would also prompted the team to consider customer needs and provide superior value for them.

3. Structuring customer needs

After all interpreting sessions had completed, the project went to the third phase. Considering that the 8468 statements of customer needs that identified in the second phase were

rough-and-tumble and hardly be used for innovation directly, the interpreting team devised a roll out plan to clear up all these disordered customer needs into a hierarchical structure that could used as company's idea database for later prototype of new product concept. This phase prescribed the following steps.

At the outset of this phase, members worked on clustering customer needs into attributions of heavy truck products according to company's existing division standard, which included some traditional attributes such as quality, safety, driver environment, and transport effectiveness, and so on. While for other needs that were not belonging to any traditional attributes, were further discussed and clustered into new attributes, such as business model. This work helped develop a preliminary clustered customer needs for analyzing later.

Next, two interdisciplinary subgroups were set up to work further on analyzing and classifying every needs of each attribution and then describing them into new statements list of a hierarchy. A plenary discussion was held following to develop the final hierarchy which was consisting of a set of 66 primary needs and 600 secondary needs.

After the hierarchy was finally set up, interpreting team discussed and decided to divide these needs into two levels: basic needs and exciting needs, to better express the relative importance and priority that customer placed on. For Shacman, basic needs were what customers assumed a heavy truck would do, which could be realized easily and were supposed to be satisfied first. This kind of needs included, for instance, heavy trucks are of good quality and bearing ability, accessories are supplied timely, and heavy trucks are designed to be safety with emergence braking device and ABS (anti-brake system). While exciting needs were those latent customer needs that Shacman developed to provide additional functions and values to surprise their customers. Exciting needs were further classified into four secondary levels (see Fig. 4) according to the surprising degree for customers, as well as the economic feasibility and technological feasibility of realizing the customer needs.

Level	Customer Needs Description	Examples
1	● Needs with high economic and technological feasibility but low surprising degree	● Personalized interior design, optional color and style ● Night barrier-free lighting

	● Able to attract customers, but probably not enough to attract the price-sensitive customers	system ● Light material
2	● Needs with medium economic and technological feasibility and medium surprising degree	● Intelligence operation, such as heater system, alarm system, alarm clock, and tire pressure monitoring/adjust
3	● Needs with low economic and technological feasibility while high surprising degree ● Able to attract the customers purchasing without noticing the price	● Solar Panels ● ESP (Electronic Stability Program) ● Remote diagnosis system
4	● The ecosystem of the product to provide supplementary services besides the product itself ● Help customers make more money and live better	● Used truck evaluation and trading services ● Establish a truck networking system which provides information of trucks, drivers and supply of goods. ● Vehicle Fleet Management

Fig. 4 levels of exciting needs for heavy trucks

After plenary discussion, 309 basic needs and 291 exciting needs were finally classified. This result provided innovation team the input to develop prototype of new product concept in the next stage.

4. Quick prototype of new product concept

Due to the constraints of time and capital of the project，Shacman focused on quick developing prototypes of new truck product concepts based on customer needs that identified and classified before. During this prototyping process, members engaged in design product concepts to best utilize and satisfy customer needs without considering any technology or capital constraint in a three day period. All these prototypes of product concepts would be

market-tested to form the ultimate effective concepts that customers will to pay for. This proactive innovation process, therefore, could shoot the arrow at the target in a fast and low cost way.

A three-day prototyping session was held to design the ideal concepts of four types of truck products as specimens, which included the trucks that specifically used for long-distance, short-distance, engineering and urban transportation. A multiple-disciplined team, which had a total of 77 innovative experts, was divided equally into four subgroups. The prototypes were eventually developed by both subgroups and plenary discussion.

On the first day, each subgroup started with learning customer needs to form a comprehensively understanding. With the similar thought in mind, they defined the objectives of each kind of truck and then came into quick prototype of new product concepts. Here, the prototype was consisted of a basic product concept and a set of alternative packages concepts. On the second day, each subgroup presented their early prototype result to the other three to discuss with and learn from each other as well as get feedback promptly. After this, they went back to modify and adjust their prototypes accordingly. On the third day, four subgroups presented their final prototype in a meeting which invited about ten managers to choose the best prototype of each kind of trucks. Therefore, the prototypes of new product concepts were finally developed.

Lessons learned from the Shacman PMOI practice

The proactive market-oriented innovation practice in Shacman yielded valuable insights not only about the value of this method for new product concept development in Shacman, but also about standard innovation process across projects. Firstly, PMOI has completely changed the traditional innovative way of reverse engineering in the enterprises, which stresses innovation from the perspectives of customer needs. Secondly, through the observation of customers' behaviors(both purchasing and using behaviors), unmet and latent needs have been explored,which makes the R & D of this company being more competitive in NPD. Thirdly and the most important as commented by the director of the company, PMOI project has trained a promising group of employees on how to develop and implement proactive market-oriented innovation in their future work.

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