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Research on Crowdinnovation Design Methods and Models for Internet Platforms Based on the Innovation Value Chain

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Abstract. One prominent characteristic of the knowledge economy era is the widespread participation of the general public, harnessing collective intelligence for networked distributed innovation. However, the theoretical discourse on crowdsourcing tends to idealize collective intelligence and its role in solving innovation challenges. Forms such as crowdsourcing and freelancing introduce certain limitations and drawbacks, leading to criticisms regarding the quality, efficiency, and issues surrounding intellectual property within crowdsourced innovation. This emphasis on public participation often undervalues and overlooks the expertise and value contributed by professionals. The author believes that the general public plays a significant role in online platform innovation, but they cannot entirely replace the leadership of professionals and experts in the innovation process. Therefore, based on the different characteristics of the general public, professionals, and experts, the author expands the value chain model of internet platform product innovation on the foundation of the innovation value chain theory. To achieve this, the author proposes and constructs a crowd innovation design method and model, harnessing the strengths of various participants in the innovation process and implementing crowdinnovationin different stages to address complex innovation problems. This approach aims to enhance the quality of creative production, improve the innovation value, and boost the innovation capabilities of internet product innovation platforms.

Keywords. Crowdinnovation, Design methods, Knowledge economy, Product innovation, Internet Platform, Innovation value chain

1.Introduction

With the development of internet technology, creative thinking and connections through online platforms have become a reality. Crowd creation (Zhong Chuang) has increasingly become a new way of thinking and an innovative approach in the internet field. Crowd creation, crowd sourcing, and crowd-funding service models have been widely applied. The rapidity, ubiquity, asynchrony, anonymity, interactivity, low entry barriers, and the ability to support various forms have made the internet an excellent medium^[1] to promote creative participation. Mass participation in online collaboration and the utilization of crowd wisdom have resulted in many successful cases. For instance, Starbucks' "ideas.starbucks" community, Lego's creative community,

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Wikipedia, and the regular T-shirt design contest platform of the wireless T-shirt company Threadless, which solicits creative ideas from consumer users. Many enterprises obtain solutions through open innovation platforms from the internet's mass collaborative innovative approach.

Internet platform crowd creation can be divided into two types: one is a spontaneous innovation community of the masses, where the platform organization is loose, and the masses spontaneously participate in the community through various drivers. They exchange knowledge, skills, and experience to meet innovation needs, such as K68, Upwork, Freelancer, Behance, Core77, and more. The other type is organized mass innovation. It utilizes enterprise-built open innovation platforms or third-party service platforms, publishes requirements to platform users, and involves the masses in providing answers and solutions. This is done through crowd-sourcing, rewards, and competitions. Examples include P&G and IBM, as well as open innovation platforms like InnoCentive, Ninesigma, yet2.com, and Yourencore. Crowd creation is essentially the democratization of individual innovation development led by elite culture. However, it also has its limitations. Academia's view of crowd wisdom and its grassroots value is often overly idealistic. The internet's anonymity and low entry create a large amount of useless information on platforms, and the quality of crowd creation has been criticized. Additionally, issues related to the protection of intellectual property rights exist.

Internet platform crowdinnovation can be classified into two primary types. The first type involves spontaneous innovation communities where the platform is loosely organized. The masses participate voluntarily through different incentives, engaging in the exchange of knowledge, skills, and experiences to fulfill their innovative needs. Prominent examples include platforms like K68, Upwork, Freelancer, Behance, Core77, and others. The second type is organized mass innovation, where enterprises establish open innovation platforms or leverage third-party service platforms to post requirements for platform users. This enables the crowd to contribute solutions through crowd-sourcing, rewards, and competitions. Companies such as P&G and IBM utilize these open innovation platforms, including InnoCentive, Ninesigma, yet2.com, and Yourencore.

The essence of crowd creation is the democratization of individual innovation led by elite culture. Nevertheless, it has inherent limitations. Academic perspectives on crowd wisdom and its grassroots value are often overly idealistic. The internet's anonymity and low entry barriers lead to an abundance of useless information on platforms, creating quality concerns within crowd creation. Additionally, issues surrounding the protection of intellectual property rights persist^[2].

The development of internet technology has underscored the immense value of online platforms as vehicles for innovation and resource interfaces. Industrial design services characterized by product innovation have entered the realm of internet platforms. They facilitate the alignment of creative needs with creative production through the internet. These platforms aggregate a wealth of creative design resources and employ network technology, collaborative tools, and service management to facilitate the synchronization of design with business needs. They offer services like intellectual property services, product technology development, and channels for market conversion, forming a model for implementing product innovation on internet platforms. Examples include platforms such as LKKER, Taihuoniao SaaS, and Lai Sheji (Figure 1).The service process typically involves the following steps: requirement posting, service matching, design service, evaluation acceptance, project assessment,

and follow-up conversion services. These product innovation platforms to some extent reduce the innovation costs for businesses. They act as third-party service providers, providing service guarantees and reducing the investment risks for both creative producers and consumers. This, in turn, enhances the efficiency of product innovation.

While implementing product innovation on internet platforms may be more challenging compared to other crowdinnovation platforms, these product innovation platforms are essentially traditional 1-to-1 closed design service models. They are often viewed as a "window" for information search and requirement contact, failing to harness the full potential of crowd wisdom participation on the internet. This hinders the creation of large-scale, high-value crowd network innovation activities. Compared to the mass participation in crowd innovation models, these platforms primarily consist of designers, which limits their personnel structure, making them predominantly youthful. The platforms lack high-end experts and other innovation resources, ultimately hindering their ability to generate high-quality and market-potential ideas. These platforms primarily focus on simple product appearance design and cannot address complex innovation needs of businesses. This study presents a theoretical model designed to address the issues in creative production on internet platforms.



Figure 1: LKKER Platform Design Tasks Image Source: LKKER Platform Official Website (http://www.lkker.com/)

2. Theory

The theory underpinning the development of the crowdinnovation design method and the perspective of this study is the Innovation Value Chain theory. The Innovation Value Chain (IVC), as conceived by Morten T. Hansen and Julian Birkinshaw, builds upon Michael $E^{[3]}$. Porter's value chain theory, merging innovation seamlessly with the value chain.

While Porter's value chain theory delves into the process of value creation, the Innovation Value Chain theory centers on the analysis of value creation within a chain-like innovation process and structure.

The Innovation Value Chain theory regards the entire process, from ideation to the eventual transformation into a product, as a cohesive chain-like structure. It categorizes innovation into three stages: idea generation, idea transformation, and idea

dissemination. Within these three stages, businesses must engage in internal adoption, cross-departmental adoption, and external procurement to generate ideas. Further, they need to navigate through six pivotal activities, including idea screening, idea development, and idea diffusion, to unlock the value of innovation (Figure 2). By scrutinizing the chain-like innovation process and phases within their organizations, business managers can assess their strengths and weaknesses in innovation and customize best practices to address issues and deficiencies. This approach empowers them to formulate strategies, seek solutions, and enhance the implementation of innovation within the enterprise, ultimately leading to value addition. The Innovation Value Chain serves as a comprehensive research framework tailored to these objectives^[4]. The Innovation Value Chain illustrates the complete innovation process within enterprises and underscores the interplay among crucial elements during the innovation process^[5].



Figure 2: Basic Model of the Innovation Value Chain Image source: Compiled based on the original content of "The Innovation Value Chain" by Morten T. Hansen and Julian Birkinshaw.

3. Methods and Models

3.1 Innovation Value Chain Model for Product Innovation Platforms

The Innovation Value Chain theory, initially developed within the context of manufacturing enterprises, forms the foundation of this study. Drawing upon a comparative analysis of innovation in traditional enterprises and innovation within internet platforms (Table 1), the author, in conjunction with Geoffrey G. Parker, Marshall V. Van Alstyne, and Sangeet Paul Choudary's delineation of the three core interactive functions in the platform value creation process: "pull," "facilitate," and "match"^[6] (Parker, G. G., Van Alstyne, M. V., & Choudary, S. P., 2019), has put forth the Innovation Value Chain model for internet product innovation platforms (Figure 3). This model extends the existing Innovation Value Chain theory.

In this research, the Innovation Value Chain model for product innovation platforms is introduced, breaking down the innovation process of these platforms into four distinct stages: creative resource integration, creative production, creative transformation, and creative diffusion. These four stages constitute critical components of the activities surrounding product innovation carried out through platform services. They represent the fundamental innovation framework of product innovation platforms. The four stages within the Innovation Value Chain for product innovation platforms encompass a total of eight key elements.

		Enterprise Product	Platform-Based Product
		Innovation Process	Innovation Service Process
Value Orienta	tion	Profit-driven pursuit of innovation through product innovation.	Value creation via the service product innovation process.
Basis of Innovation		Organization of production factors.	Integration of supply and demand resources.
Agents of Innovation		Entrepreneurs.	Participants in the platform (multi-stakeholder).
Form of Innovation		Design - Manufacture - Sale.	Achieving design - manufacture - sale through platform's "pull, facilitate, match" functions.
Stages of Innovation	Creative Generation	Generated internally by the enterprise or jointly with external parties.	Matched with creative service providers by the platform, resulting in creative generation by service providers
	Creative Transformation	The enterprise selects and invests in the creative idea.	The adopters accept the creative ideas, and they may be developed and produced through the platform's resources or other means.
	Creative Diffusion	Internal consensus within the enterprise on innovative concepts.	The platform assists in promoting creative outcomes and collaborates on sales channels.

 Table 1: A Comparison between Enterprise Product Innovation and Platform-Based Product Innovation

 Source of Information: Created by the author

Product Innovation Platform Innovation Value Chain consists of 4 stages



the 8 key activities of the Product Innovation Platform Innovation Value Chain

Figure 3: Innovation Value Chain Model for Internet Product Innovation PlatformsSource of Information: Created by the author

Integration of Creative Resources: The platform aggregates various innovation resources and attracts participants to join. Demand-side users post creative requirements on the platform, forming value units that both parties can interact with^[7]. The more and larger resources the platform attracts, the greater its potential becomes.

Creative Production: Creative production involves two key components: creative connection and creative services. Demand-side users publish innovative requirements, and eligible supply-side providers sign up and engage in collaboration through the platform. Once the connection is established, supply-side providers start providing creative services as per the requirements, with the platform facilitating communication and coordination to varying degrees between both parties, and providing relevant internet-sharing tools to enhance online collaboration.

Creative Transformation : Creative transformation consists of two key activities: creative screening and creative development. After the supply-side providers complete the creative solutions, the platform and demand-side users need to evaluate and select the most valuable and market-promising creative solutions for further development. The resources gathered by the product innovation platform also include technical development, production partners, etc., who provide support for technical development, prototyping, and manufacturing.

Creative Diffusion: Creative diffusion refers to the platform's promotion and investment in creative outcomes, connecting to sales channels and providing commercial services. It also brings funding and sales channel support for creative incubation, further promoting the diffusion of creative outcomes.

In the innovation process, the most critical stage to achieve the maximum innovation value and return on investment in the market is the early creative generation stage. Morten T. Hansen and Julian Birkinshaw also emphasized the importance of focusing on the right connections. To gain more value, companies need to choose creative solutions with higher market potential and value for development. This study will focus on the first three stages and the five key components of the product innovation platform's innovation value chain (Figure 4).



The Internet Product Innovation Platform Innovation Value Chain

Figure 4: Key Research Areas of the Product Innovation Platform's Innovation Value Chain Image source: Created by the author

3.2 Product Innovation Platform crowdinnovation Design Method

Professors Steven D. Eppinger and Karl T. Ulrich have summarized the new product development process into six stages: Planning, Concept Development, System Design, Detailed Design, Testing and Refinement, and Pilot Production and Scaling (Figure 5)^[8]. This model illustrates that product innovation is a sequential, phased innovation process. Idea generation marks the starting point of the innovation process, determining whether innovation can bring greater value and market returns to the

enterprise. How to generate better and more valuable ideas on the platform becomes a key aspect of innovation ^[9]. While a diverse crowd can indeed provide a wealth of different creative ideas and concepts, it may not suffice for the chain-like innovation process of a product. Professional designers are needed to carry out a series of conceptual and detailed design processes. Moreover, for the different design proposals collected on the platform, experienced industry experts are required to guide and assess the innovative design direction to meet the needs of innovation development. Based on this chain-like product innovation process, collaborative cooperation should be carried out in stages and objects, employing different methods for different innovation stages, and capitalizing on the respective strengths of the participants in each stage.



Figure 5: Basic Product Development Process

Image Source: Karl T. Ulrich and Steven D. Eppinger. Product Design and Development[M]. Translated by Yang Qing and Yang Na. Beijing: China Machine Press, 2018: 13.

Therefore, in the Internet platform crowd-creation design method proposed by the author, the main participants are composed of mass innovators (non-design professionals), professional designers, industry experts, and even enterprises are required to participate in the collaboration. Diversified public group thinking can solve the problem of limitations of the creative breadth of a single group. The participation of professional designers can ensure the implementation of creative professional design, and the participation of experts can guide and grasp decision-making in creative directions.

Based on the innovation value chain theory, the author constructed a crowd-creation design method. It is based on the chain structural characteristics of product innovation and focuses on the innovation needs of enterprises. It involves designers, experts, non-design professional mass innovators and other groups to participate in creative implementation to solve the problem of enterprise innovation. Regarding the complex issues of innovation, it is a "creative processing factory" that solves the problem of creative production. The crowd-creation design method includes the diverse thinking linking method of "Crowdsourced Linking", the multi-element and staged collaboration method of "Crowdsourced Collaboration", and the multi-level, multi-objective and multi-angle screening and evaluation method of "Crowdsourced

evaluation" (Figure 6).

" Crowdsourced Linking" creates the conditions for collaboration, emphasizing the involvement of both the general public and professional designers. The diversity and heterogeneity of collective thinking provide a broader range of creative proposals and problem-solving solutions.

" Crowdsourced Collaboration" aims to enhance the quality of creative ideas by promoting collaboration between the general public, designers, and experts. This approach stands in contrast to the "1-on-1" platform innovation service model and aligns better with the spirit of openness, sharing, and collaboration on the internet. Collaborative participation enhances the quality of creative ideas, thereby improving the platform's ability to address complex innovation challenges and enhancing its innovation capabilities.

" Crowdsourced evaluation " involves the selection and assessment of creative outcomes through public participation, allowing users to decide on the most favorable creative direction. Expert collaboration and opinion judgments further refine the product innovation direction, making it more valuable and feasible.



The Internet Product Innovation Platform Innovation Value Chain

Figure 6: Product Innovation Platform Collaborative Method Image Source: Created by the Author

3.3 Product Innovation Platform Crowdsourced Design Model

The crowdsourced design model is based on a chain-like innovation structure, with different innovation actors playing various roles at different stages of product innovation to produce high-quality creative content with greater market potential and value. Based on the six stages of the product innovation process and the three core interactive functions of platform value creation (attract, facilitate, match) ^[10], the author divides the crowdsourced design model into eight steps: "attract residents, publish demands, solicit problems, propose ideas, identify innovation opportunities, professional design, concept selection, and creative development" (Table 2, Figure 7).

phase	Content	Purpose
1	Attraction of Participants	Attracting the general public to participate in crowdsourced innovation
2	Demand Release	Expecting the help of the wisdom of the crowd
3	Problem Collection	Formulating the needs and pain points of the general users
4	Creative Proposals	Gaining insights into the expectations of new products from the general users
5	Innovation Opportunity Identification	Defining the innovative direction for new product development
6	Professional Design	Creating product conceptual ideas
7	Concept Selection	Realizing product concepts into actual products
8	Creative Development	Realizing product concepts into actual products

Table 2: Content of the 8 Stages of crowdinnovation Design

Source of information: Compiled by the author

On one side, various diverse groups enter the platform, forming diverse thinking, while on the other side, companies participate in the platform and release innovation propositions. The general public discusses innovation problems from a user perspective online and filters and focuses the content through user self-voting (liking), thus forming core problem points A with extensive and universal relevance. Based on core problem A, the platform again solicits solutions from the general public, aiming to predict future new products at the user level. Users, through voting (liking), filter and focus the content once again, generating creative proposals with a user-demand foundation. These creative proposals undergo analysis and discussion by professionals and experts, forming the development direction B for new products. Subsequently, professional designers work on professional design around development direction B, and the platform organizes experts, companies, and users to collectively participate in the evaluation and selection of design outcomes, ultimately establishing the design scheme for product innovation, and the product enters the subsequent development stage.

In the process of crowdinnovation design, the general public plays a dual role of user innovation and self-filtering, providing both extensive creative thinking and focusing on problems. Professional designers, based on the creative ideas from the general public, further focus on design proposals. Experts can provide guiding and decisive recommendations on creative issues, product innovation directions, and design proposals, leading to optimization and enhancement of the design plan. Diverse innovation entities leverage their respective strengths in the chain-like innovation process to collaboratively drive high-quality creative output.



Figure 7: Crowdinnovation Design Model Image Source: Created by the author

4. Conclusion and Discussion

The process of crowdinnovation design introduces the general public in the early stages to participate in problem research and creative collection, implementing an innovation model guided by user needs and user participation. Through three rounds of problem research, creative proposals, and professional design, the process casts a wide net, involving the general public and obtaining the most extensive and diverse array of solutions. This is achieved through self-selection by users, forming a funnel-based focusing approach (Figure 8). Combining professional service providers' design expertise with collaborative assessments involving users, experts, and those with demands, it achieves a design innovation model.



Figure 8: Crowd and Expert Selection of Creative Proposals Image Source: Created by the Author

The process of crowdinnovation design embodies the integration of divergent and convergent thinking, representing a funnel-shaped process of continuous divergence and convergence of thought. Divergent thinking aims to increase possibilities to create new choices, while convergence is aimed at arriving at a single best solution (Figure 9). As Linus Pauling, a two-time Nobel laureate, once said, "To have a good idea, you must first have a lot of ideas."^[11]



Figure 9: Divergence and Convergence Image Source: Tim Brown. "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation." Translated by Hou Ting. Beijing: Beijing United Publishing Media Group Co., Ltd., 2011, pp. 62-63.

Crowdinnovation design method is a new approach to product innovation activities in the Internet age. It also needs to address three important questions and establish relevant mechanisms: first, how to attract a wide range of the general public to participate in platform innovation; second, how to facilitate collaborative efforts among various platform user groups; third, through what means and mechanisms can the general public evaluate and filter creative proposals and results.

This study introduces the innovation value chain theory to Internet platforms. Based on changes in the Internet innovation scene and innovation methods, it not only extends the innovation value chain theory but also proposes crowdinnovation design methods as a research perspective and approach. It emphasizes that in the Internet age, despite changes in the innovation process, the general public cannot replace the leadership role of professionals and experts. Excellent and high-value innovations require the collaborative participation of diverse groups, with different stages of the process involving cooperative innovation.

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[7] A value unit refers to the detailed information about each service or item posted on the platform, which is information that is beneficial and exchangeable for users. Examples include YouTube videos and Uber's availability of vehicles, among others.

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