# Analysis of the Current Status of Public Innovation Participation and Information Needs in Xi' an (Postprint)

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## Abstract

[ Purpose / Significance ] Analyzing the current status of public innovation participation and information needs in Xi' an is conducive to improving societal information supply strategies and promoting public innovation. [ Process / Methods ] Based on literature analysis and interviews, a questionnaire was designed. Through survey research, we grasped relevant information regarding the public' s cognition of innovation, current status of innovation practices, factors influencing innovation participation, and innovation information needs in Xi' an. [ Results / Conclusions ] Based on the survey results and actual conditions, suggestions are proposed including promoting innovation-related information, cultivating an innovation atmosphere, establishing maker spaces, and strengthening innovation center construction, to optimize the allocation of innovation information resources and promote the enhancement of society' s independent innovation capabilities.

## Full Text

## Preamble

**Analysis on the Status Quo of Public Innovation Participation and Information Demand in Xi' an**

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## Abstract

**[Purpose/Significance]** Investigating the status quo of public innovation participation and information demand in Xi' an is conducive to improving

social information supply strategies and promoting mass innovation. [**Process/Method**] Based on literature analysis and interviews, a questionnaire was designed to gather data on the public' s perception of innovation, current innovation practices, factors influencing innovation participation, innovation information needs, and related aspects through a survey of Xi' an residents. [**Result/Conclusion**] Based on the survey findings and actual conditions, this paper proposes recommendations including promoting innovation-related information, fostering an innovation atmosphere, constructing maker spaces, and strengthening innovation center development to optimize the allocation of innovation information resources and enhance society' s independent innovation capacity.

**Keywords:** user information demand, mass innovation, maker space, Xi' an city

## 2.1 Mass Innovation

Prior to the era of mass innovation, innovation was largely an elite activity, with innovation systems primarily composed of specialized research institutions, universities, and corporate innovation. With the proposal of the "mass entrepreneurship and mass innovation" initiative, mass innovation and entrepreneurship have rapidly grown in contemporary China and globally. The advent of the "mass innovation and entrepreneurship" era has profoundly influenced public participation in innovation and information demand.

After the 2015 Central Economic Work Conference emphasized creating favorable policy and institutional environments for mass innovation and entrepreneurship, numerous scholars called for igniting the torch of mass innovation and entrepreneurship and welcoming the era of mass innovation. Researchers have explored and summarized the basic concepts of mass innovation, laying a theoretical foundation for its development. Mass innovation refers to self-organized innovation and entrepreneurship activities where individuals freely organize and participate in virtual communities or physical spaces, engaging in online and offline interaction to jointly conceptualize, research, develop, and produce products or services collectively. The internal operational models of mass innovation can be categorized into three types: network community-based, physical space-based, and platform crowdsourcing-based. The knowledge-based nature of labor resources, the shared availability of technological hardware, and the widespread adoption of the Internet constitute the fundamental conditions for mass innovation.

Some studies have focused on proposing countermeasures for the current state of mass innovation. Zhou Bin et al. offered suggestions for central state-owned enterprises, including enhancing ideological understanding, strengthening systemic reform, and exploring distinctive models. Yang Xiuli et al., based on Hefei' s achievements in "mass innovation and entrepreneurship," proposed recommendations such as improving policy systems, establishing talent support

mechanisms, and intensifying supervision and accountability. Liu Yuangang et al. noted that while Tianjin's "mass innovation and entrepreneurship"level ranks among the nation' s top, it needs to strengthen transformation in development models, driving forces, strategic focus, and institutional mechanisms.

From a disciplinary perspective, education scholars have been most responsive to the "mass innovation and entrepreneurship" era, dedicating efforts to exploring topics such as cultivating entrepreneurial talent in universities under this background, developing college students' innovation and entrepreneurship capabilities, and training models for economics and management talents, supplemented by practical case studies.

From a regional perspective, current research on information demand in western China has primarily concentrated in Shaanxi, Gansu, and Guizhou. Notably, a series of studies by Jing Shui and Li Jing have focused on analyzing information needs among Shaanxi farmers. Additionally, Tan Ying et al. conducted comprehensive investigations on farmers' scientific and technological information needs in impoverished areas of central and western China, while Li Guihua et al. reflected on the status quo in western regions by comparing information demand structures of public libraries in eastern and western China. Information status among other western populations has received limited attention.

In terms of research content, scholars have mostly employed combined interview and questionnaire methods to study the status quo, characteristics, and influencing factors of information needs among western populations. Li Jing investigated the current status of information needs among farmers in southern Shaanxi and analyzed characteristics such as enhanced information awareness and diversified types. Tan Ying analyzed influencing factors based on four types of information needs among farmer groups and proposed corresponding countermeasures. Zhang Xiaolan et al. analyzed the status quo of western farmers' information needs from perspectives such as satisfaction level, types, and access channels. Yang Suhong also examined how farmers'psychological and behavioral conditions affect information needs.

Regarding research populations, the focus has been on farmers'information needs and scientific-technological information needs. Zhu Chunyan et al. and Li Huahong conducted grouped surveys on information needs of western rural residents from perspectives of education level and population mobility respectively. Duan Xiaohu investigated information forms and content structures among different ethnic groups and age groups based on the population structure of western rural areas to comprehensively understand information demand characteristics across different groups. Tan Ying et al. categorized farmer groups in impoverished areas into four types based on income levels, noting that each type has corresponding information needs and desires to apply computer knowledge to create greater economic benefits.

Overall, research on public innovation remains scarce, and studies on the status quo and information needs of public innovation are virtually nonexistent.

## 3.1 Survey Process

Based on the literature review, few prior studies could serve as references. Therefore, this research adopted a combined interview and questionnaire approach to directly extract usable information and current conditions from the target audience. The study was conducted in three main stages: First, 25 citizens across various age groups were selected for in-depth interviews focusing on public innovation activities and information needs and fulfillment. These interviews helped understand the status quo of public innovation and information needs, laying the foundation for large-scale questionnaire data collection and making recommendations more specific. After completing the interviews, the initial draft of the "Xi' an Public Innovation Participation and Information Demand Survey" questionnaire was designed based on the findings, comprising five sections: public cognition and attitude toward innovation, innovation practices, factors influencing innovation participation, innovation information needs, and demand for maker spaces. The specific structure is shown in Table 1 .

Second, considering differences in public literacy and comprehension abilities, after initial questionnaire completion, a pilot survey of 80 participants was conducted. Based on feedback from the pilot sample, questionnaire wording was carefully revised to enhance readability and answerability. Finally, in March 2017, the formal survey was administered using a combination of online and offline distribution to ensure broad and diverse sample sources. Researchers conducted on-site distribution at Shaanxi Library, major bookstores, parks, and other locations, while also using the Wenjuanxing platform to request sample services and distributing questionnaires through social networks following convenience sampling principles.

## 3.2 Sample Composition

A total of 804 questionnaires were collected. After manual screening to eliminate invalid responses with obvious errors or more than 10 omitted items, 714 valid samples were obtained, yielding an effective rate of 88.8%. This study used SPSS Statistics 21.0 to analyze the valid samples. Descriptive statistical analysis was conducted on four demographic characteristics: gender, age, education, and occupation. The results are shown in Table 2 .

As shown in Table 2, the sample had a balanced gender distribution. Age covered all levels but concentrated in the young and middle-aged groups, who are the main force of innovation. Education covered all levels, with a concentration on undergraduate degrees, roughly consistent with the educational distribution of the general public. Occupational types showed no obvious bias, presenting characteristics of being civilian, diverse, and widespread. Additionally, data on respondents' permanent residence locations were collected, covering all ten districts and three counties under Xi' an' s jurisdiction, with most residing in the "six urban districts" (Lianhu, Xincheng, Beilin, Weiyang, Yanta, Baqiao) and Chang' an District. Yanta District had the highest representation (170 people,

23.8%). Overall, the sample distribution was comprehensive and reasonable with strong representativeness.

## 4.1 Public Cognition and Attitude Toward Innovation

This study measured the current public cognition of innovation in Xi' an from two dimensions: the degree of importance attached to innovation and the degree of attention paid to innovation (see Figure 1 [Figure 1: see original paper]). Overall, the public generally considered innovation to be of very high importance and paid relatively high attention to it, demonstrating good overall cognition of innovation. However, public emphasis on innovation concentrated at the "very important" level, while attention mainly remained at the "relatively important" level, revealing a mismatch in public attitudes toward innovation—a disconnect between cognition and behavior. In terms of dispersion, public attention to innovation showed greater variance than importance in both standard deviation ($0.642 > 0.531$) and variance ($0.412 > 0.282$), indicating that the distribution of public attention to innovation was more dispersed with potentially greater individual differences. Therefore, measures are needed to enhance public attention to innovation in Xi' an.

## 4.2 Current Status of Public Innovation Participation

To better grasp the current status of innovation practices among Xi' an' s public and make information resource supply more targeted, this study investigated the types and domains of innovation activities. Regarding innovation activity types, most respondents had engaged in one or more types of innovation activities. The most common was changing (improving) existing methods (44.0%), followed by creating new methods (35.7%), indicating that methodological innovation constitutes the main form of public innovation. Additionally, changing (improving) existing things (33.9%) and discovering new things (32.5%) also accounted for significant proportions. Regarding innovation domains, the vast majority of public innovation activities were related to learning and work (71.2%), followed by life (47.5%), personal interests (36.0%), and social development (18.8%).

A chi-square test was conducted on these two variables. The calculated Pearson chi-square value was 32.497 with significance of $0.006 < 0.05$, indicating a significant correlation between innovation activity types and domains. According to Table 3 , changing (improving) existing methods was a common innovation activity across all domains. Additionally, creating new methods was also common in learning, work, and social development domains. The public more frequently discovered new things in daily life, while in personal interest domains, they tended to change (improve) existing things.

These findings can provide topic selection suggestions for government and information institutions in innovation promotion, lectures, and exhibitions. Table 4 and Figure 2 [Figure 2: see original paper] display the number of innovation activity types and domains among Xi'an's public, facilitating preliminary assess-

ment of public innovation behavior. Table 4 shows that both indicators ranged between 1-2, indicating limited innovation activity types and narrow domains. The dispersion of innovation activity types was higher than that of innovation domains, suggesting greater diversity in types than domains. Figure 2 presents a donut chart distribution of innovation activity types and domains, with the outer ring representing domains and the inner ring representing types. The figure shows that most respondents engaged in one type of innovation activity (31%) occurring in only 1-2 domains (39%/27%), confirming that conscious public innovation involves limited types and narrow domains. This indicates that while public cognition of innovation is good, multi-channel stimulation of public innovation potential is an urgent current task.

## 4.3 Factors Influencing Public Participation in Innovation

Numerous factors influence public innovation activities. Based on Xi' an residents' current innovation experiences, this research team identified 13 hindering factors and 15 promoting factors through interviews. Investigating these factors serves dual purposes: clarifying the impact degree of information resources and related factors on current public innovation in Xi' an, and providing comprehensive understanding to inform government efforts to promote public innovation.

Table 5 shows that lack of knowledge reserves and related information support (42.6%) is the primary factor hindering public innovation in Xi' an, indicating that ensuring public access to knowledge and information should become important work for Xi' an' s government and information service institutions such as public libraries. Additionally, lack of time (40.5%) and lack of innovative thinking and ability (39.4%) also significantly impact public innovation. Other factors such as lack of confidence (26.2%), laziness (25.9%), insufficient understanding of innovation (24.6%), lack of funds (27.7%), lack of exchange and cooperation (24.5%), and lack of expert guidance (24.2%) also substantially hinder public innovation in Xi' an. Addressing these hindering factors is crucial for unleashing public innovation potential. Beyond social system and mechanism reforms, information resource supply can also help solve these problems and support public innovation.

Table 6 displays promoting factors for public innovation in Xi' an. Emphasizing these factors can make public innovation more dynamic. The results show that personal interest (47.9%), innovation highlighting personal value (39.1%), and strong personal innovation consciousness (33.3%) significantly promote public innovation. Also noteworthy are having like-minded partners (25.8%), sufficient personal knowledge reserves (24.6%), and adequate financial support (23.4%).

## 4.4 Public Innovation Information Needs and Fulfillment

Analysis of innovation influencing factors reveals that having sufficient knowledge reserves and information support is an important factor. This section investigates the status of information support obtained by Xi' an' s public dur-

ing innovation. Figure 3 [Figure 3: see original paper] shows the types of information resources needed by the public during innovation, indicating that skill-based information (68.2%) is most needed, followed by national policy information (51.0%), ideological or theoretical information (38.4%), guide-type information (37.2%), and progress/news information (30.2%).

Beyond information content needs, access channels constitute an important component of information demand. A chi-square test of independence was conducted on innovation-required information resources and channels, yielding significance $p = 0.000 < 0.05$, indicating association between the two variables.

First, to understand channel selection when obtaining specific information, based on cross-tabulations of information resource types and access channels during innovation, the frequency of channel mentions for each information type was converted to percentages, with color shading indicating value magnitude. Processed Table 7 shows that the Internet is the primary channel for obtaining all types of information, with other important channels being television, self-purchase, and peer exchange. Beyond the Internet, television and peer exchange are relatively important for national policy and progress/news information; self-purchase and television are main channels for ideological/theoretical and guide-type information; while self-purchase and peer exchange are more common for skill-based information than other channels.

Second, to understand what information types are obtained through each channel, with channels as the baseline, the primary uses of each channel were processed with color shading indicating value magnitude. Processed Table 8 shows that television, radio, and casual conversation are mainly used for national policy information. Internet, self-purchase, public libraries, organizational information departments, expert consultation, and peer exchange are primarily used for skill-based information. Notably, expert consultation is also commonly used for guide-type resources, and the public also prefers obtaining ideological/theoretical information through public libraries and self-purchase.

The study also investigated public satisfaction with various information resources. Table 9 shows overall low satisfaction, with guide-type information having the highest fulfillment, followed by progress/news information, then skill-based information, and lowest satisfaction for national policy and ideological/theoretical information. Since satisfaction level is ordinal data, rank-sum test was used to explore the relationship between information resource type and fulfillment degree. Using Kruskal-Wallis test, significance was $0.119 > 0.05$, indicating no significant relationship between satisfaction level and information resource type.

## 4.5 Public Demand for Maker Spaces

As venues for innovation activities and exchange, maker spaces have emerged globally. This study investigated public awareness of and demand for maker spaces. Over 80% of respondents considered maker spaces very necessary or

relatively necessary. Regarding resource provision in maker spaces, the public most needed innovation-related information and knowledge, followed by spaces and equipment for discussion and expert training, as shown in Figure 4 [Figure 4: see original paper].

## 4.6 Correlation Analysis

To explore patterns in Xi'an's public innovation, this section conducts correlation analysis to investigate three questions:

First, since individual innovation generally requires various resource supports, and information-rich resources play important roles in reducing uncertainty and providing innovation guidance, information resources should have close relationships with innovation. Therefore, this paper proposes:

(1) Improved information demand fulfillment can promote increased types of innovation activities.

(2) Improved information satisfaction can promote expansion of innovation activity domains.

Second, innovation activities have rich connotations encompassing different types. While previous analysis examined influencing factors on innovation as a whole, different innovation activities may have different influencing factors at the micro level. If certain innovation behaviors have specific hindering or promoting factors, these should be considered when promoting public innovation to make appropriate decisions. Therefore, this paper proposes:

(3) Specific innovation activities are associated with certain specific influencing factors.

Hypotheses 1 and 2 were tested using the average satisfaction level for all information resource types as the independent variable, with number of innovation types and domains as dependent variables. Due to continuous independent variables and continuous categorical dependent variables, Logit multiple regression analysis was employed. The first hypothesis model's likelihood ratio test showed significance $p < 0.05$, indicating model validity. The second hypothesis model's significance was $0.484 > 0.05$, thus rejecting the second hypothesis. Statistically, information resource satisfaction level has no significant relationship with the number of innovation activity domains.

Parameter testing was continued to obtain specific relationships between information resource satisfaction and innovation type count. First, likelihood ratio testing showed the average satisfaction level' s significance as $0.017 < 0.05$, indicating this variable is significantly effective. In parameter estimation, average satisfaction level showed significance less than 0.05 across innovation activity type categories 1 through 5 (see Table 10 ), with all five coefficients serving as reference values. According to these coefficients, average satisfaction level is positively correlated with innovation activity types, indicating that higher

information demand fulfillment among Xi' an' s public leads to more diverse innovation activity types.

Next, correlation between specific innovation activities and influencing factors was explored. Since both variables are categorical, chi-square tests were conducted between innovation activities and both promoting and hindering factors. Results were not significant, rejecting the third hypothesis. This suggests that reasons for conducting or not conducting specific innovation activities are independent of general innovation influencing factors, with different underlying causes for specific innovation activities.

In summary, correlation analysis reveals that information fulfillment positively satisfies the variety of public innovation activity types but has no significant effect on innovation domains. Meanwhile, whether the public conducts specific innovation activities shows no significant association with the listed promoting or hindering factors, as different reasons exist for different innovation activities.

## 5 Recommendations

Through interviews and questionnaires, this study understands the current innovation situation among Xi' an' s public, providing empirical data support and theoretical foundation for relevant entities to take measures ensuring effective public access to innovation information and stimulating public innovation enthusiasm. The government, as the main body of social management, bears the responsibility and mission to create a favorable innovation atmosphere in the era of mass innovation and entrepreneurship. Public libraries, as regional information and cultural centers, are material and cultural guarantees for fulfilling public information needs. Under new circumstances, improving public innovation information literacy and promoting user innovation activities constitute primary tasks for public libraries. Therefore, this paper primarily offers recommendations from the perspectives of public libraries and government to meet Xi' an' s public innovation information needs, promote public innovation participation enthusiasm, and enhance social innovation capacity.

### 5.1 Publicize Innovation Information and Foster a Good Innovation Atmosphere

A good innovation atmosphere can stimulate public enthusiasm for innovation, and promoting innovation-related information is crucial for cultivating such an atmosphere. Currently, Xi' an' s public shows relatively high attention to and emphasis on innovation. The government and libraries should cooperate and leverage their respective strengths to strengthen publicity on innovation values and methods, transforming public innovation cognition into concrete action.

First, public libraries can regularly promote innovation-related information through lectures, exhibitions, Weibo, WeChat, reference consultation, and other platforms to expand the dissemination scope of innovation information and promote innovation concepts. For instance, Shaanxi Library' s "Shaanxi

Library Lectures," "Shaanxi Library Classes," and "Shaanxi Library Exhibitions" have already established certain influence. Building on this, Shaanxi Library could collaborate with Xi' an Library and district libraries to launch a series of "What is Innovation" classes, helping the public correctly understand innovation by organizing basic knowledge about innovation concepts, methods, and approaches, thereby ensuring information provision for public innovation. Simultaneously, thematic lectures such as "Financing Channels in Innovation and Entrepreneurship" could be offered to help the public address specific problems like information acquisition and financial support during innovation, promoting public participation in innovation across different domains and aspects. Additionally, exhibitions on innovation cases could display various innovation activities, domain-specific innovations, and success/failure cases to enhance public innovation action capacity and align innovation concepts with actions.

Second, the government should utilize the Internet, television, radio, public libraries, and other channels to publicize policies supporting "mass innovation and entrepreneurship," clarifying government support attitudes and measures. In collaboration with public libraries and related institutions, specific dates could be designated as Xi' an' s "Innovation Festival," with various innovation promotion activities held citywide from top to bottom to create a favorable innovation atmosphere. Furthermore, the government should encourage public participation in social development domain innovation to enhance both public innovation vitality and social development participation. In 2015, the United States encouraged public participation in a materials science and engineering data challenge related to the Materials Genome Initiative to achieve goals of discovering and manufacturing new materials at lower cost and faster speed. Xi' an' s government could cooperate with public libraries to hold thematic lectures on various social development domains, helping the public understand current social development status, encouraging public participation in social problem innovation, and properly receiving public innovation achievements.

### 5.2 Build Maker Spaces and Strengthen Innovation Center Construction

Maker spaces are places where people share interests in computer technology, science, mathematics, electronic arts, and other areas and collaborate to create things hands-on. They can promote game-based learning, provide stages for knowledge innovation and exploration, and constitute important means for promoting public innovation participation. Currently, the state strongly supports maker space development to advance mass innovation and entrepreneurship. As a central city with a solid technological foundation, Xi' an has begun constructing maker spaces, but due to policy funding, industrial foundation, and technology service level constraints, its maker spaces are smaller in scale compared to Beijing, Shanghai, and Guangzhou, and all are for-profit. The survey on maker spaces shows that over 80% of Xi' an' s public have high demand

for maker spaces. Therefore, the government should strongly support public libraries in developing maker spaces to create knowledge exchange centers for maker learning and innovation.

Maker spaces offer diverse service functions. Based on the survey of Xi' an' s public demand for maker space services, three aspects of resource provision should be emphasized: Innovation-related information and knowledge. Knowledge and information reserves are important factors affecting public innovation, with 67.54% of respondents expressing demand for maker space knowledge and information. Previous surveys show low fulfillment levels for various information resources needed during innovation, particularly national policy information, ideological/theoretical information, and skill-based information. Public libraries have abundant information resources but are not primary channels for public innovation information acquisition. They should leverage maker spaces as platforms to fully utilize their information preservation and transmission functions, providing stronger support for public innovation. Regarding information resource types, particular emphasis should be placed on providing digital information resources through networks to meet public demands for efficient and convenient information access. Spaces and equipment for discussion and exchange. Discussion and exchange are essential components of public innovation activities, and maker spaces both domestically and internationally generally provide spaces and equipment for maker communication. In the Xi' an public demand survey, over half (52.19%) expressed need for this service function. Therefore, maker spaces could establish multiple dedicated discussion rooms equipped with 3D printers, 3D scanners, and other fabrication tools, while providing professional information services such as DIY training, project tracking, literature consultation, entrepreneurship guidance, and reading recommendations. They could also organize maker salons, creative exhibitions, competitions, and other activities to build bridges for innovation and entrepreneurship, creating integrated maker interaction platforms combining reading, learning, communication, innovation, fabrication, and display. Expert training. Expert training is an important pathway for acquiring professional knowledge and enhancing innovation capacity, with 44.01% of Xi' an' s public needing expert training services from maker spaces. Maker spaces could invite experts to offer targeted thematic maker tutorials based on specific needs. Additionally, they could adopt Singapore Library' s approach, offering free first-time classes but requiring participants to commit to serving as training mentors for other makers subsequently.

Beyond these three high-demand resources and services, Xi'an's public also show certain demand for experimental materials and equipment and intermediary services for connecting like-minded individuals. Maker spaces could provide more diverse resources and services while meeting primary public needs, according to their own capacities.

## 6 Conclusion

Innovation is an eternal melody of social progress, era development, and cultural prosperity. With the rise of the mass innovation wave, governments and innovation promoters such as libraries should better understand public innovation situations and information needs, facilitating public information utilization, information creation, and innovation activities. Under new circumstances, facing constantly changing socio-economic situations and local regional constraints, how to leverage local and institutional resource advantages to truly implement innovation construction and information support constitutes an important task for Xi' an' s government and public libraries to continuously explore and practice in the coming years.

Current research on innovation status and cognition still concentrates on enterprises and youth. This study on public perspective innovation cognition and practice effectively supplements mass innovation theory. The comprehensive investigation of public innovation information needs offers reference significance for current government information policy formulation and promoting information service institutions like public libraries to guarantee public innovation information needs. However, due to capability limitations and resource constraints, this paper' s categorization of public innovation information needs is relatively coarse, and the relationship between innovation influencing factors and innovation willingness/behavior has not been deeply explored. These aspects will be improved in future research.

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Yang Yukun: Questionnaire distribution, responsible for writing the survey process and data analysis sections.
Huang Yeman: Questionnaire distribution, responsible for writing the introduction, literature review, and recommendations sections.

*Note: Figure translations are in progress. See original paper for figures.*