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# A Study and Survey of the Perception towards Makerspaces of the Public Library

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## ABSTRACT

In the advent of the fourth industrial revolution, which was to become an innovative society, we now face the forefront of a technological revolution, and in response to these changes, the world is actively developing the maker movement to nurture new innovations. Accordingly, it is necessary to change the functions of the library in order to play a leading role in a changing life environment. In addition, it is necessary to present certain directions in policies in order to help expand the library's capabilities to utilize a cultural technology. In this study, we have conducted a survey on public library librarians' perceptions towards makerspaces, and based on this, we have proposed directions and support policies for public library's makerspaces and a dissemination structure of makerspaces for the public library.

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## 1. Introduction

At the Davos Forum in 2016, a forward thinking group touched upon the fourth industrial revolution as an agendum and predicted that, "We are on the verge of a technological revolution. This technology will fundamentally change the ways in which we have lived and worked, and the size, scope, and complexity of this change will be quite different from what humanity has experienced in the past."

The focus of this event was the educational changes that are taking place across the world that are inextricably linked to future human resources being pursued at the World Economic Forum. In particular, the education methods of developed countries such as the United States and the United Kingdom are focused on education for enhancing computational thinking ability to enhance adaptability to the future industrial society based on ICT technology. Furthermore, when questions were asked about the most important skills and qualities that corporate employees should have in 2020 especially for human resource managers and strategic planners at global companies around the world, they pointed out that it is important to understand the complexities of problem solving, critical thinking, creativity, personnel management, adjustment with others, emotional intelligence, wise judgment

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and decision making, service orientation, negotiation, and cognitive flexibility.

An important priority to be addressed in the short term, in order to adapt to the future environment, is to re-educate existing personnel and improve their education so that they have the appropriate skills to meet future manpower needs. The 2016 NMC/CoSN Horizon Report, published by the New Media Consortium (NMC) and the Consortium for School Networking (CoSN) in the United States, provides coded training that addresses literacy in the short term, with hopes that there will be training trends in the form of educating students creatively. In addition, it will show the trends of technological advancement across the fields of makerspaces including; online learning, robotics, virtual reality, artificial intelligence, wearable technology, etc. as presented sequentially. It is predicted that this will have a positive effect on trends in education.

From this point of view, the Park Geun Hye administration pursued national development based on a creative economy and created the Ministry of Science, ICT, and Future Planning to try to serve as the control tower of the creative economy. Furthermore, they established the ‘Infinite Imagination Room’ in libraries as a creative economic hub for fostering convergent science talents and suggesting that the role of libraries should be newly established in the age of the Internet. Five years later, the Moon Jae-in administration is now attempting to operate makerspaces in terms of strategic development of the national manufacturing business rather than through the position of cultural development. They are creating a ‘smart manufacturing revival strategy’ that connects manufacturing and IT manpower in order to use it as a Mecca for the era of a one-man manufacturing enterprise within makerspaces. President Moon also pledged to create makerspaces and digital media labs in public libraries and cultural facilities in order to enhance the capacity of utilizing cultural technologies needed during the era of the fourth industrial revolution.

In order to accommodate these policy trends and the demands of the time, it is required to establish a policy for the establishment and operation of public library makerspaces. Also, it is necessary to collect opinions on the spot. In this study, we have tried to analyze public library librarians’ perceptions of makerspaces, and provide basic data to determine the direction of a public library’s makerspaces policy. In addition, we have tried to ascertain what current librarians are asking for in terms of what kind of policy implementation method is required for makerspaces’ program operations in the field, what direction is desirable, what type of space they want to create, and what programs are applicable to public libraries, respectively.

## 2. Theoretical Background

### 2.1 Concept and Value

#### 2.1.1 Concept of the Maker

A maker is a person or an organization that designs, assembles and develops products based on imagination and creativity. It also refers to the people undertaking activities of making based on their individual ideas by applying technology easily used through development of technology

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and shared culture; that is, an open source culture.

The maker movement is a process of informing and spreading the production activities of people who have a voluntary creating, correcting, and sharing attitude. According to the maker movement leader’s opinion, the main feature of the maker is ‘creativity,’ ‘motivation,’ and ‘information sharing’ activities.

**Table 1.** Definition of maker concept

Researcher	Definition of Concept
Mark Hatch (2014)	The mass such as inventors, craftsmen, and engineers, etc. who are not bound to the existing maker category
Chris Andersen (2012)	A web generation with features that design with computers, prototypes using desktop manufacturing machines, and instinctively share their own creations
David Lang (2013)	A person who makes or produces something, thereby influencing his or her world in a physical way and makes a difference.

### 2.1.2 Value of the Maker Movement

The social value of the maker movement is that ‘individuals can get close to making things by expanding the base of a production culture, and individuals can regain their initiative while experiencing the joy of creation.’ (Seon, 2016). In addition, through the maker movement, it will be possible to develop human creative ability previously lost due to the division of labor, and also to lay the foundations for developing survival technologies in a new era.

### 2.1.3 Names

The space for makers to work together is named Makerspaces, FabLab, Hackerspaces, and TechShop. Fablab in the sense of a production lab, Techshop in the meaning of various machine tool shops, Hacker in the center of S/W, and Maker in the center of H/W. Korea’s makerspaces means a new form of creator that reflects the advantages of the existing software oriented hackers and H/W oriented makers.

**Table 2.** Names for makerspaces

Name	Details	Name	Details
Fablab	Meaning of production laboratory	hacker	Software-oriented maker
Techshop	Meaning of various machine tool shops	Maker	Hardware-oriented maker

## 2.2 Previous Research

Papers on the maker movement have been published intensively in Korea since 2014, and they have used the keywords of “infinite imagination room”, “makerspaces” and “shared economy.”

Previous research can be divided into studies on concept analysis, studies on operation model and plan, studies on case studies within the infinite imagination room, and studies on applications of makerspaces according to the type of library, among others.

First, Ahn, Choi, and Noh (2014) studied the concept of makerspaces and redefined the concept of introducing infinite creative space, the need of introduction and the role of existing space, and tried to find examples of programs that are appropriate to operate. In addition, the concepts of infinite creative space, development processes of infinite creativity space, implications derived from domestic and foreign materials, directions of utilization of infinite creation space were derived by using literature survey methods and case study methods. In addition, there were further suggestions made for a story creation program, a thematic infinite creation program reflecting the characteristics of the library, an expert mentoring program, a professional consulting program, various educational programs, a patent application and a startup support program. Hong and Park (2015) analyzed the current state of the library's infinite creation space and co-working space, and presented conceptual modeling and substantive modeling based on this analysis.

As a study on the operating model and plans for makerspaces, Noh (2014) proposed the possibility of infinite utilization of a library's infinite creation space by analyzing domestic and foreign cases and previous research papers. Yoo (2015) examined existing domestic and foreign cases of creative cultures centered around ideas of creation space and preliminary research. He presented the idea creation room within an infinite imagination room which opened central to Seoul and which was different from other idea creation spaces central to living cultures in relation to their concept, meaning and characteristics. Through this, he tried to examine achievements and limitations. After that, Yoo and Lee (2017) analyzed characteristics of the creation space of living culture oriented cultural contents, which is the creative environment of an infinite imagination room, and suggested ways of activating the living space oriented cultural contents creation space as the creative environment of the region. Through research, it was discovered that there is a need for a guide to convey clear goals; such as, a mission statement of the creative space, the charter, etc., in terms of the point of operation in order to revitalize the creation space of life culture contents including an infinite imagination room, and the need to provide opportunities for university and private organizations to participate in practical and professional areas under the leadership of public institutions and the government.

In addition, Kim et al. (2016) studied the need and purpose of the infinite imagination room considering environmental factors and human factors within the Jungwon Library located at the global campus of Konkuk University, thereby presenting model selection, annual program planning, space designs, construction of operational experts, network construction, public relations strategies, and finally, performance management stages to evaluate these issues.

As a result of analyzing previous research performed related to makerspaces, numerous findings were reported. First, research on makerspaces' activities is still underway in the conceptualization process. Second, there has been lots of research on the construction model and activation plan as another step taken toward conceptualization. Third, research is being conducted to apply makerspaces to individual libraries. Fourth, research is being carried out to expand maker activities centered on public libraries to other types of libraries. However, we could not find any research on the makerspaces' facilitator, and the users' perceptions and current situations.

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**Table 3.** Previous researchers on makerspaces

Classification	Related Previous Research
Concept Analysis	<ul style="list-style-type: none"> <li>• In-Ja Ahn, Sang-Ki Choi, and Younghee Noh. (2014). A Study on the Concept and Program of the Infinite Creation Space</li> <li>• So Ram Hong, and Seong Woo Park. (2015). Public Library as Co-Working Space</li> </ul>
Operating Model and Plan	<ul style="list-style-type: none"> <li>• Younghee Noh. (2014). A Study on the Development of Library’s Infinite Creation Space and Recommendations for Operating Model</li> <li>• Seung Hwan Yoo. (2015). A Study on the Activation Plan of Creative Space Central to the Living Culture: Focusing on the Case of Infinite Imagination Room in Seoul</li> <li>• Seung Hwan Yoo, and Byung Min Lee. (2017). A Study on the Activation Plan of Creative Space for the Living Culture Central to Cultural Contents: Focusing on the Case of Infinite Imagination Room in Postal Business Division of Seocho-Dong</li> </ul>
Application by Library Type	<ul style="list-style-type: none"> <li>• Ah Ran Jeong, and Dong Hoon Kim. (2016). A Study on the Interior Space of Children’s Library with Makerspaces Applied. Korean Institute of Interior Design Scholarly Conference</li> <li>• Bo Young Kim, and Seung Jin Kwak. (2017). A Study on the Introduction of Makerspaces at University Libraries</li> </ul>
Case Study	<ul style="list-style-type: none"> <li>• Jin Yi Kim, Han Byeol Seo, and Younghee Noh. (2016). Development and Operation Plan for the Infinite Imagination Room at the Jungwon Library</li> </ul>

### 3. Research Questions

The purpose of this research is to investigate the perception of makerspaces among domestic public library’s librarians who are establishing the makerspaces’ policy with the support of the Ministry of Culture, Sports and Tourism. And it is also the purpose of this study to offer basic research to establish the makerspaces’ policy direction based on this. In this regard, research design and implications were derived from the following research questions.

- RQ 1: Do public library librarians feel that it is necessary to introduce makerspace into public libraries, and if they do, why?
- RQ 2: What do public library librarians think of makerspaces’ operational direction and support policy?
- RQ 3: What do public librarians think of the spreading structure of makerspace?

We would like to discuss the above research questions through the research process and recommendations accordingly.

### 4. Research Design and Methodology

#### 4.1 Data Collection and Analytical Methods

The Ministry of Culture, Sports and Tourism conducted surveys of public library librarians from

September to October 2017 in order to collect opinions on the creation and operation of public library makerspaces. In this study, 165 survey questionnaires were analyzed.

According to the results of the first questionnaire analysis performed on 8 metropolitan areas including Seoul, Busan, and Incheon as well as 9 provinces including Gyeonggi and Gangwon, there were no significant differences between the regions. The results of this study are as follows. The areas were divided into metropolitan areas and non-metropolitan areas. In studying the difference between metropolitan areas and non-metropolitan areas we studied whether it affects the operation of makerspaces and how does this reflect on makerspaces' policy or program development.

As a result, as shown in Table 3, 51% of metropolitan areas and metropolitan cities and 49% of non-metropolitan areas (provinces) showed a similar response rate.

**Table 4.** Status on the collection of surveys on the perception and status of the creation and operation of makerspaces by region

Area of Survey	Metropolitan Area and Metropolitan City	Non-Metropolitan Area (Regional Areas)	Total
N	84	81	165
%	51	49	100

#### 4.2 Composition of Questionnaire and Statistical Analysis

The items in the questionnaire used in this study were 3 items concerning the needs of makerspaces' operation and 3 items dealt with makerspaces' operation requirements for a total of 6. Details of each area are as follows.

**Table 5.** Questionnaires and composition of the questionnaires on the perception surveys of makerspaces

Area of Survey	Details	# of Questions
Need for Makerspaces Operation	Whether Makerspaces and Program Operation are Needed	3
	Reason as to why makerspaces and program operation are unnecessary	
	Reason as to why makerspaces and program operation are needed	
Requirements for Makerspaces Operation	Makerspaces Operation Expansion Policy	6
	Makerspaces Operation Direction	
	Suitable spatial types	
	Appropriate program types	
	Priority for activation of operations	
Other	Community effect of makerspaces and program operation	
	Other opinions	1

Statistical analysis was performed using the SPSS statistical program. Frequency analysis was conducted to determine the frequency of questions, and the differences between the groups were analyzed using the cross-analysis (Chi-Square analysis) to identify differences among the groups. As a result of the cross analysis performed, the analysis was divided into metropolitan areas and

metropolitan city public libraries and non-metropolitan public libraries.

## 5. Results

### *5.1 Perception of the Need for Operation*

Regarding the introduction of makerspaces into the public library, 87% of public librarians answered that they needed it, and 13% said it was unnecessary. As to why the introduction was necessary, they said “diversification of the role of the library according to the changing times” was the highest at 37%, followed by “cultivation of creative talent” at 30%, and the makerspaces’ education as a lifelong educational institution’ at 21%.

On the other hand, the 13% of the respondents who said that the introduction of makerspaces was unnecessary said that the additional introduction of new work in an environment where the current work could not be faithfully performed will interfere with the current library work, followed by the impossibility of the introduction of the additional work with the current library space and manpower, and the lack of equipment and space.

### *5.2 Method of Operation Expansion and Details of Operation*

#### *5.2.1 Creation and Method of Expanding the Program Operation*

As a result of analyzing the method of constructing makerspaces and expanding the program operation, 46.7% (77 people) for ‘making up the pilot library of national wide municipalities by 2022’ was the highest, and 30.3% (50 people) for ‘voluntarily contributed to the creation and operation of the library through public libraries,’ and 6.7% (11 people) preferred ‘expansion to the public libraries by 2022. These results show that librarians prefer to adopt a gradual and careful introduction rather than an aggressive introduction of makerspace. In other words, they seem to want to gradually expand the policy based on successful cases through pilot operations.

**Table 6.** Creation and method of expanding the program operation

Item	N	%
Expansion to nationwide public libraries by 2022	11	6.7
Establishment of a pilot operation library by nationwide self-governing bodies by 2022	77	46.7
Implementation of the makerspaces program of the national public library from 2018	8	4.8
Makerspaces creation and operation guidance for voluntary creation and operation through production dissemination	50	30.3
Other	6	3.6
No answer	13	7.9
Total	165	100.0

As a result of analyzing which method is appropriate if the establishment of makerspaces and the program operation expansion policy are implemented, the items of ‘nationwide pilot operation by metropolitan self-governing bodies by 2022’ accounted for the metropolitan area and metropolitan city libraries and non-metropolitan libraries at the rates of 44.7% and 56.6%, respectively. These were followed by ‘producing makerspaces with a producing and operating guide at each rate of 38.2% and 27.6%’, respectively. In other words, it seems to be the most appropriate policy to expand the operation of nationwide metropolitan self-governing bodies by 2022, regardless of the region, and to establish and operate makerspaces and operation guides.

**Table 7.** Creation and method of expanding the program operation for makerspaces by region

Item	Metropolitan Area and Metropolitan City		Non-Metropolitan Area		Total		P (Chi square)
	N	%	N	%	N	%	
Expansion to nationwide public libraries by 2022	5	6.6	6	7.9	11	7.2	.571
Establishment of a pilot operation library by nationwide self governing bodies by 2022	34	44.7	43	56.6	77	50.7	
Implementation of the makerspaces program of the national public library from 2018	5	6.6	3	3.9	8	5.3	
Makerspaces creation and operation guidance production and supply	29	38.2	21	27.6	50	32.9	
Other	3	3.9	3	3.9	6	3.9	
Total	76	100.0	76	100.0	152	100.0	

Missing value: 13

### 5.2.2 Desirable Operating Direction

As a result of analyzing opinions on the direction of a desirable makerspace operation, 36.4% (60 people) for ‘state support for finding and training of makerspace programs’ was the highest, and ‘creating dedicated space for a centralized makerspace within local libraries’ was 33.9% (56 people), 13.9% (23 people) for ‘classifying and operating part of the existing educational programs into a type of makerspaces’, and 7.9% (13 people) for ‘creating public spaces dedicated to makerspaces for public libraries,’ respectively.

As a result, librarians in the field think that the most desirable operating direction of makerspaces is the preferential operation direction for the establishment of a makerspaces’ program and the establishment of dedicated space for makerspaces centered at the local library base.

**Table 8.** Desirable makerspaces’ operation and direction

Item	N	%
Creation of space for makerspaces for each public library	13	7.9
Creation of a dedicated space for makerspaces centered on local base library	56	33.9
Discovery of new makerspaces program and state support for educational operation	60	36.4
Classify some of the existing education programs into makerspaces types for operation	23	13.9
Other	0	0.0
No answer	13	7.9
Total	165	100.0

As a result of analyzing opinions on the direction of a desirable makerspace operation, 44.7% of the respondents in the metropolitan area and metropolitan libraries said that they were looking for a new makerspaces’ program supported by the state budget. ‘Creation of a centralized makerspaces within local libraries as the base’ was 31.6%. On the other hand, in the case of non-metropolitan libraries, ‘the creation of makerspaces centered within the local library base’ was the highest with 42.1%, followed by ‘finding a new makerspaces’ program supported by the state budget’ at 34.2%, and 14.5% for ‘classifying part of the existing educational programs into the type of makerspaces,’ respectively.

In other words, the metropolitan area and metropolitan city libraries have the greatest interest in program development, while the non-metropolitan areas seem to have more demand for dedicated spaces. Therefore, when the government establishes the makerspace policy, it is necessary to differentiate support policies for metropolitan areas and non-metropolitan areas.

**Table 9.** Direction of the desirable makerspaces’ operation by region

Item	Metropolitan Area and Metropolitan City Area		Non-Metropolitan City Area		Total		P (Chi square)
	N	%	N	%	N	%	
Creation of space for makerspaces for each public library	6	7.9	7	9.2	13	8.6	.507
Creation of a dedicated space for makerspaces centered on local base library	24	31.6	32	42.1	56	36.8	
Discovery of new makerspaces program and state support for educational operation	34	44.7	26	34.2	60	39.5	
Classify some of the existing education programs into makerspaces types for operation	12	15.8	11	14.5	23	15.1	
Total	76	100.0	76	100.0	152	100.0	

Missing value: 13

### 5.2.3 Appropriate Types of Space

As a result of analyzing the appropriate spatial type in constructing makerspaces, 31.5% (52 people) favored ‘creating multiple spaces for interconnection with advanced IT equipment experienced

space, craft rooms and coding education rooms’ while 29.1% (48 people) favored ‘creating a general space to educate and operate the program’ and 28.5% (47 people) favored ‘creating a dedicated space for each library to experience and utilize advanced IT equipment,’ respectively.

As with the above results, librarians in the field consider ‘multi spaces of interactive connection for advanced IT equipment experience spaces, craft rooms, coding education rooms, etc.’ and ‘space for training and operating all types of programs’ are most appropriate. However, as shown in the figures, the difference between the three priorities is only 1.3% which is quite minimal.

**Table 10.** Appropriate type in creating makerspaces

Item	N	%
Creation of a dedicated space for each library to experience and utilize advanced IT equipment	47	28.5
Creation of a multi space for interactive connection such as high tech IT equipment experience space, craft room, and coding education room	52	31.5
Creation of a universal space to train and operate all types of programs	48	29.1
Other	5	3.0
No answer	13	7.9
Total	165	100.0

As a result of analyzing the opinions about the appropriate spatial types in makerspaces, 34.2% of the respondents in the metropolitan area and metropolitan city libraries reported that ‘providing space for education and operation of all types of programs,’ 32.9% of respondents said that they would like to create multi spaces of interactive connection for experiencing high-tech IT equipment and crafts, and 31.6% said that they would like to create a dedicated space to experience and use high-tech IT equipment, demonstrating no significant differences between the selected items.

In the case of the non-metropolitan area libraries, 35.5% of the respondents said that they would like to have ‘a multi space with interactive connections for experiencing high-tech IT equipment and crafts’ and 30.3% wanted to create ‘a dedicated space for experiencing and utilizing advanced IT equipment’, followed by 28.9% preferred to ‘create a space where all kinds of programs can be taught and operated,’ respectively.

**Table 11.** Appropriate type for creating makerspaces according to region

Item	Metropolitan Area and Metropolitan City Area		Non-Metropolitan		Total		P (Chi square)
	N	%	N	%	N	%	
Creation of a dedicated space for each library to experience and utilize advanced IT equipment	24	31.6	23	30.3	47	30.9	.526
Creation of a multi space for interactive connection such as high tech IT equipment experience space, craft room, and coding education room	25	32.9	27	35.5	52	34.2	
Creation of a universal space to train and operate all types of programs	26	34.2	22	28.9	48	31.6	
Other	1	1.3	4	5.3	5	3.3	
Total	76	100.0	76	100.0	152	100.0	

Missing value: 13

### 5.2.4 Appropriate Program Type

As a result of analyzing the appropriate types of makerspaces' programs, the 'storytelling type' was very high at 42.9% (134 people), with 'software education' being 72 people (23.1%), product making and utilization was 21.2% (66 people) and others (12.8%). This research grouped the program types to be operated by makerspace and surveyed their opinions. However, in order to establish a mid to long term makerspace policy, it is necessary to further investigate opinions by subdividing them further.

**Table 12.** Appropriate type for makerspaces program (multiple responses)

Item	N	%
Product creation and utilization	66	21.2
Storytelling type	134	42.9
Software education	72	23.1
Other	40	12.8

The details of each program presented to the survey respondents in this study are as follows. First, the storytelling program includes writing (autobiography, e-book, etc.), webtoon production, animation production, and scenario creation. Software training included coding and understanding training (entry, scratch, Little Bits), single board computers (Arduino and Raspberry Pie) via computer coding, and mobile app production. Lastly, product and production utilization included 3D modeling, 3D printer training, robot production and control, drone production and utilization.

The quantitative rankings of the detailed programs are as follows: education on understanding coding (entry, scratch, Little Bits), 3D modeling and 3D printer education, writing (autobiography, ebook etc), webtoon production, drone production and utilization, single board computer control (such as Arduino and Raspberry Pie), video production, and mobile app production.

### 5.3 Operation Activation Plan

As a result of analyzing measures to activate the makerspaces' operation, 27.1% (103 people) of 'securing makerspaces' operation budget (including the support of the central government) was the highest, and 22.4% (85 people) of 'securing operating specialists', 21.6% (82 people) of 'establishment of medium and long-term policies to activate makerspaces and operation of pilot libraries', 16.6% (63 people) for 'training to strengthen the competency of the makerspaces' operators,' 10.8% (41 people) for 'changes in the perception of the need for makerspaces in and outside of the library', and 1.6% (6 people) of 'others,' respectively.

**Table 13.** Makerspaces operation activation plan (multiple responses)

Item	N	%
Development of a mid- to long-term policy for the activation of makerspaces and operation of a pilot library	82	21.6
Capacity building training for the manager of the makerspaces operation	63	16.6
Securing of operating budget for makerspaces (including support from central government)	103	27.1
Securing of skilled manpower to operate the makerspaces	85	22.4
Change in the perception of libraries within and outside concerning the need of makerspaces	41	10.8
Other	6	1.6

#### 5.4 Community Contribution

As a result of analyzing the effect that a makerspaces operation has on the local community, 37.5% (112 people) responded ‘contribution to cultivating creative talents and forming community’, ‘diversification of library functions beyond the book loan and return service’ (31.1% for 93 people), ‘activation of creative education centered on children and adolescents’ (23.1% for 69 people), ‘base facility as a window for expanding local community jobs and supporting employment’ (7.4% for 22 people), and others (1%), respectively.

The question of the effect of the makerspaces’ operation on the community can be seen to be very similar to the response for the need for makerspaces.

**Table 14.** Effects of makerspaces operation on the community (multiple responses)

Item	N	%
Diversification of library’s functions beyond the book loan and return services	93	31.1
Contributing to cultivating human resources and forming local communities	112	37.5
Activation of creative education central to children and youth through connection with school classes	69	23.1
A base facility as a window for expanding job openings in the local community and supporting employment	22	7.4
Other	3	1.0

#### 5.5 Other Opinions

Other areas of multiple opinions were in the order of: a responsible ministries’ policy implementation plan (52%) > space development plan (19%) > a proposal of program contents (10%) = change of direction (10%) > a recognition change and promotion plan (6%).

**Table 15.** Suggestions for makerspaces policy direction

Classification	Details
Name	- ‘Makerspaces’, standardization of the term of infinite imagination room
Direction for Supplemental Matters	- It is desirable for the library to adapt to the changes of various surrounding environments and to pave new ways.
Responsible Ministries’ Policy Implementation (52%)	<ul style="list-style-type: none"> <li>- Sharing changes in the roles and activities of public libraries in response to changing times</li> <li>- Establish mid- to long-term policies and prepare implementation plan, and present detailed business</li> <li>- Gradual changes in the perception in and outside of the library → Systematic professional education and infrastructure development → Establishment of medium and long term policy is the first priority</li> <li>- Creating a space for makerspaces through the support of the national treasury, purchasing equipment, operating the program itself, and establishing an early life culture era</li> <li>- Ensure that various activities take place on a regional basis.</li> <li>- It is difficult to reap results by allocating the budget then leaving everything up to an autonomous operation.</li> <li>- Sharing good programs and their utilization are needed even if space is not secured.</li> <li>- It is appropriate for implementation at the level of district public library or higher.</li> </ul>
Redirection (10%)	<ul style="list-style-type: none"> <li>- Prevent from becoming a means to replace private tutoring institutes.</li> <li>- A place where everyone can come and stay at any time with a sense of comfort and convenience.</li> <li>- The culture of adults enjoying public library is desperate with foremost priority.</li> </ul>
Program Details Proposal (10%)	<ul style="list-style-type: none"> <li>- Public library functions are multiple. Transformed into a place of convergence disciplines (humanities + science)</li> <li>- The use of computer and information and communication technology and information and ethics related education are given foremost priority.</li> <li>- It seems much better to direct towards the humanities.</li> <li>- Create space for existing writers and aspiring writers</li> <li>- Increasing the possibility of developing local literature and humanities is considered to be an opportunity to demonstrate competency efficiently and professionally.</li> </ul>
Promotion of Changes in Perception (6%)	<ul style="list-style-type: none"> <li>- Promotion of change in perception is also important.</li> <li>- Priority should be given to encouraging participation through awareness of makerspaces.</li> </ul>
Space Creation Plan (19%)	<ul style="list-style-type: none"> <li>- Space structure and interior, and furniture arrangement are important.</li> <li>- Continuous support for changing space.</li> <li>- Focus implementation on local libraries with a well-equipped infrastructure such as budget, manpower, facilities</li> <li>- Dedicated space should be arranged at the base institution.</li> </ul>
Manpower (3%)	- Makerspaces manager should be an external specialist and must provide minimum ex ante library education to harmonize with existing members.

Looking more closely into policy directions among the above details, we first had to observe changes in the roles and activities of public libraries which are changing according to the changes of the times, and as a result, they strongly agree with the need for makerspaces. Second, it is hoped to set up mid- to long-term policies and prepare detailed plans to demonstrate detailed projects. Third, they are considering that gradual changes in the perception of the inside and outside of the library → infrastructure establishment → systematic professional education → mid- to long-term

policy should be established first. Fourth, they think that it is necessary to establish the space for makerspaces through the support of the national treasury, in order to purchase equipment, and to operate the program itself as well as to set up a life culture era early. Fifth, various activities should be carried out on a regional basis. Sixth, it is difficult to allocate a budget and to maintain its independence through autonomous operation, and it is necessary to share and utilize good programs even if space is not secured.

## 6. Discussion and Future Research

### 6.1 Discussion

This research has investigated the need for introducing makerspaces in public libraries, the direction of makerspaces, support policies, and the perception of dissemination structures. Based on these efforts, we would like to identify issues and make recommendations accordingly.

The first subject of the discussion is the librarian's perception of the need for creating makerspaces. In other words, public library librarians answered that 87% of them think that it is necessary to introduce and install makerspace in public libraries, because the need for diversification of the library's role, through such areas as training of creative talents in the era of the 4th industrial revolution and meeting the need for library users and the surrounding area would be beneficial. 13% of the respondents who said they did not need it explained that they lacked space, equipment, carried concerns about workload, and lack of personnel. In conclusion, although they agreed in principle with introducing makerspaces in public libraries, it seems that it needs to be additionally done with space, equipment, manpower, and budget support to increase consensus and efficiency.

As the next subject of the discussion, the public library librarians refer to the most favorable operating direction of makerspaces as support for the discovery and educational operation of makerspaces' programs and the creation of a dedicated space for makerspaces centered on the local library base. It is apparent that there is also considerable opinion in this connection.

Based on these, in this study, we would like to propose a direction for a public library's makerspaces' operation as follows. First, as a need for medium- and long-term policy development, the government and budget support plan and manpower resource development plan for the purchase of equipment necessary for makerspaces' creation and education should be established, and plans should be made so that there will be no differentiation according to area. Second, after 2013, they must participate in an infinite imagination room support program and receive consultation on policy development, manual development, program planning, etc. by forming an advisory committee composed of librarians, practitioners and related researchers who have experience in operating the space. Third, it is necessary to secure space as one of the most difficult problems since it is impossible for all libraries to secure space, and it is necessary to select a central representative library or a central library at the level of a municipal public library and focus on them. Fourth, it is necessary to develop manuals for public library makerspaces including contents of space standards, manpower standards, and interior models, and it should be accompanied by manual utilization education. Fifth, even if it is impossible

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to secure a space, related programs can be shared and utilized. Therefore, it is necessary for the central government to establish detailed business plans (program contents, lecturers) for business purposes and to select and operate lectures according to their own situation. Since it is impossible for all public libraries to carry out all the processes of all subjects, it is necessary for them to analyze the community and then set up appropriate subject areas and preserve space and equipment. In addition, it will be effective to operate the public library makerspaces by determining which level of makerspaces to operate. Sixth, it is necessary to secure human resources such as librarians and external experts and volunteers. In order to operate makerspaces, external experts are required to train the librarians. In order to harmonize with existing members, it is also necessary to conduct pre-library education. Seventh, reading education should be executed so that a sharing culture, creative culture, and participation culture can be created. Furthermore, it is necessary to develop self-directed learning and experience through library utilization education. Eighth, the library should be responsible for an information service for maker production information sharing. One of the cultural programs will be the maker fair event. In addition, it is necessary to operate an information sharing database of maker culture and education programs.

The final subject of the discussion is what public library librarians think of as the expansion structure of makerspace. The fourth industrial revolution and innovation society are at the forefront of technological revolution. In response to these changes, the world is actively developing the maker movement to nurture a new innovation class. Therefore, it is necessary to change the library to play a leading role in a changing life style, and it is necessary to present a direction of policies in order to expand the library's competency to utilize a cultural technology.

In this connection, this research proposes to divide the dissemination structure of the maker movement into aspects of infrastructure, culture, education, and commercialization. First, in terms of infrastructure, the creative space will serve as a centerpiece and foundation for the proliferation of maker campaigns, providing various facilities and spaces, various educational programs and commercialization support that are available to anyone with ideas. To spread the makerspace's movement, the government could support policies such as space and budget for cultural facilities such as public libraries, art and science museums. The library, which plays the role of an infrastructure for the proliferation of makers' movements, should provide production facilities and space, various educational programs, commercialization support, and promote publicity for the proliferation of a maker movement. Second, concerning a cultural aspect, this comes from a creative culture that enjoys making and sharing within the context of people's interests, and spreads all to the public through online sites and communities for information sharing and maker fairs. One of the cultural programs will be the maker fair event. In addition, it is necessary to operate an information sharing database of maker culture and education programs. Third, as an educational aspect, it is necessary to provide opportunities for anyone to easily learn production skills and implement their own creative ideas as prototypes with various educational support for manufacturers. It is possible to provide production technology education through the educational functions of the library. In the US and Europe, maker education is rapidly spreading with STEAM education and S/W education. We will also need a personality education along with the reading program to develop the maker culture. In the field of personality education, reading education should be done so that a shared culture, a creative culture, and a participatory

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culture can be created. Furthermore, it is necessary to develop self-directed learning and experience through library utilization education. Fourth, in terms of commercialization, prototypes can be commercialized through an entrepreneurial support system. As a successful entrepreneurship case has emerged, social interest and policy support for the maker movement is expanding. Libraries can also contribute to sharing case information.

## 6.2 *Suggestions for the Future Research*

In this study, we propose some future research based on the above findings and discussions.

First, in order to introduce makerspaces suitable for Korea into the public library, research that establishes a mid-term to long-term development plan should be performed. This research should include policies related to budget, manpower, organization, programs, and space as well as step-by-step strategies and operational directions.

Second, it is necessary to conduct a comparative study on the public perception of librarians and the users of public libraries operating the makerspace and public libraries that are not operating makerspaces. In fact, the needs and perceptions of users are more important than librarians in terms of operators. Therefore, it is necessary to conduct research on perception based on the deeper consumer demand.

NMC Horizon Report (2017) expects that maker space of university libraries will shape the major trend for the following three year. Therefore, this paper is of significance in context of analyzing the perception of maker space related public libraries as one of the roles played by such futuristic libraries.

## 7. Conclusion

Through the proliferation of a makers' movement, it will be possible to implement a foundation for developing a creative power, expanding the foundation of business, and developing them towards the manufacturing business. In the midst of this structure, the library plays a role of establishing the maker infrastructure, and contributes to the nurturing of the novice maker → specialized makers on a growth path that develops from "novice maker → specialty maker → manufacturing entrepreneur," respectively.

Based on this need, this study conducted a survey on public library librarians' perceptions about makerspaces. Based on this, we have proposed the direction and support policy suitable for public library makerspaces and the expansion structure of makerspaces in public libraries.

Based on this, government departments such as the Ministry of the Future, the Ministry of Commerce and Industry and the Ministry of Culture, Sports and Tourism must implement the activation of makerspaces, which is the basis for the makers' activities, in the role of sharing and cooperation among private institutions as follows: for Step 1: Zero to Maker, for Step 2: Maker to Maker, for Step 3: Maker to Market. In the first Step (Zero to Maker), it is aimed to expand the basis of the maker within the center of a creative education, and it should expand the basis of various

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education centers by age. In the second Step (Maker to Maker), the aim is to create communities for knowledge sharing, and for this purpose, communities for knowledge sharing activities for primary and intermediate makers should be created. In addition, in the third Step (Maker to Market), it is necessary to actively support employment and entrepreneurial activities of medium to high end makers in order to nurture professional makers for start-up + product innovation.

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