From Makers to Maker Communities: A Survey on Turkish Makerspaces

Doğan Can Hatunoğlu
Atılım University, Faculty of Art, Design and Architecture, Department of Interior Architecture and Environmental Design, Ankara, Turkey.
can.hatunoglu@atilim.edu.tr

Cengiz Hakan Gürkanlı
Middle East Technical University, Faculty of Architecture, Department of Industrial Design, Ankara, Turkey.
hakangurkanli@gmail.com

Hatice Merve Demirci
Atılım University, Faculty of Art, Design and Architecture, Department of Industrial Design, Ankara, Turkey.
merve.demirci@atilim.edu.tr

ABSTRACT
Today, the maker movement is regarded as a socio-cultural movement that represents designing objects for innovations. In these creativity-based activities, individuals from different backgrounds; craftspeople, DIY'ers, engineers, designers, and hackers, form a community and work collaboratively for mutual, open-source innovations. With the recently emerged technologies and digital fabrication tools, movement is continuously expanding its scope and has evolved into a new experience, and for many, it is now considered as new kind of industrial revolution. Makers create within their community by using new digital tools and technologies in spots called makerspaces, in which of learning, experience sharing, and mentoring are evolved into maker events. In literature, there are many sources on these concepts, however there is a gap about the maker communities in Turkey. Research aims to be an information source on the dynamics and process design of "making" activities in Turkish maker communities that provides insights to sustain and enhance local maker communities in the future. Within this aim, semi-structured interviews were conducted with founders and facilitators from selected Turkish maker communities. After a qualitative data analysis, research reveals that there are two main conclusions regarding the foundation of the Turkish maker mindset and emergence of self-sustaining communities.

Keywords: Maker Movement, maker community, makerspaces, open-source design, sustainability.

1. INTRODUCTION

The Maker Movement aims to create, make, and develop innovations by using new fabrication tools like 3D printers in areas such as; open spaces, workshops, or labs (Anderson, 2012). In the last decades, maker movement influenced a wide range of communities from hobbyists to learning environments without any limitations of age, cultural background, or profession.

Maker movement benefits from design, engineering, and other disciplines while creating an interdisciplinary and collaborative working environment. One of the major underlying philosophical issues of the maker movement is to understand and extract meaning from the surrounding world around us by the creation of an artifact or to reflect on somebody's needs. Fabrication tools and information and communication technologies enable people who are interested in making something to share their projects and ideas or to get recommendations on their project with ease. Besides interacting with the whole world's maker communities via digital interfaces, local meetups and maker spaces also provide face to face motivational support. Green, & Kirk (2018) state the importance of

the "intersections and interactions" of diverse makers groups in the makerspaces to motivate and support more participants into the maker events.

Several makers provide social gathering spaces or meeting areas for meetups to empower and ensure continuity of local or national maker communities. To respond and understand the needs of maker community members and makerspaces, supportive makers provided valuable information. Thus, to understand more genuinely and to form a positive contribution to tomorrow's society, maker fairs, meetups, and maker spaces in Turkey were attractive cases to conduct qualitative research. Thereby, to understand the needs, motivations, and expectations of makers and makerspaces community meetups and workshops in Ankara and İstanbul on individual basis interviews were conducted with maker community founders and facilitators. This study aims to explore problematic issues in maker communities in Turkey, and find patterns by the following questions:

- What are the key drivers of Turkish maker communities?
- How designs, projects, or events are designed within maker communities?
    - How actors in maker communities collaborate?
    - What could be said about the decision-making process?
    - How communities co-operate and interact externally by either sponsorships or partnerships?
    - What are the expectations of makers towards maker events and makerspaces?

2. MAKER MOVEMENT IN THE LITERATURE

This research benefited from the literature regarding; first the history and emergence of the Maker Movement, then a definition of maker, and the concept of makerspace, and lastly, how these terms evolved to the present. Besides, potentials of makers and makerspaces were explored, and the scope of current research topics on the makers and makerspaces were searched by utilizing various sources from different fields of literature such as; management, research design, design process, and innovation management.

Today the maker movement is regarded as a socio-cultural movement that represents designing, creating, and building objects for innovations (Peppler & Bender, 2013; Martin, 2015). In these creativity-based activities of this movement, individuals from different backgrounds such as; inventors, programmers, craftspeople, DIY'ers, tinkerers, engineers, designers, and hackers, form a community and work collaboratively for mutual, open-source outputs (Stewart, 2014; Sheninger, 2015, Techopedia, n.d.).

The emergence and foundation of the Maker Movement could be traced back to the first years of the 2000s, when Make Magazine and Maker Faire were founded. Dougherty (2012) identifies the aim of starting Make Magazine as providing a community to the people who want to start a hobby and learn new skills. He also indicates that in the Maker Faire, the members of the newly formed community come together and extend and share their knowledge. Back then, the context of these events based on simpler hobbies, crafts, and activities like; woodworking, sewing, and electronics (Martin, 2015). However, with the developments in the fields of innovation and technology, as well as the advent of digital fabrication tools and online networks, the context and working areas of the maker movement is continuously expanding. These enhancements make people easily share, critique, and compare their knowledge, ideas, and designs. Because of the high growth rate of the Maker Movement and how it introduced the digital making as a new design paradigm, it is now considered as a new kind of industrial revolution (Anderson, 2012; Willett, 2016).

In this new kind of industrial revolution, members of the maker community are named *makers* (Dougherty, 2012; Kalil, 2013; Peppler, & Bender, 2013; Martin, 2015), and their collaborative activities for designing, creating, and building objects for innovations are defined as *making* in general. While there are many definitions of the maker, in the context of Maker Movement, founder Dougherty (2012; 2013) defined makers as every

one of us. In his description, every individual is a maker who cooks, knits, works, in short, people who make things. In years, additions to the definitive aspects of makers have been made; according to the sources, makers are technology enthusiasts who design and make things in their lives who find it rewarding to think, design, and solve problems (Kalil, 2013; Dougherty, 2013; Dixon, & Martin, 2014). Just like additional definitive features of the makers, multiple sources provide enhancements to the definition of the activity of making (Hatch, 2013; Schön, Ebner, & Kumar, 2014).

In the Maker Movement Manifesto (Hatch, 2013), nine principles of the movement are described as in below; (1) MAKE; people must make, create, and express themselves to feel as humans. (2) SHARE; to obtain a feeling of wholeness, people must share what they have made or what they know about making. (3) GIVE; after sharing and giving things, people feel more selfless and satisfied. (4) LEARN; to make something, first, people must learn about, which is a continuous cycle. (5) TOOL UP; to participate the activity of making, people must have open access to all related tools about their projects. (6) PLAY; when people play in the process of making, exciting and unexpected results will occur. (7) PARTICIPATE; when people join the Maker Movement, they participate and discover a network of making. (8) SUPPORT; this activity of making needs emotional, intellectual, financial, political, and lastly institutional support. The best solutions for improving the surrounding world, people need to support it. (9) CHANGE; to make this movement successful, participants need to embrace change.

Hatch (2013) states that to make something properly, people should use these principles as a guideline, and interpret them according to themselves. According to how they interpret the activity of making, makers from different backgrounds create new things within their community, by using new digital tools and technologies in spots called makerspaces. Thus, in these makerspaces, makers bring theoretical knowledge and design thinking together for creating stuff by using digital fabrication tools together to attract new people into their communities (Kohtala, 2017).

Many sources agree that maker movement is a result of changes in both technology and consumption (Dougherty, 2012; Marsh, 2012; Hatch, 2013; Wolf-Powers et al., 2017). According to Wolf-Powers et al. (2017), with the rapid developments to access open-source design and to new technologies such as 3D printing and prototyping, people start to make things easier. They do not require the same amount of sources as before. Industries such as product design and fabrication become much more accessible to people from all around the world. Open-source design leads to falling prices in equipment, which finally creates a relative financial comfort. Makers who play and experiment in design while making (Hatch, 2013) reach their goals. In this process, makerspaces help makers by providing affordable sources, and environments where they share knowledge and equipment among their communities and create new areas in the making (van Holm, 2017; Wolf-Powers et al., 2017; Browder et al., 2019).

According to Browder et al. (2019), Maker Movement represents a break from crafts by providing; (1) a strong social exchange and collaboration between members of its community, (2) enhanced knowledge creation and sharing, and (3) enable to create innovations with the help of the high developments in technology. These aspects create more democratized services, products, and innovations and allowing their makers to commercialize them. While in the Maker Movement commercialization is not considered as a focal point, the role of digitalization, economization, collaboration, and user-innovation in the outputs of making activity create a foundation for commercialization in the Maker Movement (Browder et al.; 2019). With the addition of commercialization of prototyping, manufacturing, and making, the Maker Movement has a link with entrepreneurship.

3. RESEARCH DESIGN

The starting point of this research is to explore the reflections of the global Maker Movement within the scope of Turkish maker communities. To reach that goal, the makers from Turkey, their communities, and their activities are examined in detail. In that sense, firstly, makers' mindsets, motivations, and values are explored and are linked with the community building. Later on, the internal and external dynamics of these communities are analyzed and their effects on the creation of maker activities and makerspaces are examined. In the end, all of the analysis is about discovering the purpose of the research that is how maker culture and communities in Turkey could evolve into a more sustainable model. The research is mostly related to personal and abstract concepts such as; motivation, culture, values, and goals of the makers. Since all of these concepts are based on personal feelings and perspectives that are not observable or reproducible (Merriam, & Tisdell, 2016), the semi-structured interview is selected as the data collection method (Matthews, & Ross, 2010).

In the field research, two main criteria were applied in the formation of the sample group. First of all, participants were selected from either founders or facilitators of the maker communities. In this way, while participants provide their maker motivations and values, they also present knowledge about process design of maker activities and makerspaces, community building, and project management. Secondly, participants are needed to have at least two years of experience in the network of maker communities. This criterion is selected to provide a certain level of experience and know-how among participants. Because Maker Movement is still relatively new, its reflections could only be traced in the major cities in Turkey. That is why the sample group has consisted of makers from Istanbul and Ankara. Participants were chosen as diverse as possible to ensure the diversity of backgrounds, motivations, and values. A total of 18 potential participants were contacted through online platforms and personal networks. They were informed about the research by e-mail, and they were informed that the participation to the research is voluntarily-based, and its results would be anonymized and only would be used for academic purposes (Glesne, 2011).

In this qualitative research, purposeful sampling was chosen as the best suitable option for analysis. In purposeful sampling, while forming a sample group, the aim and selection criteria of the participants must be very clear to obtain healthy results (Tongco, 2007; Merriam, & Tisdell, 2016). Initially, the first two participants were selected from personal networks. After the first two interviews, participants became references for further interviews. Their networks were used for further research, and the final form of the sample group was created by the snowball sampling method (Merriam & Tisdell, 2016). All of the participants were currently taking part in maker communities as either founders or facilitators. Four out of ten participants are working in Istanbul based makerspaces and the rest are working in Ankara based makerspaces. Thus, nine participants all have a university degree; one participant is an undergraduate student.

Table 3. Participant List.

#	Gender	City	Interview Method	Work Experience
1	Man	Ankara	Face-to-face	3,5 years
2	Man	Ankara	Face-to-face	Three years
3	Woman	Istanbul	Face-to-face	Six years
4	Man	Istanbul	Face-to-face	Three years
5	Woman	Ankara	Face-to-face	Four years
6	Man	Istanbul	Online	Three years
7	Woman	Ankara	Face-to-face	Three years
8	Man	Istanbul	Online	Six years
9	Man	Ankara	Face-to-face	Two years
10	Man	Ankara	Face-to-face	Three years

Eight of the ten interviews were conducted face-to-face and the other two of the interviews were conducted through online software. All of the interviews were lasted 45 minutes on average. In the interview process, an interview guide was followed regularly. In the interviews, a total of 23 open-ended questions were asked to the participants. These questions were collected under four main headings; (1) Perception of makers, (2) community, collaboration, and internal/external dynamics, (3) facilitation and design process, and (4) sustaining the makerspace and maker communities. All of the questions were mainly about the past, and present personal experiences shared values, feelings, and point of view. Some of the topics that were discussed during interviews were; the first encounters with the maker community, design process of maker activities, inner and external collaborations and decision-making systems among maker communities, and the design of makerspaces.

After collecting data from semi-structured interviews, the data analysis process started. Ten interviews were transcribed to be analyzed via thematic analysis method. According to Given (2008) and Saldaña (2015), in thematic analysis, themes within a group of people or events are identified. These themes usually present a set of topics, ideas, and patterns of meanings. These themes are kept close to the relevant studies from the literature. Interview transcriptions were coded via the computer-assisted qualitative data analysis software ATLAS.ti. According to the interconnections of the codes, a codebook was created, and a network of coded was formed as an outline of the findings to present the qualitative data. According to the data analysis, the most used codes in the in interviews are (1) open-source, (2) community, (3) business model, (4) sustainability, and (5) collaboration. Finally, the quotations were selected from semi-structured interviews to illustrate and provide evidence for the findings.

4. FINDINGS

In this research, findings of the field research are presented under three main sections; (1) the maker mindset which explores the motivations and values of makers in general; (2) key drivers of the maker communities which reveal the interpersonal relations of maker communities; and (3) outputs of maker activities which provides information on the final products of the process of making within maker communities.

4.1. The Maker Mindset

For a better understanding of the design and project development processes of maker communities, first, understanding their members', makers' mindsets are needed. In that context, interviews consist of semi-structured questions regarding how makers perceive themselves and their roles within their communities. Firstly, when their maker definitions were asked, most of the participants agreed on a general definition that emphasized on the activity of making.

[1] I defined the maker as a person who makes things from everything.

The statement above presents the common definition of the maker. However, sometimes a simple making activity does not enough to cover all functioning areas of making. Most participants add aspects from their expertise and knowledge to the general definition. Account below presents another participant's perspective:

[2] Four main features define the maker. One; design, designing original ideas. Two; produce, make, and implement. Three; hacking, we consider hacking as a positive activity. We translate it into use differently in Turkish. Hacking is not only in software or digital sense, but we also believe in hacking a piece of furniture by using it differently from its purpose. Four; share. Maker Movement is a team and culture that feeds on and believe the importance of open-source design. So, if you do not share, we say that you are not a maker. If you are a maker, you need to give it back to your community, your culture.

While this account still emphasizes on the making aspect of the definition, it also brings out the importance of creativity, experiencing, and open-source design in the process of making. Apart from making, open-source working, giving, and sharing knowledge are the focal points of the makers. The account above states the location of interpersonal relationships among makers as well. Making is not an activity that is done by the individualistic approach; on the contrary, personal collaborations, co-operations, and interactions are key drivers that shape the activity of making.

It was common among the participants to indicate that community building has a very pivotal role in the Turkish maker mindset. Most of the participants stated that both forming and being a part of a community motivate them to be a maker. In that sense, one participant made the following statement.

[3] The ability of people to make or produce things on their own or together as a group… Community aspect mentally attracted me very much. Because I think it is nice that people come together and work for a common purpose. Additionally, in terms of production, we are now in a world where many things are available to everyone online. The concept of open-source comes to the agenda at that point.

As could be seen in the account above, rather than working individually, makers form communities with people who have the motivation to make for a common purpose and work accordingly. Sharing motivations, values, and knowledge provides a fundamental point in the mindset of makers. Besides, the same statement mentions that there is much open-source information in the field of the production industry. In an open-source environment, with the help of collective work of communities, access to information has become easier than ever. This helps maker communities to work towards a common goal, project, or design, and this open-source environment is considered as a key element to the sustainability of maker communities.
When the common motivations that the participants mentioned were examined, many results were depending on the goals. However, in common sense, it was seen that there is a desire to create a social impact. The following account shows one of the participant's starting point to the Maker Movement and the activity of making.

[4] We were looking for an exemplary project to show how 3D printer technology will affect human life. Then, while looking at the sample projects, we came across a group called [name] from abroad. Just like us, they were also newly established in 2014. With an open-source design approach, they were working on making mechanical hands with 3D printers to children with no hands or fingers. It was an excellent example, and we considered that we should also do it as a project about how 3D printer technology will change human life. Then, we made our first hand in 2014, which we also published on our website.

As this example shows, in the Turkish maker mindset, creating a social impact is a driving force. Additionally, it is one of the explanations indicating the limited number of academic resources on the Maker Movement and maker communities in Turkey. The idea of creating a social impact highlights the role of the 3D printer, which is one of the emerging technologies commonly associated with makers. Makers are working on projects that will create social impact with the help of global technologies, tools, and innovation, but most importantly, they aim to present their outputs to the society online as open-source information for sustainability.

This section, until now, has explained the maker mindsets from Turkish maker communities. Makers explained how they see themselves and their roles. According to the findings, most of the participants agreed on some essential aspects of their mindset; (1) only making is not enough for being a maker. (2) While making, makers should also reuse, recycle, hack, and reproduce designs, products, or services with the help of new technologies and tools. (3) While doing so, they should also work as a community and

share, collaborate, co-operate, and interact among themselves. (4) Their output should be open-source, also should be shared on online platforms, and becomes accessible to everyone, and (5) their aims and goals should refer to creating a social impact.

4.2. Key Drivers of Maker Communities

Another important topic that emerged as a result of the field research is about the key drivers of maker communities. In the previous section, it was stated that certain elements play important roles in ensuring the sustainability of the maker mindsets and maker communities, which include interpersonal relations, interactions, collaborations, and co-operations between either member of a community or different communities. Accordingly, the importance of interdisciplinary collaboration is emphasized when maker communities in Turkey are examined. The following account provides crucial information on a participant's perspective on interdisciplinary collaboration with the community.

[5] We have three types of team models; full-time, part-time, and on-call. We believe in interdisciplinary work and train accordingly. Hence, there is much variety, a rich team. Furthermore, our team circulates a lot because we are transferring staff to institutions that need interdisciplinary work. While this has both positive/negative effects on us, we are very proud of it. Because no matter what discipline you are, we say, the important thing is what you are interested in and are willing to learn. There are architects, engineers, designers, and so on. One of our interns studied Japanese; another one is from sociology. What matters is your curiosity and interest.

This account focuses on the participant profiles of maker communities, and while doing so, emphasizes the importance of interdisciplinary collaboration. Continuous circulation of teams and members among communities and organizations create an area where sustainability becomes visible. Because of the constant circulation, every team member actively learns new things that improve and sustain the current dynamics of maker communities. The fact that members of the community are educated and working together without any discipline specifications positively affects the use and share of information and resources that contribute to the process of projects and activities of maker communities. Also, another participant makes the following statement, which points out the importance of the role distribution and task assignment process in this interdisciplinary field of work.

[6] We do not believe in assigning tasks. We have a pool of assignments. Everyone is taking the initiative according to their skills and desires. So, to be willing to do is as important as skills and desires. However, there is also such automation. For example, I am mostly working on project coordination and developing new projects and business models. [Name], for example, works on technology research, production, IT, the digital side of the business, which is a bit like a CTO. After that, my friend [name] works on managing human resources and managing operations. We have such an organic division of labor, the first one who comes to the office, makes tea.

As participant states, there is no strict division of work or labor within the community members. By taking individual competences as a basis, roles are organically distributed amongst the collaborators. Thus, instead of sticking on one role as incorporate institutions, makers tend to prefer fluidity in roles during work or collaboration. This fluidity of working roles also reflects upon external collaborations of maker communities. Collaborators which stands outside of the maker communities usually are NGO's, or governmental institutions. For this matter, a participant presents the following account:

[7] Because we are working with development agencies, although we normally do productivity-based business, now we do business that serves development. Therefore universities, agencies, NGOs (both national and international), we co-

operate with all of them. We are fully co-operating with chambers of commerce, municipalities, and humanitarian organizations.

Beyond mere product-oriented acts of makers, there is a development benefit for industrial, governmental, and humanitarian organizations. The type of support that is given to the maker community defines collaboration or co-operation with organizations. Given support could be in the form of finance or social relations such as; grants, networking activities, or empowering the community's access to specific groups of people, as well as fabrication tools and equipment for makerspaces. However, a balance between financial and social support derived from external collaborations is important as well as continuity of taken support and its impact on the community. Similarly, another participant states that:

[8] Generally, in [organization name], you can see the fact that the state generally supports them. They receive 500K grants from development agencies. With these grants, all of the tools and materials are stacked, but when it comes to community… The community is already absent. There is not a single way of accessing the materials. Sometimes you cannot even find a way to learn how to use materials.

One of the essential elements of maker communities is their capability to realize project ideas by using a variety of materials and equipment that allow fabrication in a collective, playful context. Alongside individual creations that demand additional effort to supply and purchase required ingredients of a project, a maker community may allow ease of access to fabrication tools and materials through well-established space that reflects on the needs of the local community to quickly shape and realize their ideas. Without considering the actual interests of local makers, even the fully equipped working spaces may remain untouched because of the absence of motivated or ill-informed makers.

Makerspaces are only functional when actively used by the maker community. Thus, creating a space without a community is not effective or useful. Appropriate examples of makerspaces have emerged from the needs of makers because space becomes functional when community members fulfill their both individual and collective objectives satisfactorily. There is not a defined guideline for makerspaces to fulfill members' needs except for a few fundamental equipment like 3D printers. Makerspaces should be flexible and adaptable enough as well as accessible for local maker communities. In line with the issue, one participant stated:

[9] We do not believe that makerspace has a clear definition. Your purposes, aims, goals shape your expectations. That is why the definition of makerspace is very broad. The purpose of a makerspace within a school is different from the purpose of another makerspace within an organization. (…) Therefore, there is no clear definition nor a clear expectation of makerspace.

The mutual aspects of the makerspaces might consist of the tangible and intangible needs of the community members. Intangible needs may be concerned about providing a warm and friendly common ground to empower social relationships amongst members while tangible needs may address physical equipment or setup to keep makerspaces as an active place. To provide such motivation to makers to keep makerspaces as an active area, offering suitable working areas and fabrication tools for community members is crucial. Additionally, the location of a makerspace is one of the major issues regarding the continuous and effortless participation of the community members. Considering this issue, one of the participants said:

[10] The transportation [to makerspace] must be easily available, and the location [of makerspace] must be accessible. I think it is also important to create a habit in people to make them say; I have already been [makerspace name], I can go again and again.

[11] We used to prefer bars or something [for activities]. We wanted an environment where people eat, talk, and socialize. Let us not lose that warm area.

The location of the space and its features in terms of equipment is one of the prominent considerations that shape the key drivers of a maker community. If there are an active maker community and an area or space which allows community members to meet with each other with ease, all of the remaining features of a makerspace such as technical equipment or high-tech tools remain as a bonus. The essential function of a space is to gather around the people with shared motivations and interests. Hence, space is created through the existence of a community, whether in a structured or unstructured environment.

4.3. Outputs of Maker Activities

Projects and activities that are conducted in makerspaces are generally evolving into business models through the process of creation. As most of the participants pointed out, the need for income-based models often emerge during the process of open-source projects, which demands more resources. Therefore, makerspaces that provide a variety of services from fabrication to working spots need income models to sustain their services for the maker communities. On this point, one of the participants said that:

[12] For a year, we voluntarily made panels, festivals, and workshops to present the Maker Movement in Turkey.

[13] Nevertheless, after a while, we realized that it was not a sustainable model. We had one job that we earned money and two jobs that we were working voluntarily. We needed to build a business model. So, we established [Organization name] as social development.

As the participant put it, sustaining the motivation to promote the Maker Movement via open-source sharing and volunteer work to expand its scale demands a vast amount of resources. Thus, without appropriate funding or grants, it is not possible to create a more significant impact to promote maker mindset. The need for a business model emerges from the non-returning expenses of those volunteer makers who arrange a variety of activities to gather people with common interests. Local makerspaces are mediating makers to collaborate, work, and to share their creations as a community by bringing them together. Makerspaces act as a mediating agent between makers, and need appropriate business models to sustain their services for the maker communities. In line with the mentioned issue, one participant said:

[14] In terms of sustainability, small and local communities' efforts of self-sufficiency were valuable to me. Let us start a constantly active bottom-up move together. This system that we are in is not the one that we want. Changing this system should be our concern, and the model we need is the bottom-up model which is a model that people can make, produce, and can afford to build communities. I believe we can move forward from that point.

Keeping a productive community alive is only achievable through an active, welcoming, enjoyable environment in which makers can feel intimate belonging. However, it is not easy to provide such a space for a community that in need of a variety of technological tools and materials. Most of the expenses are spent on workshops which often require craft and electronic materials, and fairs and panels which demand catering and a space to welcome a large number of guests alongside with exhibitors. All these events demand a considerable amount of both financial and personal resources. To expand the valuable notion of making instead of consuming, it is crucial to sustain the motivation and existence of makerspaces on a regional basis with sufficient institutional support.

5. DISCUSSION AND CONCLUSION

According to both the literature review and the findings of the interviews, this research emphasizes two main conclusions that regarding (1) the formation of the Turkish maker mindset and (2) the emergence of self-sustaining maker communities in Turkey.

5.1. Formation of Turkish Maker Mindset

The first main conclusion of the research provided detailed information on the Turkish makers' mindsets. Because makers form a community as a gathered group, their mindset has an important place in the community building. In addition to the aspects of the Maker Movement, individual approaches and perspectives shape the maker communities and the outputs driven by the community. Although the Maker Movement is a relatively new formation, its place in the world is constantly increasing. Hatch's (2013) Maker Manifesto provides detailed information on both the Maker Movement at the international level and the maker mindset from foreign countries. In Turkey, Maker Movement is in an early development phase, so local maker communities are guided and shaped by multiple international sources such as; Dougherty (2012), Dougherty (2013), and Hatch (2013). For this reason, nine principles of the Maker Movement mentioned in Hatch (2013) are also applied by the Turkish maker communities. However, because of the socio-cultural and economic differences, the Turkish makers' focal points differ on these principles.

First of all, in the field research, all makers are considered as the people who "make", produce and create in general. "Share" is the most common principle among the Turkish maker communities. Sharing is considered as an irreplaceable part of the Maker Movement and among Turkish makers, if a person is not sharing, s/he is not considered as a maker. While in international sources, sharing is more related to the wholeness and selfless act, in Turkish maker communities, it is linked with open-source design. This is where the "tool up" principle starts to appear. According to the outcomes of the field research, because of the lack of Turkish sources and tools on the given subject, the tool up principle is shaped differently in the Turkish maker mindset. Having a 3D printer and laser cutting machines as tools seems to be enough according to the Turkish makers, and so, tool up has become a more supporting feature.

Turkish maker communities provide education to the children, young adults, and adults and work to spread the Maker Movement and to sustain a maker culture and maker mindset in Turkey. At this point, the activity of making has an abstract nature and based on the experiences, and it creates a playful, experience-based creative work environment. This emphasizes the importance of peer learning at this stage. In the makerspaces, all members are actively learning from the other members of the community. Therefore, attributing a creative meaning to the activity of making creates a link between makers with design.

At the international level, it is emphasized that makers should be open to innovations and open to "change." Although there is a visible awareness on this issue among Turkish makers, the principle of change is considered ill-fated. Turkish makers state that because of the lack of technology literacy and problems in accessing tools and sources, Turkish makers are not very familiar with the principle of change. To overcome this problem, they emphasize on increasing and spreading the maker education for children and young adults.

"Participate" is another principle that Turkish maker communities state the importance. In that sense, the importance of being a community and the necessity of creating networks of communities are pointed out. These networks are also cover external groups such as; NGO's, governments, organizations, educational institutions, and municipalities. All these networks create possible "supports." According to the interviews, Turkish maker communities emphasize the financial support the most and state that their business models are created accordingly. This statement shows that Turkish makers, while started as makers to create social impact; by the end, they evolve into entrepreneurs by creating

business models (Browder et al., 2019). Turkish maker mindset is shaped as mentioned above. The perception of being a community, have financial support, open-source information and technological tools, and the importance of maker education constitute the fundamentals of maker mindset in Turkey and take a step further to the self-sustaining maker communities.

5.2. The emergence of Self-Sustaining Maker Communities

Makerspaces have a pivotal role in the formation of self-sustaining maker communities. This sustainability emerges through the opportunities and motivational activities that are provided by maker communities. The possibilities offered by makerspaces could be examined in two contexts; technical and social. Given that existing maker communities are trying to create a positive social impact (Browder et al., 2019), and it could be seen the insufficient number of professionals who could help makers. However, the professional experience and knowledge of people from different professions are not well transferred due to time limitations spared for the activities, panels, or meetings. People from outside of the maker communities who transfer knowledge based on their profession, usually act as a guide or mentor for makers, also lead them to entrepreneurship through their ideas (Troxley, & Wolf, 2017). Nowadays, most makerspaces are built upon the idea of open-source information sharing and to support a variety of maker events. Therefore, makerspaces aim to support makers for a social impact by providing mentorship and equipment to the community members who have difficulties in doing projects on their own. Aligned with the services provided by makerspaces, online open-source platforms play a significant role in sharing experiences with other maker communities at local, national, and global levels (Wolf-Powers et al., 2017). Also, the development of makers occurs through mutual learning, constructive criticism, and knowledge transfer. The role that makerspaces play in supporting this development is particularly crucial at the local level.

The motivations of local maker communities for open-source design, learning, and making could only be achieved through makerspaces that are designed according to the shared values and desires of the community. However, makerspaces are not enough to create values and meanings on their own. The founders and facilitators of these spaces play vital roles. Since the research is conducted with these people, the contribution of the individuals to the making process depends on their adaptation features to different situations as well as their technical and social skills. That is why founders and facilitator have more than one role in the maker activities that make them more useful. Rather than having a strict authority on the community, facilitators create a more organic decision-making process. Also, any community member could switch roles if s/he has enough experience, knowledge, and motivation.

All these processes take place in the common shared areas. Unlike online platforms, makerspaces face many challenges. The most important of these is the lack of financial profit of the provided services. Therefore, a need to create business models has appeared for the sustainability of makerspaces. In Turkey, business models are aimed at providing technology literacy and product supply to individuals through pieces of training on the use of various technical tools and equipment. Business models that are constructed without considering community values could harm rather than support the expansion of these communities. Since the few of many prominent values of the maker, communities are based on collaboration and providing open-source knowledge; If this system has a financial concern over community values, it could be harming the future of local maker communities. At this point, business models that require expert knowledge, such as; technology and instructor pieces of training, could also influence the community and its values. As mentioned, a business model should be created for the sustainability of maker community and makerspace by taking into account of shared values of makers. This business model is also fundamental in the creation of social impact (Hamalainen, & Karjalainen, 2017).

Makerspaces also have additional problems besides finance-related problems. According to the scope of this study, prominent challenges of the makerspaces have emerged as lack of spared time for educational training business models, lack of technical competencies of the trainers, non-continuous mentor support, equipment deficiencies of the working areas, and locating makerspaces to a central location. Also, poorly decided income models and overlooking shared values of the maker community with financial concerns damages the collaboration between makers and volunteer works. For instance, a poorly decided income model as paid workshops leads to insufficient open source sharing that often misleads or provide lesser details. As a result of putting financial concern upfront, openly sharing of projects, ideas, and experiences diminish or even stops. However, to create a positive social impact by projects on the future's society as well as on the environment, it is crucial to provide open, transparent sharing system among the maker community.

Ultimately, sharing open-source knowledge and life-long learning within the maker communities is an essential aspect for sustaining makers' social network for incremental growth of collaborative problem solving from local to national and to the global scale. Alongside the vital role of the facilitators and mentors who keep their process transparent and positively supportive, sustaining such maker communities can only be achieved through well-established business models based on shared values of the community members.

Funding
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

6. REFERENCES

Anderson, C. (2012). *Makers: The new industrial revolution*. New York: Crown.

Browder, R. E., Aldrich, H. E., & Bradley, S. W. (2019). The emergence of the maker movement: Implications for entrepreneurship research. *Journal of Business Venturing*, *34*(3), 459-476.

Dixon, C., & Martin, L. (2014). Make to relate: Narratives of, and as, community practice. Boulder, CO: International Society of the Learning Sciences.

Dougherty, D. (2012). The maker movement. *Innovations: Technology, Governance, Globalization*, *7*(3), 11-14.

Dougherty, D. (2013). The maker mindset. *Design, make, play.* Routledge, 25-29.

Given, L. M. (Ed.). (2008). *The Sage encyclopedia of qualitative research methods* (Vols. 1-2). Sage Publications.

Glesne, C. (2011). *Becoming Qualitative Researchers: An Introduction* (4th Ed.). Boston, MA: Pearson Education.

Green, D., & Kirk, D. (2018). Open design, inclusivity, and the intersections of making. *Proceedings of the 2018 Designing Interactive Systems Conference.* ACM, 173-186.

Hamalainen, M., & Karjalainen, J. (2017). Social manufacturing: When the maker movement meets interfirm production networks. *Business Horizons*, *60*(6), 795-805.

Hatch, M. (2013). *The maker movement manifesto: Rules for innovation in the new world of crafters, hackers, and tinkerers*. McGraw Hill Professional.

Kalil, T. (2013). Have fun—learn something, do something, make something. *Design, Make, Play.* Routledge, 30-34.

Kohtala, C. (2017). Making "Making" critical: How sustainability is constituted in fab lab ideology. *The Design Journal, 20*(3), 375-394.

Marsh, P. (2012). *The new industrial revolution: consumers, globalization and the end of mass production*. Yale University Press.

Martin, L. (2015). The promise of the maker movement for education. *Journal of Pre-College Engineering Education Research (J-PEER)*, *5*(1), 4.

Matthews, B., & Ross, L. (2010). *Research methods: a practical guide for the social sciences.* New York, NY: Pearson Longman, 2010.

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th Ed.). San Francisco, CA: Jossey-Bass.

Peppler, K., & Bender, S. (2013). Maker movement spreads innovation one project at a time. *Phi Delta Kappan*, *95*(3), 22-27.

Saldaña, J. (2015). *The coding manual for qualitative researchers*. Sage.

Schön, S., Ebner, M., & Kumar, S. (2014). The Maker Movement. Implications of new digital gadgets, fabrication tools and spaces for creative learning and teaching. *eLearning papers*, *39*, 14-25.

Stewart, L. (2014). Maker Movement Reinvents Education. Retrieved in October 24, 2019 from, https://www.newsweek.com/2014/09/19/maker-movement-reinvents-education-268739.html

Sheninger, E. (2015). Leading the Maker Movement. Retrieved in October 24, 2019 from, http://esheninger.blogspot.com/2015/01/leading-maker-movement.html

Techopedia (n.d.). Maker Movement. Retrieved in October 24, 2019 from, https://www.techopedia.com/definition/28408/maker-movement

Tongco, M. D. C. (2007). Purposive sampling as a tool for informant selection. *Ethnobotany Research and applications*, *5*, 147-158.

Troxler, P., & Wolf, P. (2017). Digital maker-entrepreneurs in open design: What activities make up their business model?. *Business Horizons*, *60*(6), 807-817.

van Holm, E. J. (2017). Makerspaces and local economic development. *Economic Development Quarterly*, *31*(2), 164-173.

Willett, R. (2016). Making, makers, and makerspaces: A discourse analysis of professional journal articles and blog posts about makerspaces in public libraries. *The library quarterly*, *86*(3), 313-329.

Wolf-Powers, L., Doussard, M., Schrock, G., Heying, C., Eisenburger, M., & Marotta, S. (2017). The maker movement and urban economic development. *Journal of the American planning association*, *83*(4), 365-376.