Norwegian University
of Life Sciences

Master's Thesis 2022 30 ECTS
Faculty of Landscape and Society (LANDSAM)

Make Yourself at Home: Makerspaces as a Tool for Resettlement and Reconstruction in Conflict-Affected Settings

Ashley Rose Horton
Master of Science in Global Development Studies

Abstract

Millions of people worldwide have had their lives upended by violent conflict. In the last decade, the number of people forcibly displaced by conflict has doubled, reaching current heights of more than eighty million. Once the emergency needs of food, shelter, and medical care have been met, there is an opportunity for aid providers to assist in the resettling of populations and reconstruction of devastated cities. This study highlights the value of a recent evolution in this response to include makerspaces: communal workshops that offer access to tools and materials as well as education and sometimes even employment. Semi-structured interviews were conducted with program leaders in five different locations to examine makerspaces in conflict-affected settings. Through a lens of Human Capabilities, this study shows how they contribute to the improvement of livelihoods and well-being of users and their communities. The cases studied here have been particularly beneficial for women and youth. Through a blending of new and old technologies makerspaces allow users to shape or re-shape their own surroundings and participate in their own care. They contribute to improved livelihoods through skills development and market access. Makerspaces foster community and offer notable benefits to users' mental health and notably allow for some retention and restoration of cultural heritage. Additionally, this thesis assembles the experiences of makerspace program leaders to provide expertise on the challenges and enablers of operating a makerspace for conflict-affected populations.

The Department of International Environment and Development Studies, Noragric, is the international gateway for the Norwegian University of Life Sciences (NMBU). Established in 1986, Noragric's contribution to international development lies in the interface between research, education (Bachelor, Master and PhD programmes) and assignments.

The Noragric Master's theses are the final theses submitted by students in order to fulfil the requirements under the Noragric Master's programmes 'International Environmental Studies', 'International Development Studies' and 'International Relations'.
'

The findings in this thesis do not necessarily reflect the views of Noragric. Extracts from this publication may only be reproduced after prior consultation with the author and on condition that the source is indicated. For rights of reproduction or translation contact Noragric.

© Ashley Rose Horton, May 2022
Ashley.rose.horton@nmbu.no
Noragric
Department of International Environment and Development Studies
The Faculty of Landscape and Society
P.O. Box 5003
N-1432 Ås
Norway
Tel.: +47 67 23 00 00
Internet: https://www.nmbu.no/fakultet/landsam/institutt/noragric

Declaration

I, (Ashley Rose Horton), declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Signature.....

Acknowledgments

My deepest thanks to my advisors, Gry Synnevåg and Karim Merchant, without whom I would likely still be staring at a blank screen. The generous feedback and encouragement from two people I admire so greatly were invaluable.

I am so grateful to have studied alongside such talented, kind, and clever classmates who have been and will no doubt continue to be an inspiration.

Thanks to the B1 ferry in the Oslo Fjord and its friendly crew for providing such a delightful place to accomplish much of this writing.

I am so appreciative of the practitioners who gave their time to be interviewed for this thesis. My heart leaped often during these conversations with inspiring people who are actually solving the problems I am only writing about.

Finally, and most importantly, thanks to my family who have loved me and supported me through every impossible task I've attempted and believed in me when it didn't make any sense.

Table of Contents

Abstract **1**

Declaration **3**

Acknowledgments **4**

Figures **7**

Abbreviations **8**

1 Introduction **9**

1.1 The crisis and the response *9*

1.2 Conflict-affected populations *10*

1.3 Social Entrepreneurship (SE) and Technical and Vocational Education and Training (TVET): two common models of response *11*

1.4 Outline *12*

2 Objectives and Research Questions **13**

3 Background and Framework **15**

3.1 What is a makerspace? *15*
3.1.1 A brief history of the maker movement 15
3.1.2 A modern makerspace 16
3.1.3 Makerspaces in development 17

3.2 Human Capabilities Approach *20*
3.2.1 Amartya Sen: Development as Freedom 20
3.2.2 Martha Nussbaum: Functional capabilities 20
3.2.3 Individual vs collective capabilities 22
3.2.4 Capabilities and conflict 23

4 Methods **23**

4.1 Sampling *24*

4.2 Data Collection and Analysis *25*

4.3 Safety and Ethics *26*

4.4 Case Studies *26*
4.4.1 Preemptive Love in Iraq 26
4.4.2 Field Ready 27
4.4.3 Mosul Space in Iraq 28
4.4.4 Habibi.works in Greece 28
4.4.5 Doin' Good and Salam LADC in Lebanon 29

4.5 Positionality *30*

4.6 Limitations *31*

5 Findings and Analysis **31**

5.1 Social benefits of the makerspace *32*
5.1.1 Mental Health 32
5.1.2 Making friends: Community development through a makerspace 33
5.1.3 Psychosocial empowerment 33
5.1.4 Education 34
5.1.5 Making peace 35

5.2 Making a living: Economic benefits of the makerspace *36*
5.2.1 A makerspace with a social entrepreneurship model: Sisterhood Collection 36
5.2.2 Indirect economic benefits 37

5.3 The target user: Who benefits most from a makerspace? *39*

5.4 Reconstruction and Resettlement *40*
5.4.1 No potters left in Sulaymaniyah?: preserving and restoring cultural inheritance 40
5.4.2 Making A Fresh Start 43

5.5 Making a makerspace: an organizational perspective *45*
5.5.1 Challenges 45
5.5.2 Enablers 48

6 Discussion **50**

6.1 Individual capabilities *50*

6.2 Collective Capabilities *52*

6.3 Sustainability *54*

6.4 Only part of the solution *55*

6.5 Recommendations for future research *56*

7 Conclusion **57**

REFERENCES **59**

Appendix 1: Table of interviewees **63**

Appendix 2: Staff interview guide **64**

Appendix 3: User questionnaire **65**

Figures

Figure 1 Global Trends of Total Forced Displacement (Migration Data Portal, 2022) 9
Figure 2 Combined maturity grid for humanitarian makerspaces (Corsini & Moultrie, 2020, p. 377) 19
Figure 3 (top) A potter at work at the Preemptive Love makerspace (Sisterhood Products, 2021a) 41
Figure 4 (bottom) hand-crafted candles made in the Preemptive Love makerspace. (Sisterhood Products, 2021b) 41
Figure 5 Hand-carved cookie molds from Preemptive Love (Sisterhood Products, 2022) 42

Abbreviations

ACLED – Armed Conflict Location &Event Data Project

CA – Capabilities Approach

CBI – Cash-Based Initiative

CNC – Computer Numerical Control

INGO – International non-governmental organization

IOM – International Organization for Migration

HRS – High Resource Setting

LADC – Lebanese Association for Development and Communication

LRS – Low Resource Setting

NGO – Non-Governmental Organization

PLC – Programmable Logic Controller

SE – Social Entrepreneurship

STEM – Science, Technology, Engineering, and Math

TVET – Technical and Vocational Education and Training

UCDP – Uppsala Conflict Data Project

UNESCO – United Nations Educational, Scientific, and Cultural Organization

UNHCR – United Nations High Council on Refugees

VTP – Vocational Training Programs

WB – World Bank

1 Introduction

1.1 The crisis and the response

As conflicts rage and the climate changes, every year more and more people are forcibly displaced (see **Error! Not a valid bookmark self-reference.**). Aid agencies, governments, INGOs, and NGOs rush to respond, to provide relief and aid to those who suddenly find themselves without a safe and stable place to call home. This response necessarily begins with peoples' most immediate and critical needs: food, water, shelter, and medical care; but as time passes, the task moves from crisis response and the target progresses beyond mere survival. Whether in reconstruction or protracted refugee situations[1], these actors often encounter the challenge of longer-term management (Earnest, 2015, p.105; Milner & Loescher, 2011, p.10).

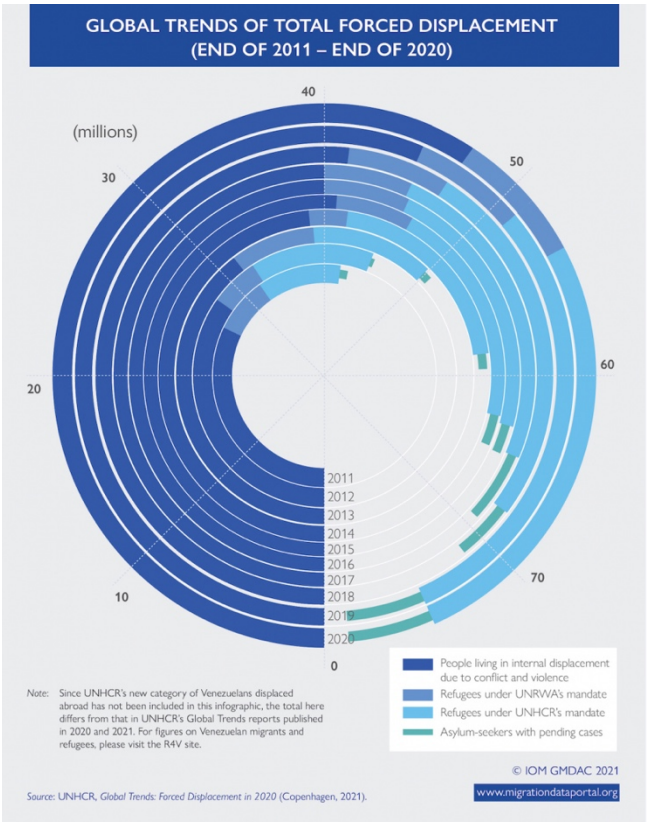

Figure 1 Global Trends of Total Forced Displacement (Migration Data Portal, 2022)

More than 80 million people around the world have been forcibly displaced by conflict or violence (UNHCR, 2021b). This includes 48 million internally displaced people and over 30 million refugees and asylum-seekers who have had to flee across national borders (UNHCR, 2021b). 86 percent of these people are hosted in developing countries (UNHCR, 2021a) and these numbers don't even account for the more than 7.1 million people recently displaced by the violent Russian invasion of Ukraine this year (IOM Global Migration Data Analysis Centre, 2022).

Aid agencies, INGOs, NGOs, and national and local governments respond to these crises in a variety of means and at different scales. Within UN agencies, International Organization for

[1] Protracted Refugee Situations (PRS) occur when 'refugees have been in exile for 5 years or more after their initial displacement without immediate prospects for implementation of durable solutions' (UNHCR 2009)

Migration (IOM) specializes in providing shelter, non-food items, health, protection, and Water, Sanitation, and Hygiene (WASH)(International Organization for Migration, 2022). The UN Refugee Agency (UNHCR) along with coordinating broad inter-agency assistance in camps and settlements, and extending education access for refugee children, also operates Cash-Based Interventions (CBIs) (UNHCR, 2022d). Where refugees have access to local markets, CBIs distribute cash payments. They allow the recipients to make their own choices in best meeting their needs and they benefit the host economy at the same time (UNHCR, 2022a). From the INGO corner, Médecins Sans Frontières provides health care (Médecins Sans Frontières, 1997). Local Governments and organizations have a variety of responsibilities that may, in the refugee context, include legal counsel, language classes, vocational training programs, and other projects aimed at integration and social cohesion (Lowndes & Polat, 2020).

As a crisis moves from emergency response to rehabilitation, humanitarian assistance develops along with it. For places that have experienced conflict, this includes physical reconstruction, an economic restart, and reintroducing institutions like health and education services along with governmental and judicial structures (Anderlini & El-Bushra, 2004). For displaced people who may be looking at extended if not permanent relocation, this may include the introduction of language learning or Technical and Vocational Education and Training (TVET will be covered further in section 1.3) to expand people's skills and training with the goal of integration into the host country's labor markets (UNHCR, 2019). This thesis will explore makerspaces, a recent addition to the toolkit of actors responding to the needs of conflict-affected communities, which are not explicitly vocational training but frequently produce outcomes that include those of TVET.

1.2 Conflict-affected populations

The World Bank uses data from the Armed Conflict Location & Event Data Project (ACLED) as well as the Uppsala Conflict Data Project (UCDP) to define conflict-affected countries. They fall into two categories, high-intensity and medium-intensity, based on the absolute number of

conflict-related deaths and/or the number of conflict-related deaths relative to the population[2] (World Bank Group).

Conflict-affected populations are those living in conflict-affected areas or forcibly displaced due to conflict (Rass et al., 2020). This study expands the definition to include communities who may not have experienced violent conflict themselves but who have been decidedly reshaped by hosting conflict-affected, displaced people. Greece is currently host to over 160,000 refugees and asylum seekers (UNHCR, 2022b) many of whom are likely to remain in the country indefinitely. The community of Katsikas, studied in this thesis, has a population of 3885 (Simplemaps, 2022) and hosts around 1300 refugees (Papadapoulos, 2020). Lebanon hosts the most refugees per capita of any country (UNHCR, 2022c). In the village of Qaroun in the Bekaa valley, they have doubled the population (Mayssa Awad, 2021). Türkiye is host to the largest refugee population in the world comprised of 3.6 million Syrians displaced by the ongoing civil war and another 330,000 refugees and asylum seekers from other countries (UNHCR, 2021c). The presence of a refugee settlement necessarily impacts the host community in a variety of ways. These population shifts are not automatically negative but this thesis recognizes that a community doesn't have to directly experience a conflict to be affected by it.

1.3 Social Entrepreneurship (SE) and Technical and Vocational Education and Training (TVET): two common models of response

In the occasion of forced displacement, people often must leave behind livelihoods and the stability and security they and their families have built. Abandoning not only jobs and resources but also networks and connections, they frequently find themselves reliant on

[2] "Countries in high-intensity conflict are defined as those with (i) an absolute number of conflict deaths above 250 according to ACLED and 150 according to UCDP; and (ii) a number of conflict deaths relative to the population above 10 per 100,000 according to both ACLED and UCDP, reflecting widespread and intense violence across many parts of the country. Countries in medium-intensity conflict are defined as (i) countries with lower intensity conflict, as measured by (a) an absolute number of conflict deaths above 250 according to ACLED and 150 according to UCDP; and (b) between 2 and 10 per 100,000 population according to ACLED and between 1 and 10 according to UCDP; or (ii) countries with a rapid deterioration of the security situation, as measured by (a) an absolute number of conflict deaths above 250 according to ACLED and 150 according to UCDP; (b) a lower number of conflict deaths relative to the population between 1 and 2 (ACLED) and 0.5 and 1 (UCDP) and (c) more than a doubling of the number of casualties in the last year." (World Bank Group)

provision and support from receiving governments and other aid providers. The institutions responding to this challenge employ an arsenal of services and programming ranging from food distribution to schools for children and employment training for youth and adults. There are social enterprise projects like UNHCR's MADE51 which employs refugees to produce traditional crafts for sale in a global marketplace (UNHCR) and recently the appearance of related makerspaces in several conflict-affected environments that employ similar approaches with slightly modified purposes.

TVET, a model often expressed through Vocational Training Programs, usually aims to increase a person's skill and ability to compete in a specific labor market (Jabbar & Zaza, 2016). Social entrepreneurship "use[s] a business logic in a novel and entrepreneurial way to improve the situation of segments of the population that are excluded, marginalized, or suffering" and for various reasons lack the capacity to change their situation independently (Saebi et al., 2019). Both models have paramount objectives of increasing employment and income and thereby self-reliance.

1.4 Outline

This project aims to contribute to a thin body of knowledge concerning humanitarian makerspaces by exploring five different makerspaces and how each one functions in its unique setting while recognizing the common experiences of the participants whose lives have been affected by conflict in their home countries. In this introduction, you find an exploration of what is meant by "conflict-affected" as well as global data on people displaced and impacted by violence and some context of the strata of programming offered to them by aid agencies, governments, NGOs, INGOs, and others. Consequently, a brief chapter will put forth the research question and explain its purpose and the data required to answer it. Following, Chapter Three (p.15) will begin by defining a makerspace and exploring its roots, its modern expression, and its entrance into the field of development and humanitarian aid. This is followed by a summary of the Capabilities Approach (CA) as identified by Amartya Sen (1999), an explanation of how the CA was expanded by Martha Nussbaum (2000), and then finally how it has been specified by Solava Ibrahim (2006) in terms of individual versus collective capabilities. Chapter Four (p.23) is a description of the methods used for this research and a brief background on the makerspaces that provided the data. In Chapter Five (p. 31), I present the findings of this research and tell the

stories of five different makerspaces operating in conflict-affected communities as they relate to the research questions. Subsequently, in Chapter Six (p.50), I will discuss the relevance of these findings in relation to the Capabilities Approach and present the argument that makerspaces are a useful tool for development. Lastly, a conclusion will summarize what has been learned through this research.

2 Objectives and Research Questions

Taking this context into account and believing that there is an opportunity for further innovation on the part of aid providers, this study set out to answer the following:

RQ: How does the introduction of a makerspace improve the well-being and livelihood of conflict-affected peoples? For the purposes of this study, livelihood will refer to an individual or family's "ensemble or opportunity set of capabilities, assets, and activities that are required to make a living (Olsson et al., 2014)"; in short, their means of providing for their own needs. This will address economic issues of employment and income, which may include both monetary payment and barter, an exchange of goods or services. Academics have found a definition of well-being difficult to pin down (Dodge et al., 2012; Huppert, 2014). As used here, the idea of well-being will pull from these writings to encompass psychosocial dynamics such as mental and emotional health, community integration, opportunity, and satisfaction. It is highly related to CA's concept of a life considered valuable by the one living it (Sen, 1999, p. 18) To answer this broad question, the study will focus on a few sub-questions:

Sub RQ 1: What are the social and economic benefits for the participant and the community? This primary level research will investigate if and how precisely the included makerspaces have improved the circumstances of those who participate. To consider concepts of individual versus collective capabilities, it will also consider whether the benefits of participation apply only to the maker or extend to their family and community at large.

Sub RQ 2: Who benefits most from the makerspace? Is there a demographic group that is particularly well-suited to this type of programming? By learning about who current

users are, we learn into which contexts and audiences might makerspaces be optimally introduced.

Sub RQ 3: How can makerspaces aid in resettlement/rebuilding post-conflict? Makerspaces have a variety of applications. This study will seek to understand if and how they can be applied uniquely for individuals and communities who are affected by conflict. This includes two primary groups and a third that is only briefly covered here. The first are those who have been displaced by conflict to a new location, who either temporarily or more long-term must consider a new place their home, likely a refugee or IDP camp or settlement. The second are those who remain or return to the location of the conflict and are faced with the collective task of restoring the home they lost. In this sense, home may refer as much to physical dwellings as to the infrastructure, traditions, and social foundations of the community of which they are a part. The third group are those presently living within a current conflict where some semblance of a makerspace is providing them with agency and unique solutions. There is only sparse data collected on this group, but it provides valuable information on the potential of makerspaces in such circumstances.

Sub RQ 4: What contributes to the success of a makerspace for conflict-affected people? Lastly, in order to gather insights from the organizations who have experienced the startup and operation of a makerspace and hopefully pass that on to others who desire to do the same, this study asks program leaders about the barriers and enablers to maker participation and makerspace operation. There are at least as many definitions of success as there are programs and donors they report to. For donors and implementers, it may center on the numbers or demographics of beneficiaries. For makers, success may revolve around perceived improvements to quality of life and opportunities. When asked to define success, most interviewees relayed stories of individuals developing a new skill, building a new relationship, stepping into leadership roles, or even employment in the makerspace. This area of questioning will prove useful for those interested in opening a makerspace, concentrating the knowledge of pioneers in the field so that the next cohort of practitioners can benefit from their experience, increasing the likelihood that the resources are expended efficiently and with the highest possible amount of impact for the beneficiaries.

3 Background and Framework

3.1 What is a makerspace?

Since the early 2000s, makerspaces have been cropping up around the world as places for education, discovery, innovation, and play. I first became familiar with the concept seeing advertisements on the subway for MakerSpace NYC. In the wake of Hurricane Sandy, two local makers opened their private studio and metal shop to the community (MakerSpace NYC, 2019). That space has since spawned two additional locations in the city and become a hub for metalwork, woodwork, machining, technology, ceramics, and textiles, providing access and education in a place where both are at a premium (MakerSpace NYC, 2019). The advent of venues like these into the field of development and humanitarian services is, itself, innovation. Makerspaces have moved from the tech playgrounds, universities, and after-school programs of wealthy metropoles into programming for migrants, refugees, and displaced people (MRDPs) around the world.

The makerspace takes its name from the maker movement. Regarding the term 'maker', Holman (2015) quotes New York's Museum of Art and Design director Glenn Adamson:

> "We use the term 'making' — as opposed to other such closely related terms as craft, workmanship, and artistry — because it emphasizes the active and open nature of our subject. To capture this fascinating range of production," he wrote, "only a very broad term like 'making' will do."

3.1.1 A brief history of the maker movement

Makerspaces are a somewhat recent expression of an idea with roots reaching back to the early 19th century. The Mechanics Institute movement was a combination of a library, lecture hall, and laboratory created for the education of the day's "mechanics"—modern-day engineers, tradespeople, and builders (Holman, 2015). They began in Scotland in the 1820s and spread as far as North America and Australia with over 9000 locations worldwide by 1900 (https://mechanicsinstitutes.org). At the same time, important inventors of the day were creating research labs, many of which placed a high value on collaboration. These labs were the source of inventions and technologies that shaped nearly every facet of our modern world (Holman, 2015).

The labs were not, however, very accessible to the public. With concern for both intellectual property rights and sometimes military contracts requiring secrecy, the threshold for entry was high and these labs were typically very exclusive spaces demanding extensive education and expertise (Holman, 2015). Holman (2015) also tells of the development in the second half of the twentieth century of more inclusive, public-facing DIY facilities in the US and Technology Networks in London created with the goal of educating unemployed factory workers and increasing and leveling access to the means of production during a recession. These spaces can be seen as the immediate precursors to the makerspace movement of the 21st century.

3.1.2 A modern makerspace

Drawing on these traditions of invention, discovery, collaboration, and innovation, the borders of what defines a modern makerspace are a bit porous. While there are a few purely digital anomalies (Conservation X Labs, 2021), a makerspace is usually a physical space that functions as a collective workshop, a "constructionist learning environment" (Keune & Peppler, 2018) and this research will be restricted to such physical spaces. The materials and tools that fill the workshop vary depending on the population it serves. Some makerspaces cater to creative professionals who benefit from sharing space, resources, and exchanging skills. Some are found in schools or youth centers exposing young people to a range of vocations and technologies, and encouraging creative development and leadership abilities. Keune & Peppler (2018) record the story of a makerspace participant from Baltimore, MD who as a teen was offered the task of assembling the makerspace's first 3D printer. Through his own diligent research, trial and error, and persistence he constructed the printer from parts and got it online. When it soon became the most popular resource in the space, he assembled more. This one printer developed into an ample and thriving 3D printing program at the makerspace. Many other students now have the ability to learn how to use the tool and the young man eventually became the first African American person on the makerspace staff as well as a 3D printing entrepreneur in his own right with his side business (Keune & Peppler, 2018).

The proliferation of makerspaces, hackerspaces[3], and other digital fabrication centers and tools in high-resource settings (HRS) has been well researched, but only recently broached by Corsini et al. (2019) is the appearance of digital fabrication tools in low-resource settings (LRS). This research by Corsini et al. is relevant in its discussion of LRSs but where it approaches this study it remains predominantly focused on the use of the tools themselves and the function of the goods produced: 3D printed prosthetics, medical tools, pipefittings for sanitation, and materials for shelter. As this movement continues more specifically into conflict-affected settings (CAS) there remains a knowledge gap concerning the function of the makerspace itself in aiding in development.

In these high-resource settings, it may be more common to find makerspaces with a digital dominance. The 3D printer is a staple. CNC routers[4], Laser-cutters, plasma-cutters, robotics kits, and other high-investment tools (and toys) are often present. The shared expense of shared equipment expands access to more makers--although it should be noted that these HRS membership-based makerspaces are predominantly inhabited by "male, well-educated, and affluent" users (Holman, 2015). However, in many makerspaces, you are just as likely to find a wide array of more traditional or analog tools: sewing machines, band saws and other woodworking tools, and welding equipment. There is often high value placed on skill sharing, with classes being offered (some for free and some for additional fees) and collaboration celebrated.

3.1.3 Makerspaces in development

Makerspaces, high-tech, low-tech, and a blend of the two, have recently begun to appear as tools for development. Traditionally, vocational training programs would offer a relatively narrow range of curricula from language skills to computer skills to hairdressing (Ahmed, 2019).

[3] 'Hackerspace' can sometimes be used interchangeably with 'makerspace.' While well-equipped hackerspaces *may* include the physical fabrication elements of a makerspace, a hackerspace is likely to center more computer programming and coding. See Gui Cavalcanti's article "Is it a Hackerspace, Makerspace, TechShop, or FabLab?" in Make: magazine (Cavalcanti, 2013)

[4] A computer numerical control (CNC) router is used for cutting, carving, engraving, drilling, objects from wood, acrylic, glass, and plastic by combining computer controls with a spindle drill. A 3-axis machine works in 3D and provides users with both efficiency and repeatability one doesn't find with hand carving. It can be used for furniture making, door frames and moldings, carved panels, signboards, and more (Camci et al., 2018, p. 1; Ginting et al., 2017, p. 1)

These programs usually span a concrete amount of time and result in the acquisition of a specific skill that would qualify the participant for a specific profession. In contrast, data collected for this study shows that a makerspace in a conflict-affected setting may incorporate entrepreneurship and skills-development schemes but frequently has a broader goal of collaboration, exchange, innovation, personal fulfillment, increased individual agency, and creativity. Many displaced people left home with well-developed skill sets and lack only the tools and materials with which to use them. They may benefit from developing a new skill through TVET but they may need only the opportunity to exercise the skills already in their possession. A makerspace also offers the opportunity to extend or develop new skills not as linked to a designated task, but rather, as personal development and creative exercise. Ideally, there is some support for entrepreneurship as well and the potential to not only practice these skills but develop them into a livelihood.

The early research in this field has focused primarily on refugees and migrants in Europe where most humanitarian makerspaces are found. This study is heavily influenced by Corsini & Moultrie's (2018; 2019; 2020) studies focusing on makerspaces in Greece. This thesis aims to add to the body of knowledge they have pioneered and expand it to include makerspaces that are closer to the origin of the conflict. They discover that the makerspaces they study can be categorized as "workshop-makerspaces" with a focus on the accessibility of tools and new technologies, or "training center-makerspaces" focusing on education and employment (2020, p 376). Through workshops with program leaders and beneficiaries, they synthesize a maturity grid (Figure 2) that assesses the strength and development of significant features and aims of the program. Through this maturity grid, they conclude that the Greek workshop-makerspaces have stronger results in the categories of access, improved living conditions, and psychosocial empowerment, while the training center-makerspaces, tend to be stronger in terms of integration, education, and livelihoods (2020, pp. 376-377).

In Lebanon, a makerspace and social enterprise called Art of Hoping is in its early phases. What began as one-on-one art therapy grew into a communal workshop and now boasts a small online shop where makers can sell their products. In a 2021 conversation with its founder, I learned how the makerspace started almost by accident, but she has a goal now of more intentional programming in the future. In our conversation she expressed a desire to see the kind

of effects that Corsini & Moultrie describe in their analysis of workshop-makerspaces, offering "a holistic provision of resources. In humanitarian makerspaces, access to social support (e.g. advice, mentoring) plays an important role alongside access to tools (e.g. 3D printers, sewing machines, etc." and technology (e.g. WiFi, IT)."(Corsini & Moultrie, 2020, p. 378) Should this trend continue in crisis and conflict-affected countries, it will be interesting to see if these patterns hold.

	Level 1	Level 2	Level 3	Level 4
1. *Access (to tools, technology, and support)* *People access the resources they need and they develop skills through experiences in the makerspace.*	People do not visit the space regularly. They have little motivation and do not articulate their needs. They do not understand how to use resources to meet their needs.	People visit the space regularly, where they can gain access to tools, technology, and support. They are interested in the resources available. They start to recognize how they can use tools and resources to meet their needs but do not use them.	People visit the space regularly, where they can gain access to tools, technology, and support. They recognize how these resources can help to meet their needs. The start actively engaging with the resources and others; however, they need motivation and encouragement.	People visit the space regularly and gain access to tools, technology, and support. They recognize how these resources can help to meet their needs. They actively engage with the resources and others, as well as sharing skills and developing coping strategies. They are motivated to keep developing themselves.
2. *Improved living conditions* *People use the space to improve their living conditions by making functional and personal items.*	Basic needs might be covered but living conditions are undignified and impersonal.	People are interested in making items to improve their environments but do not have the skills or confidence to do so.	People start copying other projects and have their own ideas on how to improve their living conditions.	People use the makerspace to improve and personalize their environments, according to their own ideas and preferences.
3. *Psychosocial empowerment* *People get active and are empowered to change their situation.*	People are depressed, anxious, and passive. They have little confidence and rely on others for simple tasks. They focus on themselves more than on relationships.	People recognize their current skills and knowledge. They begin to see themselves in a new light and their self-esteem increases.	People are confident in their abilities and they recognize their potential. They recognize the needs of others around them. They have the motivation to change their lives; however, they do not contribute to the daily management of the makerspace.	People have a healthy self-esteem. They consider themselves capable of decision-making and actively shaping their lives. They contribute to the daily management of the makerspace.
4. *Integration* *People contribute to their community and they interact with other people from different ethnic backgrounds.*	People are isolated and disinterested in wider society. They have poor and even racist views toward one another. They do not communicate well and have little interaction with others in the makerspace. They speak no Greek and have limited interactions with people outside their ethnic community.	People visit the makerspace but are mainly focused on their own tasks. They have some interaction with people not from their ethnic community in the makerspace, but they do not show interest in the wider society. They speak little Greek.	People use the makerspace to develop solutions for themselves and the community. They have positive relationships with people outside their ethnic community in the makerspace, but they are not integrated with Greek society.	People use the makerspace to develop solutions for themselves and the community. People are open-minded and encounter others (including MRAs and local people) without prejudice. They can speak Greek and develop relationships with both MRAs and Greek people. They have a willingness to participate in society by themselves.
5. *Education* *People learn tangible skills through training.*	People are unable to understand learning purpose and content or to communicate their learning needs.	People understand the learning purpose but struggle to understand the content.	People understand the learning purpose and the content in order to process and combine knowledge.	People understand the content and are confident in applying it to other applications. They are able to demonstrate self-learning.
6. *Livelihoods* *People can find employment and develop meaningful livelihoods.*	People do not understand what job they can get, what they are good at, and what they want to do.	People understand what they want to do, but not what they are capable of doing.	People understand what they want to do, and what they are capable of doing.	People can reflect on their own performance and actively seek job opportunities.

Figure 2 Combined maturity grid for humanitarian makerspaces (Corsini & Moultrie, 2020, p. 377)

3.2 Human Capabilities Approach

3.2.1 Amartya Sen: Development as Freedom

Amartya Sen in his book Development as Freedom (1999) introduces us to five types of freedom that broadened the existing idea of development, primarily focused on economic growth, to a more holistic approach encompassing political freedoms, economic facilities, social opportunities, transparency guarantees, and protective securities (1999, p. 10). Sen argues that people are deprived of these freedoms in countries with high GDPs as well as low ones (1999, p. 15) and that the "preeminent objective of development" is human freedom. Expanding the markers of development from solely economic to this wider frame includes a fuller picture of the qualities that constitute a 'valuable' life, that is to say, a life considered valuable by the one living it (Sen, 1999, p. 18). Notable when discussing the topic of makerspaces is Sen's argument that these 'five freedoms' are both the way of reaching a goal AND the goal itself. Sen makes this point by designating the 'constitutive role' and the 'instrumental role' of the freedoms (1999, p. 36). Makerspaces have the potential to specifically address the areas of economic facilities, and social opportunities, as well as indirectly impact protective security.

The area of economic facilities includes markers like access to product markets, the ability for women to seek employment outside the home, and spaces and opportunities for free economic exchange (Removing Unfreedoms, 2007). As this study will show, makerspaces can increase people's access to employment and income as well as actually create markets for them to engage with. When it comes to freedom in social opportunities, the expansion of education, gender equity, encouragement and cultivation of initiatives (Removing Unfreedoms, 2007), are some of the attributes that are addressed by makerspaces. And while protective security may more clearly address things like emergency facilities and protection networks (Removing Unfreedoms, 2007), the ability to improve one's physical living conditions, personal shelters, and community structures that is provided by makerspace access is an element of this freedom worth mentioning.

3.2.2 Martha Nussbaum: Functional capabilities

Sen is joined in this thought by Martha Nussbaum. She often explores the idea of human capabilities as it applies to gender equity. Supporting a governmental level incorporation of such values, she writes "**the best approach to this idea of a basic social minimum is provided by an**

approach that focuses on 'human capabilities', i.e. what people are actually able to do and to be" (Nussbaum, 2000, p. 222). Her list of Central Human Functional Capabilities includes *Life*; *Bodily Health*; *Bodily Integrity*; *Senses, Imagination, and Thought*; *Emotions*; *Practical Reason*; *Affiliation*; *Other Species*; *Play*; and *Control over one's Environment* (Nussbaum 2000, p. 232-233). Nussbaum focuses on the ability to choose, not requiring that all humans achieve 'full functioning' in each area, but rather the access to choose their own level of function. She writes, "The person with plenty of food may always choose to fast, but there is a great difference between fasting and starving, and it is this difference that we wish to capture." (Nussbaum 2000, p.235)

While no endeavor will tackle all of them, makerspaces increase access to functioning in several of these capabilities, namely *Control over one's environment* especially as relates to *Material*; *Senses, imagination and Thought*; *Play*; and to a lesser extent *Affiliation*. Nussbaum's definitions of these are as follow:

Control over one's Environment

(A) *Political*. Being able to participate effectively in political choices that govern one's life; having the right of political participation, protections of free speech and association.

(B) *Material*. Being able to hold property (both land and movable goods); having the right to seek employment on an equal basis with others; having the freedom from unwarranted search and seizure. In work, being able to work as a human being, exercising practical reason and entering into meaningful relationships of mutual recognition with other workers.

Senses, Imagination, and Thought. Being able to use the senses, to imagine, think, and reason —and to do these things in a 'truly human' way, a way informed and cultivated by an adequate education, including, but by no means limited to, literacy and basic mathematical and scientific training. Being able to use imagination and thought in connection with experiencing and producing works and events of one's own choice, religious, literary, musical, and so forth. Being able to use one's mind in ways protected by guarantees of freedom of expression with respect to both political

and artistic speech, and freedom of religious exercise. Being able to have pleasurable experiences, and to avoid non-necessary pain.

Play. Being able to laugh, to play, to enjoy recreational activities.

Affiliation

(A) Being able to live with and toward others, to recognize and show concern for other human beings, to engage in various forms of social interaction; to be able to imagine the situation of another and to have compassion for that situation; to have the capability for both justice and friendship. (Protecting this capability means protecting institutions that constitute and nourish such forms of affiliation, and also protecting the freedom of assembly and political speech.)

(B) Having the social bases of self-respect and non-humiliation; being able to be treated as a dignified being whose worth is equal to that of others. This entails protections against discrimination on the basis of race, sex, sexual orientation, religion, caste, ethnicity, or national origin. (Nussbaum, 2000)

As this data will show, makerspaces provide people access to the tools, materials, and environment they need to exercise their own creativity, try new things, meet some of their own needs in terms of their physical surroundings, learn both hard and soft skills, enjoy meaningful and fruitful work, and build relationships across inherent gender, national, cultural, and religious divides. They are a useful tool in increasing functioning in several of the capabilities on Nussbaum's list.

3.2.3 Individual vs collective capabilities

A criticism of CA is that it is overly individualistic, focusing on the freedoms and capabilities of the individual while overlooking the community or group (Stewart, 2005a). Sen does take groups into account, recognizing the need for engagement in social and political life (Ibrahim, 2006). These freedoms however have their value in the way they "[contribute] to enhancing and guaranteeing the substantive freedoms of individuals." (Sen, 1999, p. 18)

In response, Ibrahim (2006) introduces the idea of 'collective' capabilities. With this shift, the capabilities are only seen in 'collective action' and they benefit the group rather than the

individual. They require group membership to be achieved and aspire to communal development rather than individual development. Ibrahim takes us through the varying definitions of 'collective capabilities.' There is the idea that they are effectively the 'average' of the capabilities of the individuals in the group (Stewart, 2005a, p. 192) and the idea that collective capabilities are "those capabilities that can only be achieved…..as a result of social interaction" (Comim & Carey, 2001). Ibrahim proposes that collective capabilities are "**not simply the sum (or average) of individual capabilities, but rather new capabilities that the individual alone would neither have nor be able to achieve, if he/she did not join a collectivity."** (Ibrahim, 2006). As this data will show, the introduction of a collective resource like a makerspace to a community has the potential to expand the capabilities of the individuals that use it as well as the capabilities of the community as a unit. The makerspace approach IS the collective.

3.2.4 Capabilities and conflict

In general, both individual and collective capabilities are weakened as a result of violent conflict (Stewart, 2005a). The very basic and most individual level of freedom, what Nussbaum boils down to *life*, or the ability to live out the length of normal human life, is compromised by the presence of violent conflict. Beyond this, `conflict increases the likelihood of famine, reduces security and freedom, and makes it harder for social systems to function (Stewart, 2005a). Additionally, as Stewart (2005a) points out, deprivation in group capabilities can in fact sometimes lead to violent conflict. It is certainly not the only cause of conflict but when a group lacks freedom in political, economic, or social systems, the group can move to violence. The fear of the loss of these freedoms can also motivate conflict (Stewart, 2005a). If the presence of what Stewart (2005b) terms *horizontal inequalities* or diminished capabilities increases the likelihood of conflict (Stewart, 2005a) it may be argued that the opposite is also true and that expanding equality and working to cultivate capabilities may reduce the likelihood of conflict.

4 Methods

To answer the stated questions regarding the function, benefit, and contributors to success of humanitarian makerspaces in conflict-affected environments, I chose to complete a qualitative study gathering data through semi-structured interviews. Qualitative research allows the researcher to see through the eyes of the ones being studied, to understand the issue through

the words of those experiencing it (Bryman, 2012, ch. 15). The limited scope of the field and the wide variation from one makerspace to another occasions the use of a qualitative approach to gain an in-depth understanding (Bryman, 2012, ch. 15) of the experiences of creating a makerspace. A smaller sample limits the prescriptive capacity of this study but does provide descriptive insight into the existing makerspaces that will hopefully prove useful for future program developers.

There was an element of inductive research (Bryman, 2012) which included determining who would comprise the sample based on who engages with the space. By beginning the interview process with the developers of the makerspaces, the study has been able to define the goals of the programs and learn what elements have contributed to the functioning of the makerspaces as well as what hurdles were encountered on the way. This was intended to be followed by similar conversations with program beneficiaries to discover whether, and how, the makerspaces have contributed to their well-being. I did not start out looking for a particular demographic but through data collection learned that women and youth were two key areas of focus. Thus, the data collection itself shaped the research as a whole (Bryman, 2012).

4.1 Sampling

This research is based on data collected through semi-structured interviews with program leaders in the field. Interviews were conducted with a total of nine subjects who had experience starting, advising, or operating makerspaces in a variety of environments from a refugee camp outside of Athens to the once besieged city of Mosul. In the case of Preemptive Love, subjects were located through convenience sampling (Berg & Lune, 2012) through pre-existing personal contacts. In the case of Preemptive Love, the initial contact helped define the themes of this research and then introduced additional respondents and so this study also includes snowball sampling, where one participant leads to another who leads to another (Bryman, 2012, p. 415-416). Bryman (2012) offers examples where snowball sampling can be effective when studying highly sensitive and not very transparent areas but it is also useful here where the field is quite limited and potential respondents are few and difficult to locate. The remaining respondents were located through internet research and social media connections via Linked In, Facebook, and addresses listed on websites. Purposive sampling, an intentional selection of respondents

for their relevant experience in the field (Bryman, 2012, p. 408-409) was used to identify appropriate respondents, and interviews were conducted with program leaders at Habibi.works, Field Ready, Mosul Space, Preemptive Love, and Doin' Good. Some respondents are international aid workers overseeing the programs either remotely from their home countries or in the field, and some are local, native to the areas in which they are working. As the field of makerspaces in conflict-affected environments is new and therefore still relatively small, attempts at snowball sampling often led back to existing respondents but it was still employed in the case of respondents from a few organizations, namely Field Ready/Mosul Space and Doin' Good/Salam LADC. Due to the relative narrowness of the field, there has been no further demographic selection for age, gender, or ethnicity in reference to interview subjects although the demographic information provided about the populations they serve is noted. The locations sampled, while all conflict-affected in some form or another, vary but I propose this is a strength of the research as we can learn how makerspaces function in a variety of settings.

4.2 Data Collection and Analysis

Two interview guides were created with the goal of learning about both the process of developing the makerspace as well as its operation and outcomes. One interview guide targeted makerspace staff and was engaged when speaking with anyone at the organizational level, from daily makerspace managers to program directors. A second interview guide was created for the makers themselves. Securing interviews with makers was a challenge and so this interview guide was turned into an open-ended questionnaire that was emailed to a few makers but ultimately went unreturned. All interviews were conducted in English via Zoom, Teams, or Skype. They were then transcribed using an online transcription service. Following this, digital transcripts were confirmed and corrected before being anonymized.

The interviews were coded using a key originating with the key aspects identified in **Error! Reference source not found.**: *Access, Improved Living conditions, Psychosocial empowerment, Integration, Education,* and *Livelihoods*. In addition to the six aspects identified by the grid, interviews were also coded for *Barriers to user participation*, *Enablers to user participation*, *Organizational challenges*, *Organizational enablers*, *Cultural/heritage preservation/restoration*, *Mental/emotional/social benefits*, and *Peace*.

4.3 Safety and Ethics

As with all types of research but particularly when dealing with vulnerable populations as this study does, great care must be taken to preserve participant anonymity and ensure participant safety. To that end, this project has been registered with the Norwegian Center for Research Data (NSD) to ensure that the data is collected, stored, and shared safely and legally. A letter of consent was delivered to each interviewee and permission was obtained to record and digitally transcribe interviews. All recorded interviews were then deleted, and transcripts coded to anonymize the respondents.

Bryman (2012, p. 4) notes that many social scientists stress that research should not only add to a body of knowledge but should have implications for practice. As a researcher, I align myself with this stream of thought and so it was important to me that this project attempt to deliver practical, actionable, data that can be of use in the field. To that end, one aim of the research is to provide a resource for those who want to create a makerspace in a similar environment, to synthesize the experience of creating and operating some existing makerspaces so that knowledge can be transferred.

4.4 Case Studies

4.4.1 Preemptive Love in Iraq

The Preemptive Love makerspace is located in the Arbat Refugee Camp in Sulaymaniyah, Iraq. The camp is host to just under 2500 people (UNHCR IM Unit). The makerspace is one of the NGO's initiatives to help restore life and livelihood after conflict (Preemptive Love, 2021). The makers are primarily Syrian refugees, and also include internally displaced Iraqis working alongside members of the host community (Interviewee 9). Many makers participate from the makerspace itself, but Preemptive Love also opens participation to those who prefer to work at home or who live far from the makerspace. A primary aim of the makerspace is advocating for women's empowerment. The flexibility of participation is particularly useful, being able to work on one's own schedule makes this project accessible to women who also have childcare and household duties that would prevent them from a more rigidly scheduled job or VTP. There is even a room intended for the makers' children however, that aspect of the program has been closed during the COVID-19 pandemic. While great care is taken to create a space that encourages participation from women, it is not to the exclusion of men. Participants range in age

from 18 to 60s. Many makers are also heads of households. Part of the goal of the space is to provide income.

Preemptive Love does provide more traditional vocational training and skill-development services as well. They have tech labs to help people develop digital skills to prepare for jobs that can be done from anywhere. They are complemented by the makerspace that is more geared towards female membership with flexible access and the ability for makers both in and out of the camp setting to participate even from home. Makers at Preemptive Love, sell their products both internationally through online stores with a foreign customer base as well as in local markets. Makers are welcome to create products through Preemptive Love's Sisterhood Collection brand for these markets, but they are also encouraged in entrepreneurship to start their own businesses as well. According to their website, 167 new businesses were launched in Iraq in 2019 through the organization's work (https://preemptivelove.org/our-work/jobs/).

4.4.2 Field Ready

Field Ready is a collection of NGOs and non-profits applying design, technology, and engineering to humanitarian aid (Field Ready, 2022). They are currently operating in the Syrian Crisis, in Nepal, the South Pacific, and Iraq. A foundational belief is in "making useful things locally" (Field Ready, 2022, Charter point 1) and they not only meet emergency needs by constructing lifesaving tools where they are needed most, but are committed to staying past the crisis to see communities through reconstruction to resilience (Field Ready, 2022, Charter point 7). This study will look primarily at their work in Gaziantep, Türkiye where they had a makerspace open to the public from 2017 to 2018. This makerspace, catering mostly to students, served both Syrian refugees as well as the host community (Interviewee 7). It closed due to a lack of funding, but they are currently in the process of opening a new makerspace (Interviewee 7). In Northern Syria, they also furnished a makerspace in response to requests of a team of local engineers. Along with the significant impact of being able to quickly and locally produce parts to repair broken medical equipment (Interviewee 7), this makerspace is responsible for developing an airbag used to lift rubble in search-and-rescue missions that can be made locally using accessible tools and materials (James, 2017). This avoids the expenses, delays, and often impossibility of

manufacturing abroad and shipping into conflict zones. In Iraq, Field Ready has supported existing makerspaces and tech hubs like Mosul Space.

4.4.3 Mosul Space in Iraq

Just days before ISIS began its attack on Mosul in June 2014, Mosul Space was born. A project of a few university students, it started as a group of friends purchasing common equipment, sharing ideas, and hosting hackathons[5], seminars, and electronic build sessions in local cafes or university lecture halls. When ISIS attacked, the partners relocated to Kirkuk and then Erbil, continuing the work from temporary locations. When ISIS was defeated there, the team was able to return to Mosul where they established a physical location where along with business incubators and co-working space, they offer a makerspace equipped with 3D printers, CNC router, laser cutter, plotter cutter, electronics, virtual reality, PLC automation[6], and more. Their primary users are students from the University of Mosul Technical Institute, but they also have participation from local entrepreneurs (Interviewee 2). They continue to host hackathons as well as craft nights and Speak-up English club (Interviewee 1). With support from Field Ready, Mosul Space uses its digital manufacturing techniques to help maintain damaged medical devices in four nearby hospitals (Mosul Space). Mosul space is unique among the makerspaces studied here in that it was not created in response to conflict rather, it was imagined before the conflict commenced, adapted to function during the conflict, and then further matured once the conflict ceased. Along with the other Field Ready projects, much of the work centers on more advanced technologies, with programs for robotics and AI (Interviewee 2).

4.4.4 Habibi.works in Greece

Habibi.works has been included in previous research by Corsini and Moultrie (2020). The makerspace is located near the Katsikas Refugee Camp in Northwestern Greece. It consists of thirteen separate working areas (Interviewee 4). In the kitchen, wood workshop, metal workshop, sewing workshop, creative workshop, media lab, bike repair station, creative atelier,

[5] A *hackathon* (a portmanteau of *hacking* and *marathon*) is an intense design event usually associated with coding and software development in which participants "gather to work collaboratively, often over 24 to 48 hours, to develop new solutions to a pre-defined problem." They sometimes include a competitive element where winners can earn prizes or funding for their proposals (Kvamsås et al., 2021).

[6] A Programmable Logic Controller is an industrial computer frequently used in automated manufacturing that automatically controls physical processes (Zubair et al., 2022, p.2).

and community library, an international staff works alongside refugees and locals to “create products and perspectives” (Habibi.works) One especially interesting project of Habibi.works is Home.work. Using the CNC router, users build a portable toolbox that opens up and is simply transformed into a workbench. The box is outfitted with tools for basic repairs and gardening. One box can be co-managed by five residents of the Katsikas refugee camp for use in the camp itself so that users don't necessarily have to travel to the makerspace to access tools. (Jäger) The project allows users to meet their own needs where they are and to build trust with their neighbors through resource sharing and collaborative work.

> “Being able to create something demonstrates a person’s ability to change and alter something, and to be self-determinatory. This contributes to integration and to a worthy active, productive life, in a context of continuous frustration and endless waiting.” (Jäger)

While Greece itself has not recently been the site of violent conflict, the years-long flow of refugees and migrants many of whom are fleeing violence in Syria, Afghanistan, and Iraq, among other places has affected the environment there. As Europe has closed its doors to these people, many have realized that Greece will be home for longer than they expected. It may not have seen battles and bombs, but it is fair to say that Greece with over 160,000 refugees and asylum seekers likely to remain in-country (UNHCR, 2021b), is a “conflict-affected” environment

4.4.5 Doin’ Good and Salam LADC in Lebanon

Doin’ Good is a German NGO with a mission of “fighting poverty through education” (Doin’ Good). Along with a program to engage underserved youth in their home of Hamburg, Doin’ Good partners with Salam LADC to operate a makerspace that serves Syrian refugees living in Informal Tent Settlements in the Bekaa Valley in Lebanon (Doin’ Good). This makerspace is closer to a vocational training program in the way it functions with participants joining 12-week courses in electrics, woodwork, or sewing. The goal of the courses is to provide the participants with skills they can use to better find employment—there is a certificate after completion of the course—while at the same time giving them the opportunity to design and create objects they and their families need. The organization’s ambition of functioning more in the vein of an open-access communal workshop has met challenges of transportation access and funding that will be

explored in this thesis. It is included here as an example of how the plan for a makerspace can be forced to pivot and yet still be a successful project. If this research is to serve as a guide for others who seek to start a makerspace, the history of Doin' Good[7] and their partnership with Salam LADC is relevant.

4.5 Positionality

As I undertook this research, I was aware of my own expectation and desire to present makerspaces as a positive development in the field. My own professional background as an artist and maker predisposes me to optimism about the practical utility as well as the social benefit of makerspaces for people who have experienced the trauma of conflict. I hoped to discover that programming of this sort goes beyond meeting concrete education and employment needs to address and satisfy a deeper longing for creativity, culture, heritage, and home.

Moreover, throughout this research, I continued to hear from program leaders that their main obstacle was obtaining and securing funding. Governments and foundations were more inclined to provide a hospital with a new incubator, for example, purchased abroad and imported, than to fund a makerspace that could give the local community the ability to manufacture the part needed to repair the four existing but broken incubators (Interviewee 7). Of course, the new incubator is much easier for the donor to catalog and report, but I believe this hesitancy must also come in some part from a lack of awareness and understanding of what a makerspace is and how it functions. It is my opinion, supported by Sen (1999) and Nussbaum (2000) that assisting local capacity for production and problem solving is significantly more useful in terms of creating self-reliance and increasing individual and collective capability. This study hopefully indicates the significance of directing funding towards makerspaces. Recognizing my own expectations and what I hoped to discover, care was taken to value all data equally even when it contradicted my hypotheses.

[7] Throughout this thesis, the name "Doin' Good" will refer to this partnership. Not to diminish the work of Salam LADC who, as the local partners, are crucial for program operations, but rather because due to local issues resulting in regular electricity and internet failures, it was not possible to speak directly with someone at Salam LADC. The interview was conducted with a Germany-based program manager at Doin' Good, so this thesis won't attribute statements made by them to the partner organization.

4.6 Limitations

The outstanding limitation of this research was the inability to travel to the program sites. Covid-19 restrictions and university policies prohibited traveling to these locations, so all interviews were conducted digitally. In-person access to the field would undoubtedly have resulted in more contact with program participants. This was difficult to arrange remotely and a key factor missing from a full report on the benefits and challenges of makerspaces operating in conflict-affected environments. Visits to the sites could have resulted in a more thorough ethnographic study and more could have been learned through shared experiences with the makers in the makerspaces themselves. Program leaders could communicate some of this information but learning first-hand about the details of participation from makers themselves would have been preferable. Further engagement with makers would have also allowed for a deeper application of Corsini and Moultrie's maturity grid (**Error! Reference source not found.**). As it was used originally, the makers could have provided their responses in reference to the grid in terms of assessing the development or progress of the program in each field.

The interviews were conducted in English which was not usually the first language of the respondent. While it was only rarely a challenge, there were occasions where the combination of remote interviews and communicating in a second language left some responses unclear. The frequency of internet service interruption during some interviews also left some gaps in understanding. I attempted written follow-up questions where it seemed relevant but there may be questions that went unasked simply because the concepts were too abstract to be communicated with limited common language.

As with all qualitative research, there are limits to how these findings may be applied in other contexts. As the field is still rather thin, gathering sufficient data for more prescriptive results would be unlikely so an individual experience-based approach is preferable at this time. It may not have the specific transferability of a more quantitative study but will provide if not a roadmap, perhaps a travel guide for the development of similar projects in the future.

5 Findings and Analysis

This chapter will present the findings of in-depth interviews with makerspace leaders from five different organizations as they relate to the research questions introduced in section 2. The

maturity grid (**Error! Reference source not found.**) assembled by Corsini and Moultrie (2020) determined six useful categories to evaluate the utility of makerspaces in 'crisis-affected communities'. The grid itself was created through a series of workshops with makerspace employees and was originally used to code interviews with staff and makers (Corsini & Moultrie, 2020). For this study, I reference the original six and a few additional categories. Considering the absence of maker (Corsini and Moultrie call them beneficiaries) interviews, this thesis will not assign levels to the makerspaces on the grid in terms of maturity as they originally did. Rather, referencing each of the categories, it will report on the strengths and weaknesses of the different makerspaces, their goals, and reported outcomes, as they appertain to the research questions.

5.1 Social benefits of the makerspace

5.1.1 Mental Health

Makerspaces at the outset appear to have very practical, tangible goals. They are concerned with making *things*. In surveys of participants at Habibi.works, however, they were surprised to learn that where they consistently scored the highest was not in skill acquisition or improved surroundings but rather, in improved mental health. Through exercising these skills makers can build up their self-confidence:

> …they can … reshape their identity, they can get rid of this limiting label of being a refugee and be a carpenter… Be a tailor or chef or an artist. And this massively helps people to move on with their lives in Europe - Interviewee 4

At Mosul Space, one maker attended a training program with no previous experience in the field. He discovered an interest in robotics and is now confidently and capably working on two robots (Interviewee 1). Through weeks of increasing participation, makerspace staff observed his transformation from an 'introvert' to an engaged participant.

Preemptive Love takes a much more proactive approach to mental health, incorporating it into the foundations of their program from the way they structure their days to the design of the building itself. The makerspace manager has time built into her day to meet with makers individually and listen to them. A goal for this year is to bring in trained life coaches from the community. When they renovated the abandoned warehouse that houses the makerspace, one room was set aside for counseling and while there is some privacy available, the whole space is

constructed with windows with the idea that "what we are trying to advocate for is heal through togetherness, through being together within the community healing as a community." (Interviewee 9) The makerspace hosts yoga and other fitness classes, and movie nights with thematic discussions, to prioritize collective and individual healing and trauma recovery.

5.1.2 Making friends: Community development through a makerspace

These practices result in social development and support within the makerspace. Staff have seen makers advocating for community members:

> "Last year…there was an accident where like, a man got hit by a car, by bus driver, and he died on the spot. He was … the lead household. The immediate response of the community [was], like 50 women coming up, and they were like, 'You need to support her. Give her a job, you know, you need to train her she's good…She's not alone, we need to support her.' Then even inside the maker space, they were all advocating for her to come even though that she was so sad that she didn't want. We visited her. We invited her. We said 'Come.' And little by little she became a maker." - Interviewee 9

This type of inclusion and support is not uncommon. Once Preemptive Love's commercial entity, Sisterhood Collection, decides how many of a product to manufacture, the work is then distributed fairly among the collective, considering how much people want to and are able to make. When a different maker also lost her husband, the other makers were observed secretly putting their work on her tally, effectively donating their labor so that she, having become the family breadwinner, would receive a larger portion of the proceeds.

> "We are here to be friend, we need to support each other we will not be sustainable and successful if each one of us have thought about their own success and livelihood" - Interviewee 9

5.1.3 Psychosocial empowerment

In the maturity grid, Corsini and Moultrie (2020) grade the level of psychosocial empowerment in terms of self-esteem, motivation, and capacity to shape their own lives. At the highest level, you see makers also participating in the management of the makerspace itself. Among respondents, this quality was reported in different ways. Several respondents noted the

satisfaction of seeing female makers' desire and satisfaction with learning skills that are traditionally considered to be 'men's work'.

Representatives from Field Ready discussed the advantages of makerspaces over direct vocational training programs.

> "The vocational training program is very specific, that I will train you how to solve this, how to solve this, how to fix this mobile and that. But the other one **is really changing the mindset**" - Interviewee 7, emphasis added

> A makerspace is "giving people a lot more skills to be able **to be able to create and be inventive** and make businesses that are needed. Rather than like 50 people learning to make the same thing which then wipes out the market." - Interviewee 6, emphasis added

In Lebanon, one participant, newly confident in his own skills as an electrician, realized that now he can teach others (Interviewee 5). At Preemptive Love, makers can present their own designs to be made and sold in the online shop or local market. At Habibi.works, makers may come to the makerspace initially to improve their living conditions but often continue their participation in order to deepen their skills and remain involved in the community. Because there is frequent stagnation in terms of asylum or immigration procedures in Greece, at Habibi.works, they find that after about a year and a half, makers often get frustrated (Interviewee 4). Sometimes this results in makers seeking out unofficial work outside of the makerspace but sometimes, they will start to teach or share a skill or even take over a workshop. Opportunities like these recognize that makers have something to contribute and support people having agency over their own lives.

5.1.4 Education

There is organized education—classes and workshops—taking place at most makerspaces and there is also the informal education of skill-sharing, makers teaching other makers. In the carpentry course in Lebanon, rather than a class where everyone learns to build a cabinet, they allow the makers to choose different types of furniture to make so that the makers can learn from each other's different processes as they work alongside each other (Interviewee 5).

At Habibi.works they see makers crossing language and culture barriers to teach each other by modeling and repeating but they also find that extended participation in the makerspace often leads to people asking for more knowledge and training:

> "The longer people stay, the more important education becomes, so the more people ask for really structured workshops and classes. Because we have two different concepts like one, we can either be open and really wait for the people to come to us and see what is the need and then support on a one-to-one basis basically. Or we can say oh, we have identified that a lot of people are asking how to make curtains at the moment because there's no privacy in the camp, let's have a workshop about curtain making." - Interviewee 4

The makerspaces in Mosul and Gaziantep enhance the learning of university students:

> "Universities aren't very well equipped in Iraq. So, you know, like, the universities and professors, they come and see some 3D, like, they're very keen to get hands-on experience to go with their theoretical." - Interviewee 6

Students have access to not only the equipment they need to affordably complete assignments but also the expertise of the makerspace staff:

> "Two students from the university came here, they have a robot. They printed it in their home, but they have some issue in it… our leader helping them in the programming and they were have mechanical problem. We solve it and it's now work." - Interviewee 2

5.1.5 Making peace

One final potential of a makerspace is its ability to contribute to future peace. Somewhat harder to quantify, the spirit of cooperation and equality in terms of access encourages collaboration rather than competition. In the case of Preemptive Love who has an organizational mandate to "unmake violence," (Preemptive Love, 2021):

> "We have people who come from different areas of placement or from like, different area of where they originated…and historically, these areas are in clash. They don't like each other. They hate each other. And, and that was a conversation in the beginning, actually, where like 'you are from this [area], don't talk to me'… Or when we are

distributing the fund, 'You give money for people from that area, you don't give money for me.' But that little by little dissolved. And even the language they started to use started to be language of peacemaking." - Interviewee 9

Overall, the social benefits of makerspaces seem to be extensive. In all five cases studied, positive results in this field are observed.

5.2 Making a living: Economic benefits of the makerspace

The highest level of maturity as defined by Corsini and Moultrie's *livelihoods* category is achieved when people can (1) recognize the job they want, (2) have the ability to do it, (3) can evaluate their own capacity, and (4) can 'actively seek job opportunities' (see Figure 2). The makerspaces studied here impact makers' livelihoods in diverse ways.

5.2.1 A makerspace with a social entrepreneurship model: Sisterhood Collection

The Preemptive Love makerspace is intrinsically connected to their initiative Sisterhood Collection[8]. Sisterhood is an independently registered business in Iraq but relies heavily on Preemptive Love which provides its main online market, selling goods produced in the makerspace to customers primarily in the United States. The program began with soapmaking but now offers a variety of products manufactured through the makerspace. Through this program, the makers (Sisterhood calls them artisans) are paid by the piece for the goods they create. I heard the example of a woman who was selling knitted products from her home but after training and selling through Sisterhood, she was able to significantly increase her income:

"…from home, they sell it for like quarter dollar if they make it right. But if they make it with us, they can get $1 or $2 for some stuff and maybe $5[9] for other stuff depending on the size and the time that it takes" - Interviewee 9

Sisterhood also has a presence in the local bazaar. Currently, about three-fourths of what they produce goes to the online shop and one-quarter to local sales. With an eye toward sustainability and a self-sufficient enterprise for the makers, the program director is working to

[8] While the Sisterhood Collection is advocating for women's empowerment in Iraq, they do have male makers as well. (Interviewee 9)

[9] As of 27 Apr 2022, $1 was equal to 1,460.00 Iraqi Dinar (IQD). 1000 IQD will buy 10 pieces of bread. 1 dozen eggs=2,648 IQD. 2liter Coca-Cola=1,293 IQD (*Cost of Living in Iraq*, 2022).

build up local demand for handcrafted locally manufactured goods so that the project is not dependent on foreign markets.

> "…because thinking about sustainability and my background where I come from, what if the US market shut down? What if we were not able to export anymore? what if, like there was a disconnect between the program and [the Preemptive Love] shop and we were not able to do it. There are so many what-ifs, that can actually hinder the sustainability of the program locally and will cut the livelihood of the makers. So that's why I wanted to focus on the local aspect and introduced them to the local market." - Interviewee 9

With only a few exceptions[10], Preemptive Love purchases its raw materials locally. They may ultimately be imported from China or Türkiye but by purchasing from local vendors, the initiative is also investing in the local economy and benefits the livelihoods of those outside the makerspace as well.

Selling through Sisterhood Collection isn't the only way that Preemptive Love's makers can improve their livelihoods. Along with trainings in entrepreneurship, there is regular encouragement and support from makerspace staff for the makers who want to start their own independent businesses outside of Sisterhood. The integration of a social entrepreneurship model into the makerspace makes Preemptive Love unique among the makerspaces studied here. They have the most direct impact on makers' incomes.

5.2.2 Indirect economic benefits

Even without the organizational commercial support, makerspaces can have a positive impact on makers' livelihoods. Many of the spaces studied have some sort of formal training scheme with scheduled courses. These include the basics of how to use different tools as well as more advanced skill development. At Preemptive Love, this comes with a certificate of completion after passing an exam. This qualifies makers to sell their products through Sisterhood Collection and can also be valuable if they seek employment elsewhere or start their own businesses. Some makerspaces offer language learning courses or events as well as courses on

[10] They are working to source high-quality, locally-produced fragrances for their scented candles but until they are found, import them from the US. (Interviewee 9)

entrepreneurship. Mosul Space regularly sponsors business incubators offering participants extensive training in "design-thinking, lean business models, and problem-solving."(USAID, 2022) In a similar vein, Preemptive Love offers occasional classes on entrepreneurial topics like marketing and branding. These classes are extended to the wider community, not just those who participate as makers. At Field Ready, they were able to offer training sessions in PLC automation (see footnote 6). The courses were extremely popular because they are seen to have "high employment potential" in the growing manufacturing sector (Interviewee 6).

The makerspace inside Syria has been able to take paid orders from other NGOs (e.g., parts to repair medical equipment) and from the community that remains to manufacture goods that have managed at times to pay for the operation of the space itself as well as modest salaries for its engineers. The space in Gaziantep saw several female makers, in particular, come in and use the space to manufacture goods they could sell through their personal social media platforms (Interviewee 6).

At Mosul Space, they can give some concrete figures regarding livelihoods:

> "We have over 11 startups that have evolved out of Mosul Space activities. We have over 60 people who got jobs because of Mosul Space trainings and incubation programs and all of that, so we have quite the success stories" - Interviewee 1

In Lebanon, Doin' Good is formalizing this aspect of their program. The main goal of the makerspace is to get people into employment so that they can get out of the trap of working unofficial jobs[11]. Along with the sewing, carpentry, and electrics courses offered in their makerspace, they have begun to offer an additional microbusiness track. This program supports 10 female makers, graduates of their courses, who are also heads of households in starting their own small businesses.

> "Ideally, the vision would definitely be to have…micro-businesses being founded by participants coming out of the makerspace. And then, like, building a business where they can employ other participants coming out of our courses." - Interviewee 5

[11] Many of the informal settlements in the Bekaa Valley are located on farms where the landowner has allowed refugees to set up tents and live there for small fees. Many of the residents also work 'illegally' on these farms for less than a dollar a day (Interviewee 5).

Additionally, the makerspace employs local professionals to teach their courses, creating jobs for the host community.

For some makerspaces, like Preemptive Love with its incorporated social enterprise scheme, the economic benefits are direct. For others the economic benefits come less in the form of tangible income and more in the form of opportunity, increasing people's capacity to meet their needs.

5.3 The target user: Who benefits most from a makerspace?

Of the five main makerspaces studied (Preemptive Love in Iraq, Doin' Good in Lebanon, Habibi.works in Greece, Mosul Space in Iraq, and Field Ready's makerspace in Gaziantep, Türkiye) only one was created with a target user in mind. Preemptive Love who already operated a range of programming including VTPs set out to create a program that could specifically engage the women who weren't accessing their existing offerings. They do have male makers at Preemptive Love, the program is not exclusionary, but it was designed with things like childcare and flexible hours in mind to circumvent the typical barriers for female participation and so their makers are primarily female.

The other makerspaces are predominantly male, but they are proud of the levels of female participation. After working with their local partner to seek out interested women, Doin' Good had 20% females in their last carpentry course and 100% in their last sewing course (Interviewee 5) Even in HRSs in places where women are becoming more present in the STEM (science, technology, engineering, and math) fields, makerspace participation skews male (Holman, 2015) so the numbers are satisfying to these program leaders considering the cultural contexts in which they are operating.

> For gender, again, we can say it's about 70%, male and 30%. Female. We had a good, really good number of … female participants. But again, this is like, like for *here*, it's a good percentage. - Interviewee 7

In Mosul and Gaziantep with their proximity to universities, and makerspaces that also include more advanced technology tools, from 3d printers and laser cutters to robotics kits and AI programming software the maker population is made up mostly of students.

Apart from the additional Field Ready workshop space in Syria which is only available to be used by their team of engineers, the makerspaces all have varying levels of public access. They all require some sort of training to use the tools that can be dangerous. But whereas, the makerspaces in Mosul and Gaziantep operate on a subscription basis where makers pay a daily, weekly, or monthly, fee for access to the space and raw materials, a maker can walk into the Preemptive Love makerspace and as long as they are available, sit down at a sewing machine to work on whatever they bring in. There is no evidence that makerspaces are not useful for non-student males (on the contrary, many makers at Habibi.works would fall into this category), but this research can say that females and students are two groups who have been particularly well served by their presence.

5.4 Reconstruction and Resettlement

In the existing research on humanitarian makerspaces—and in this thesis—much attention is focused on the economic and social benefits to the makers, and how their mental and emotional health is impacted by the increased personal agency provided by a makerspace. Additionally, this study uncovers a unique potential of makerspaces to retain and restore the cultural heritage of a people or a place. Much has been written about the destruction of cultural heritage sites and objects during war (Auwera, 2012; Lenzerini, 2020) both as collateral damage of combat and as intentional, targeted devastation. One immediately recalls the Buddhas of Bamiyan, demolished by the Taliban in Afghanistan (Francioni & Lenzerini, 2006) and a brief search turns up obliterated libraries in the Balkan wars in the 1990s (Riedlmayer, 2007), but what about the less newsworthy cultural losses? the industries and traditions that quietly disappear when factories are bombed and people are scattered? the fine artists who are forced to leave behind their brushes and clay?

5.4.1 No potters left in Sulaymaniyah?: preserving and restoring cultural inheritance

. As a result of the war, Iraq has generally become heavily reliant on imports and some trades and crafts that were passed down for generations have effectively disappeared. (Interviewee 9). Sulaymaniyah has a rich tradition of making pottery but when representatives from Preemptive Love went looking for a pottery factory, they couldn't find one.

> "You know, after the war, a lot of the local trades stopped from happening, like in Iraq, when I was looking for pottery makers, there was none! … The only factory that I found,

it's like factory who was like destroyed, closed and the only guy who now has the trade—had from his dad—he is so emotionally drained, exhausted, and he is so, like, a trauma. He has a PTSD from the war and what happened to his dad. He doesn't want to do it anymore…With the pottery training, **we are trying to revive something that was part of the culture so long ago, and it was part of our economy so long ago, but it vanished**."

- Interviewee 9

Figure 3 (top) A potter at work at the Preemptive Love makerspace (Sisterhood Products, 2021a)

Figure 4 (bottom) hand-crafted candles made in the Preemptive Love makerspace. (Sisterhood Products, 2021b)

Preemptive Love doesn't stop here. Along with training potters and painters and reviving both a tradition and an industry that died during the war, in March of this year, many local women who were not necessarily part of the Sisterhood Collection came to use the makerspace's sewing machines to make clothes for themselves and their families for Norooz (also Novruz or Nowruz), the celebration of spring and a New Year. Meanwhile, in another room in the makerspace, makers were busy carving wooden cookie molds (Figure 5). There are cheap plastic imported versions available in the local market, but the makerspace artisans are helping to maintain the art of hand-carving while both developing community appreciation for locally made products and introducing an international market to these traditionally crafted goods.

Figure 5 Hand-carved cookie molds from Preemptive Love (Sisterhood Products, 2022)

The city of Mosul was devastated by three years of battle and occupation by ISIS. In 2018 UNESCO launched a program called *Revive the Spirit of Mosul* reconstructing heritage sites and "empowering the population as agents of change involved in the process of rebuilding their city" (UNESCO, 2021). As part of rebuilding the old city, UNESCO has contracted Mosul Space to design and digitally manufacture an old style of bell for the main doors of ancient houses they are restoring after ISIS' destruction of Old Mosul (Interviewee 2). In another unique blend of tradition

and technology, in Gaziantep, a maker created a board game that would teach Syrian history and robotics learning (Interviewee 6).

This culture work is not only about preserving traditions, however. Culture isn't only our past. Makerspaces can be a place where the future culture is established as well. A Field Ready representative spoke about the role makerspaces play in inciting community growth, revitalization, and development, ultimately a future:

> "I also think there's a bit that is sort of intangible as well, on top of everything about, like, creating cool places for people to hang out, which makes the whole city more attractive. And, you know, when you sort of see like, the kind of brain drain that you have, from places like Mosul… that if you start to create these, these centers, these hubs where it's fun for young people to hang out, where they can feel like they're sort of part of something that's, that's innovative, and, and it's cool...." - Interviewee 6

5.4.2 Making A Fresh Start

Sometimes, the conflict-affected population doesn't have the opportunity or desire to rebuild. Perhaps, as with many currently displaced people, the conflict has been ongoing for years and they can't return home. Perhaps the destruction is so absolute, or the trauma so profound, that their best option is to make a fresh start in a new place. Makerspaces can be of use here as well.

5.4.2.1 Improved surroundings

As displaced people settle into new surroundings whether that is a (hopefully) temporary camp[12] or something more permanent, access to a makerspace presents many opportunities. In some of the makerspaces studied particularly those closely associated with camps, the ability to improve one's physical surroundings was a highly valued feature.

As a volunteer in 2017, I encountered a catastrophe of plastic waste in Moria refugee camp on the Greek Island of Lesvos where every day, more than 6,000 camp residents were

[12] The average length of time spent in a refugee camp is very hard to pin down. "17 years" is an often-quoted figure but it rarely includes all the caveats that came with it in the 2004 UNHCR internal report that is its source (Devictor, 2019). There are UNHCR reports that the median length of stay is 4 years and in some regions more than 20 (Devictor & Do, 2017). As of 2015, the average length of stay was figured to be 10 years with over 60% of refugees experiencing a 'protracted refugee situation' spending years unable to return home but also unable to access basic rights, economic opportunities, and social services in the host country (Van Den Hoek et al., 2021)

receiving, using, and then throwing away, a 1.5-liter bottle of water. There were mountains of discarded plastic, and I couldn't help wondering if we were solving one problem by creating the next. Field Ready is a partner in pioneering a program in conjunction with its new makerspace in Gaziantep and the workshop in Syria. The PolyFloss machine transforms plastic waste into fibers that can be used as heating insulation. The machine can be operated in a camp, an innovation that solves both the problem of excessive plastic waste in the camps and the problem of poorly outfitted tents and other temporary dwellings, going beyond issues of comfort and convenience to the lifesaving[13] matter of warmth. Field ready engineers have also responded to requests of local agronomists and designed and manufactured hydroponics kits for use in Syria. From very low tech (e.g., building a shoe shelf) to very high tech (e.g., the PolyFloss machine) access to makerspaces does improve the living conditions of conflict-affected people.

In these temporary shelters, there is both a *need* for improvement in function and a *desire* for improvement in form. Makerspaces are meeting this need as makers are building furniture to solve issues of storage and organization and sewing curtains to create privacy (Interviewee 4). On the most basic end, the need is met. Optimally, makers even get to make aesthetic choices in terms of the material and design of the items they create. The ability for self-expression in one's environment can be overlooked in crisis situations like these but the introduction of choice (Melchionne, 2017) through the makerspace improves quality of life. This is true in temporary shelters as well as in more stable housing in a new environment where one may not have the ability to purchase the things that they are used to. For a maker in possession of the necessary skills, however, access to a makerspace can help make a new place feel like home.

5.4.2.2 Integration

Integration is best explored in the cases where a group is settling into a new community, in Greece, Lebanon, and Türkiye. In Greece, at Habibi.works, makers are gaining and refining skills that could help them integrate into Greek life but the interaction with their Greek neighbors is limited. The makerspace is located near to the camp which, as is often the case, is far from town. There is hesitancy on the part of many Greek people to come out to the makerspace despite

[13] Portable heaters inside tents in refugee camps have led to death through carbon monoxide poisoning. In Jan 2017, a few weeks prior to my arrival in Moria, this was the cause of two deaths.

being offered the same services and access. Habibi.works however is committed to assisting makers in integrating into European culture. When asked to have times where women could come without men being there, they chose to host some sessions to allow women to get comfortable working with new tools but declined to make a regular division in the use of the space.

> "I think we would never split our working week by the genders because we believe that this is not how Europe functions. And it's not how it should function. So we believe the real victory is actually a woman coming to the space, regardless whether there are men around or not."- Interviewee 4

The makerspaces that engage with displaced people and host communities often find it challenging to incorporate the host community. Common challenges (explored in 5.5) are location, language, and a stigma around projects that are perceived by the host community as being for 'them' not 'us' (Interviewees 1, 4, 5). In Gaziantep, Field Ready's makerspace noticed that despite some resistance on the part of the host community to come to a "Syrian-led" makerspace, they did manage about 70% refugee community and 30% host community participation (Interviewee 7) and in Lebanon, inflation and political unrest have created challenging times for Lebanese people as well as refugees (Interviewee 5) and they see the host community is also beginning to participate in the courses they offer.

5.5 Making a makerspace: an organizational perspective

Having covered several outcomes supporting the establishment and funding of makerspaces for conflict-affected communities—the *why*, if you will—the last portion of this research seeks to collect the learning of these case studies when it comes to the *how*—answering the questions of what the challenges and enablers for both the participants and the organizations are when engaging this type of programming. This portion of the study aims to aggregate and transfer knowledge to practitioners considering such an undertaking themselves.

5.5.1 Challenges

5.5.1.1 Funding

Without a doubt, the number one challenge to makerspace success, like most other development projects, is securing reliable and consistent funding. These programs may be more fiscally sustainable in high-resource settings where members can afford higher subscription fees

but even there, many rely on supplemental support from local governments, philanthropists, and foundations[14]. In the cases studied here, even when there are subscription fees introduced as with Mosul Space, or a commercial venture is integrated as with Preemptive Love, the difficulty of accessing and sustaining funding is the first challenge cited by each respondent. Interviewee 7 from Field Ready cited the lack of donor awareness and thereby, interest in makerspaces as a hindrance to securing these funds. They mentioned that donors would rather just import a new incubator for the local hospital than support a local makerspace that could produce the part needed to repair the existing one. This lack is felt in different ways by different organizations. In Lebanon, they aren't able to plan their programming with much of a future outlook. It is always season by season, not knowing if they will have the support for the next year which prevents long-term goal setting and requires consistent management. At Mosul Space, they spoke of the constraints of the funding support they do have, needing to file paperwork for permission to order pens for the office (Interviewee 1); and at Habibi.works, how the competition for funding between organizations doing relief work disincentivizes collaboration. Low funding for staff compensation leads to high turnover which also inhibits long-term planning.

> "I really wish there was one big sponsor or foundation to fall in love with our work and see the enthusiasm and kind of like, catch fire and say, 'Okay, here's the funding for the next year or two. And now really focus on what you're doing, instead of worrying about whether in a month or two, you will still have the money to do your work.'" – Interviewee 4

In the absence of such a donor, however, the commercial arm of several makerspaces is a significant help. In the Field Ready supported workshop in Syria as well as at Mosul Space, the ability to manufacture products ordered by the community has sustained the workshop financially when funding has run low.

5.5.1.2 Communication

Another challenge can be language. When it comes to maker participation, language is often easy to overcome, with the exception of some issues of safety, the majority of the

[14] Makerspace NYC has a "Donate" button on their homepage and lists 3 sponsoring partners and 24 program partners on their website (MakerSpace NYC, 2019)

experiences of making and learning in a makerspace can be modeled and repeated. It is a place with a lot of non-verbal communication where skills are transferred by demonstrating. However, on the organizational front, language plays a crucial role. At Habibi.works, the staff and volunteers are mostly international and operate in English. Any language acquisition is usually reserved for the languages that are spoken by the makers they are working with. This creates a barrier between the makerspace and the Greek host community. With little to no Greek participation, this inhibits integration and has led to some resentment within the host community. To combat this, they have recently hired a Greek staff member and moved their staff housing away from the makerspace and into town in an effort to build relationship with the host community and bridge this gap. In Gaziantep and at Preemptive Love they noted the struggle to find qualified staff who could communicate with makers in Farsi, Turkish, Arabic, and Kurdish but also communicate adequately with donors and organization administrators in English.

5.5.1.3 Operations

Interviewee 6 noted that it was hard to find support staff to run the non-maker aspects of the program, (i.e., accounting, HR) who had enough experience in those areas but also the open-mindedness and sense of collaboration to let the younger engineers and technical teams lead. Several respondents noted, however, that experienced people in these administrative positions were necessary so that the creative teams had the freedom to do their job and weren't occupied with tasks outside of their expertise like marketing and fundraising. In Iraq, both Mosul Space and Preemptive Love also encountered challenges in procuring equipment and raw materials. While some parts or materials can be substituted many cannot and need to be imported.

5.5.1.4 Making lemonade

At Doin' Good in Lebanon, challenges like these have redefined the program. The intention at the creation of the makerspace was, like the others studied here, a publicly accessible shared workshop where makers could learn or sharpen a skill and then freely access tools and materials. Materials are included in the courses and the distance from the temporary settlements to the makerspace is easily surmounted during the training courses where transportation is provided to participants. But the organization doesn't have the funding to provide transportation and materials for all who might wish to continue the use of the makerspace so most people tend

to end their participation at the completion of the 12-week course. While continued access to the makerspace is technically permitted, due to the economic crisis in Lebanon and the irregular employment of the participants, the cost of raw materials and transportation means that in practice, no one continues to use the makerspace after the course is complete. The organization continues, however, to have a waiting list for all three of its training courses, and many makers wish to re-enroll or ask for a more advanced course. This goes to show that a makerspace that has to modify its practices because of insufficient funding can continue to provide a valuable service to the community.

It is worth noting that some challenges may not be solved by more funding. In the case of Mosul Space, the conflict itself, the invasion of ISIS was a severe hindrance in their early days and all the makerspaces studied were, like most of the world, significantly impacted by COVID-19. At its root, a makerspace is centered on community, interaction, collectivity, and collaboration (Asdourian & Lazarte, 2018). As many of the makers are already living in sensitive environments, the makerspaces studied here have all taken strict precautions during the pandemic, resulting in restricted access and limited interaction. Several respondents lamented the shift from a "buzzing vivid space that had opened doors, and anybody was welcome" (Interviewee 4) to appointment-based, socially-distanced workshops. Programs that were intended to generate not only craft but community, necessarily became a bit narrower in their output.

5.5.2 Enablers

5.5.2.1 Partnerships

In obvious contrast to the challenges of funding, a strong enabler to successful makerspace operation is organizational partnerships. Mosul Space opened with assistance from Field Ready and Caritas Czech Republic (Interviewee 1). Preemptive Love got their building from UNHCR (Interviewee 9). Doin' Good as a German organization lists 12 financial partners but also operates in Lebanon through an on-the-ground partnership with Salam LADC (Doin' Good).

5.5.2.2 Operations

Many respondents spoke about staffing, and the need to have both an engaged maker or team of makers at the center of the project and qualified administrative staff. Interviewee 6 was personally working from a co-working space in an HRS in Türkiye that had recently closed its makerspace due to lack of use. Without an inspired and inspiring maker, the room sat empty and

the equipment unused. Interviewee 6 also spoke of previous difficult experiences with only hiring makers and expecting engineers to act as accountants and an HR department. At Mosul Space, having trained people in each department streamlined operations:

> When it comes to real implementation, and satisfying donor demands, writing all the project, all the reports, all the proposals, maintaining good budget, and without a too high standard in mind, this is not easy when you consider how unstable things has been in Iraq for the past couple decades… You have to have an internal system, you have to have an HR, procurement, logistics, you basically have to have everything in this space." - Interviewee 1

In the makerspaces that are university adjacent, one very practical thing they noted was about access and availability. At Gaziantep, they observed that their working hours which included evenings were a real benefit to many. As the space was open until 8 pm, even after makers finished school or work, they could come and use the facilities for a few hours.

5.5.2.3 Make yourself comfortable

One surprising factor that encouraged participation at Habibi.works was hospitality. The makerspace functions as a community center as well and for many makers, the beginning of their engagement with the makerspace was a cup of tea and Wi-Fi access:

> "I remember, like when we started, like, me as this really driven young German woman looking at [people just] having cups of teas being like, 'This is a maker space, guys, come on, like…' it took me a while to understand that this is the first step that people need to take in order to make the space their own and to feel like they can get involved in some of the activities."- Interviewee 4

From there, they observed that many makers would begin their engagement with the low-tech working areas, building a shelf or fixing a bike so they could travel to town. After getting comfortable in those places, they might stretch into some of the higher-tech areas, expanding their skills and exploring new ones.

5.5.2.4 Childcare

An access issue that comes up in some of the camp-adjacent makerspaces is childcare. At Habibi.works, they have never had a children's maker program or planned childcare, but they do allow parents (usually mothers) with children under 5 to bring them into the safe working areas

(sewing room, creative atelier, media room, i.e., areas without heavy machinery) recognizing that it would be a barrier for many women (Interviewee 4). At Preemptive Love, which opened in 2020, there are four rooms intended for children. Like many things, this has been heavily impacted by the COVID-19 pandemic. The original plan included hiring a trained childcare worker to facilitate a little bit of making practice for the kids but mostly standard education "language, math, other stuff." (Interviewee 9) The COVID-19 pandemic has restricted this aspect of the program. For a little while, children were gathered in one of the rooms and the makers took turns caring for each other's kids but eventually, even this became a health risk and is currently non-operational (Interviewee 9). In the other makerspaces studied, perhaps because of their different maker demographics, childcare wasn't seen to be an area of much concern.

6 Discussion

Makerspaces have expanded from high-resource urban centers where they are both playgrounds for the rich and educational tools for the underprivileged and have been adopted as a tool for humanitarian relief and development. The initial appearances of these 'humanitarian makerspaces' were in relatively stable settings. European cities that had received refugees and asylum seekers saw makerspaces opened as a part of the response. Within the last several years, makerspaces can be found closer to the source of the conflicts that caused people to flee. They can be found in places where the conflict lingers and also where rebuilding has begun. This study looks at five unique makerspaces in conflict-affected settings to discover the functions and benefits of investing in this type of programming. This chapter will discuss how makerspaces are exceptionally useful to address certain aspects of the Capabilities Approach as explained by Nussbaum (2000) and elaborated by Ibrahim (2006) and Stewart (2005a).

6.1 Individual capabilities

Looking at makerspaces through the lens of the Human Capabilities, we can see the ways in which they expand an individual's capacity. At a fundamental level, having access to tools allows a person to build and create for themselves. Whether a user is improving their shelter or advancing their career, access to a makerspace removes a layer of forced dependency on others to provide for their needs. Even if there are outside forces limiting the extent of their freedoms in some areas, in many of the makerspaces studied here, we see people increasing their capacity

to shape their own environment. From a simple act of creating privacy in communal dwellings by making curtains to the social and political agency people can express through collective decision-making within the makerspace itself; through these opportunities, participants can recapture a portion of the capability they may have lost as a consequence of the conflict.

Nussbaum (2000) breaks down *control over one's environment* into two elements, the political and the *material.* It is the *material*, which is primarily about property and employment that is most relevant for this research. The theory and definitions used here come from Nussbaum's *Women's Capabilities and Social Justice* (2000) where she focuses Capabilities Approach on gender so it makes sense to begin the in the Preemptive Love makerspace, where we encounter a segment of the population that may find it difficult to engage with more formal employment or education for many reasons. For the women who comprise the majority of the makers in this space, both cultural norms and caregiving obligations may prohibit work or classes scheduled by a conventional employer or institution. The self-scheduled aspect of both the time and the amount of their participation in the makerspace supports involvement by women with other responsibilities and demands on their time. The makerspace allows users to both create the objects they need to better their physical environment and to increase their earning potential through skill development and in the case of Preemptive Love, a direct market for the items they produce.

We see expressions of what Nussbaum explains as "*meaningful relationships of mutual recognition with other workers*" exemplified in each case studied. The collaborative nature of the makerspace is a perfect example of this value realized. A makerspace can also circumvent *some* of the need for employment. This is especially important in circumstances where refugees are prevented from obtaining legal employment in a host country. When one becomes the means of production themselves, there is a reduced need to purchase the products of someone else's labor and thereby a reduced need to work for pay. This shouldn't excuse governments prohibiting refugees from working legally but in such circumstances, it mitigates the damage of such policies addressing deficits without creating dependency.

Nussbaum's idea of *affiliation* addresses an individual or collective capability for 'justice and friendship' 'self-respect and non-humiliation'(2000, p.232). The crossing of cultural barriers

like language, religion, and gender is seen in each makerspace. The Habibi.works representative tells of a tailor from Cameroon noticing an Afghan woman struggling at the sewing machine. With no shared language, he manages to show her what to do and the next time "these two people will cross paths in the camp, **they will have a connection to each other [they are] able to relate to each other in a way that they wouldn't before**."(Interviewee 4) At the beginning of the Preemptive Love makerspace, there was skepticism and hostility between makers of different backgrounds but that has grown into a community that actively reaches out to include new people and supports each other giving the profits of their own work to their co-makers when they recognize a need. This 'justice and friendship' benefits both the individual and the collective in the immediate sense and contributes to building future peace by encouraging people across divides toward collaboration rather than contention.

The 'self-respect and non-humiliation' aspect of Nussbaum's *affiliation* is also addressed by a makerspace. All the independence and autonomy one may possess in normal circumstances can fall short when faced with a new language and culture or the collapse of local institutions. When this frustration is compounded by the trauma of violent conflict, potential loss or theft of critical documents, and in some cases even detainment, 'self-respect and non-humiliation' can be severely damaged. Makerspaces have the potential to re-establish some of those qualities by removing the identity of 'victim' or 'refugee' (with its associations of being 'needy' or 'helpless' at best) and replacing it with 'carpenter' 'tailor' 'chef' or 'artist' (the associations being 'capable' or 'talented') perhaps restoring an identity they had previously or granting a new one for a new life (Interviewee 4). Food and clothing distributions and Cash-Based Initiatives can take care of necessities but the satisfaction of solving one's own problems and meeting one's own needs whether through the design and construction of goods or through makerspace-enriched income is perhaps the most important result that is unique to this type of programming.

6.2 Collective Capabilities

This study was initiated with hopes of learning that the introduction of a makerspace would allow the survivors of conflict to retain or recreate a sense of home and self, a connection to culture and tradition that could be lost in the destruction of war. While this aspect was not reported everywhere, the examples of recreating a pottery industry in Iraq and teaching Syrian

history through robotics in Türkiye show that makerspaces can provide this benefit in a multitude of ways, mostly dependent on *how* the approach is used by the people it benefits. Nussbaum (2000) discusses the human capacity for *Senses, Imagination, and Thought* in a way that includes artistic expression, creativity, and "producing works of one's own choice" (p. 232). This data shows that along with increasing users' capacity in more quantifiable areas like education and employment, a makerspace improves users' freedom to exercise their creativity. This freedom is important for the individual maker who can shape their surroundings but also for the community they belong to. At Mosul Space, makers can use the CNC router to carve wedding gifts and home décor while across the room, someone else is 3D printing bells for UNESCO's project to restore the aesthetics of the Old City. On one end of the spectrum, intimate, personal, and private art; on the other, works that help a whole community remember their identity and history. The more frequently employed TVET model can provide much-needed technical skills and training but this opportunity for artistic expression and creativity satisfies a deep human desire and is unique to the makerspace approach.

As this thesis engages the concept of collective capabilities, the question of makerspace versus VTP becomes relevant. Instead of teaching a whole group one particular skill,

> A makerspace is "giving people a lot more skills to be able to create and be inventive and make businesses that are needed, **rather than like 50 people learning to make the same thing which then wipes out the market**." -Interviewee 6

If the goal is to increase not only the individual's capabilities but also those of the community, a makerspace provides the tools to innovate and create, to identify needs or problems around them, and to solve them. It is an extrapolation of the well-known "give a man a fish" proverb. The potential of the makerspace is just so much more expansive. This is not to say that makerspaces should replace VTPs rather, they function well in tandem. Some individuals will find themselves more suited to the concrete training that a VTP provides, and some will flourish in the broad possibilities of a makerspace where the diversification of skillsets and encouraged innovation increases the community's capacity to tackle a broader range of challenges.

6.3 Sustainability

Practitioners can approach a makerspace from two different financial perspectives. With Doin' Good and the Field Ready Space in Gaziantep where the programs were entirely donor-funded, the results were either, cessation of the project in the case of Field Ready or significant adaptation as in Doin' Good where program leaders admit that what they have is not strictly speaking functioning as a makerspace. It is certainly true that a program needn't run forever to be considered successful. A makerspace can function as a short-term intervention but the one in Gaziantep didn't end because the demand for it dried up rather, the funding. The adaptation of Doin' Good's makerspace towards more of a TVET model allowed them to keep benefitting the community they serve albeit in a more restricted fashion than intended.

Mosul Space receives both member fees and local manufacturing orders. Preemptive Love has its commercial arm in Sisterhood Collection. Both still rely on donor funding, but these makerspaces are on the road to financial sustainability. The director of the Preemptive Love space is optimistic that it will one day be able to operate independently of the organization, the livelihoods of the makers secure against donor whims and global fundraising trends. Even the little Field Ready makerspace/workshop in the embattled region of Syria continues to survive because of its ability to manufacture and sell locally. I admittedly hoped to find that the 'making' itself was the most crucial part of operating a makerspace, but it seems that even here, finding some way to make *money* is still imperative. Even in HRSs in the Global North, only roughly ten percent of makerspaces are profitmaking businesses (Holman, 2015).

It is only Habibi.works that has managed to maintain and even expand their offerings on purely donor funding. They pride themselves on not receiving government funding thus far, allowing them exceptional flexibility and the ability to pivot when needed.

> "But at the same time, this liberty, this freedom of flexibility comes with a lot of insecurity, we never have more money on our bank account than for the next three months. And still, we have to plan for a year or two if we really want a sustainable project, and not like invest in short-sighted solutions."
>
> - Interviewee 4

In connection, follow-up inquiries with Habibi.works confirmed that the new refugee crisis caused by the Russian invasion of Ukraine has impacted their operations in Greece both in terms of funding and staffing. As public attention has shifted, so have money and volunteers.

There is a common thread between Preemptive Love and Habibi.works that both reference in terms of sustainability. Both spaces grew up out of community-expressed needs.

> The reason that we chose to set up a makerspace was the observation that during [a previous] month that we had spent in the camp, so many people had approached us not only for food, but to ask for the tools that we had used to set up the kitchen, for our drivers, for our saws, for so many things. And we realized *Wow. Like, people live under really dire conditions, but they do have ideas and they do have skills to improve them.* - Interviewee 4, emphasis added

At Preemptive Love, in fact, the respondent said that she wouldn't necessarily choose to replicate this program elsewhere. While it has produced a demonstrably positive impact, the makerspace was created in response to the specific needs of the specific community. It is far from self-sufficient, relying heavily on donor support despite its commercial facet. Key partnerships[15] make it financially feasible but the makerspace is an expensive project to run and as a sustainable business model it probably can't be dropped into circumstances without vibrant local market demand. There is a limit to the reach of their online shop and adding products from more locations won't necessarily expand that market.

6.4 Only *part* of the solution

It is crucial to note that central to Nussbaum's exploration of Human Capabilities is the idea that a deficit in one area cannot be overcome by an abundance in another area (Nussbaum, 2000, p. 233). She writes that the ten areas on her list are "distinct in quality" but that each one is "of central importance" (Nussbaum, 2000, p. 233). This distinctness should not however be equated with independence; on the contrary, the areas on her list are intricately related and improvement in one *may* lead to improvement in another. Nussbaum gives the example of improved women's

[15] Preemptive love invested a significant sum into renovating the abandoned warehouse that became their makerspace but the building itself was given to them by UNHCR (Interviewee 9).

literacy resulting in improved political participation or *control over one's environment* (Nussbaum, 2000, p. 233).

Makerspaces are not a fix-all solution for conflict-affected communities but applied in combination with other initiatives, they positively impact people's present circumstances and may reduce the duration that other emergency response initiatives are necessary. Just as increasing someone's capacity for play won't make up for insufficient control over their political environment (two of Nussbaum's central human functional capabilities), the presence of a makerspace will not compensate for deficits in safety or freedom of movement for those whose *Life* or *Bodily Integrity* (Nussbaum, 2000) are compromised by violent conflict or reluctant or overburdened bureaucracy. Access to a makerspace will not even directly address issues of inadequate access to food, shelter, or healthcare (Nussbaum calls this *Bodily Health*). It will, however, indirectly allow people to repair or enhance inadequate shelter. It will sharpen and expand skills that can lead to employment, aiding in the procurement of sufficient and satisfying food. And the capacity shown in Syria and Iraq to keep local medical equipment in working order contributes to collective access to adequate healthcare. Conflict-affected communities still need the first-wave emergency response of food, water, shelter, and medical care but once the situation moves from crisis response to recovery or long-term management, makerspaces provide these unique opportunities for conflict-affected communities to participate in their own care.

> It is really about reducing the cost and … supporting the people locally. So, you are not like only purchasing from a company and just to give… **you are empowering them**, you are training them on how to do it. - Interviewee 7

6.5 Recommendations for future research

This study notes in its Limitations the lack of maker (or beneficiary) input. Future research would do well to engage personally with the makers themselves to learn if their experiences align with the reports of the program leaders. Along the lines of Habibi.works' mental health outcomes, there may also be impacts—positive or negative—not intentioned or perceived by the implementers but reported by beneficiaries. This data would strengthen the validity of the

findings recorded here and potentially better support one goal of this research namely, institutional understanding of and appreciation for makerspaces.

Having learned something about what makerspaces can accomplish during and post-conflict, it would also be valuable to see if makerspaces can play a role in preventing conflict. Data shows that makerspaces when well-staffed and funded can provide the outcomes described here, expanding human capabilities. Stewart (2005a) stated that horizontal inequalities and diminished capabilities increase the likelihood of conflict so is the opposite true? To thoroughly investigate this would likely require the creation of makerspaces in conflict-prone areas and long-term study. It is also, of course, very difficult to give explanations for things that *don't* happen, but could more makerspaces, more collaboration and cooperation, more opportunity to exercise creative capabilities, to be at once self-reliant and interdependent within community, lead to less violent conflict?

7 Conclusion

The number of people displaced and otherwise affected by conflict has doubled in the last decade. The actors tasked with responding to the needs of conflict-affected people employ a range of approaches. One recent addition to the menu are makerspaces. This study set out to learn about five makerspaces that benefit conflict-affected populations. Interviews were conducted with program leaders of makerspaces in five uniquely conflict-affected settings (four that deal primarily with refugees and displaced people and one in a city rebuilding after war). After using a maturity grid designed by Corsini and Moultrie (2020), to explore the reasons makerspaces are a benefit to the development toolkit and the people who use them, the study looks at the factors that hinder and enable makerspace construction and utilization. In agreement with Corsini and Moultrie, this study shows that makerspaces have the potential to provide significant benefits and that their innate flexibility allows them to respond adeptly to the needs of conflict-affected people but that this potential is often limited by resources.

This research shows that makerspaces strengthen the individual and collective capabilities of users in specific areas. They result in improved mental health, and social connection and often improve participants' livelihoods through either direct (employment or market access) or indirect (education and skills development) means. Other types of

programming offer similar benefits, however, there are additional results that are unique to makerspaces. They enable people to exercise a level of choice and preference in their living conditions (within the constraints of not always having a choice in *where* they live).

Anyone who has knit a scarf, built a bookshelf, or prepared a nice meal knows the satisfaction of 'making,' of turning raw materials into something useful and hopefully beautiful. Makerspaces give people the satisfaction of creation and production, of transforming parts into something whole, of problem-solving on their own terms and in their own abilities. Additionally, people are able to use this creativity to restore and maintain traditional aspects of their culture. When creating a new life in a new place, people can retain an aesthetic connection to their place of origin. In cases of reconstruction in the aftermath of conflict, makerspaces can help restore traditional industries like pottery in Sulaymaniyah as well as give communities the capability to literally rebuild their physical surroundings.

The makerspaces studied here seem to be, through either intention or coincidence, especially beneficial to women and youth. Makerspaces may innately attract more open-minded, innovative people (Interviewee 6) making them natural places to find these groups that may feel excluded from some settings. In these cases, this quality is augmented by things like providing childcare, and proximity to a university.

The last section of this research is dedicated to collecting the experiences of the practitioners operating humanitarian makerspaces in order to learn what helped and what hindered the process of establishing and managing a makerspace. The results show that in each case, the most significant challenge was securing funding. There were additional responses around diversely skilled staffing and the benefit of institutional partnerships but this one issue of funding reshaped programs or even canceled them altogether despite active user engagement and demonstrable benefit. I believe the data shows the value of makerspaces in partnership with other types of aid for developing individual and collective capabilities in conflict-affected settings and hope that it also serves to promote greater institutional support for their implementation and operation.

REFERENCES

Ahmed, A. (2019). Impacts of Vocational Training for Socio-economic Development of Afghan Refugees in Labor Markets of Host Societies in Baluchistan. *Journal of International Migration and Integration*, 20: 751-768. doi: https://doi.org/10.1007/s12134-018-0627-4.

Anderlini, S. N. & El-Bushra, J. (2004). Post-conflict reconstruction. *Inclusive security, sustainable peace: A toolkit for advocacy and action*: 51-68.

Asdourian, B. & Lazarte, J. (2018). Making for humanity: Why Makers Participate in Distributed Problem-Solving Humanitarian Projects. *Nordisk Tidsskrift for Informationsvidenskab og Kulturformidling*, 7: 32-45. doi: 10.7146/ntik.v7i2.111298.

Auwera, S. v. d. (2012). Contemporary Conflict, Nationalism, and the Destruction of Cultural Property During Armed Conflict: A Theoretical Framework. *Journal of Conflict Archaeology*, 7 (1): 49-65. doi: 10.1179/157407812X13245464933821.

Berg, B. L. & Lune, H. (2012). *Qualitative Research Methods for the Social Sciences.* . 8th edition, international. ed. USA: Pearson.

Bryman, A. (2012). *Social Research Methods*. 4th ed.: Oxford University Press.

Camci, A., Temur, G. T. & Beskese, A. (2018). CNC router selection for SMEs in woodwork manufacturing using hesitant fuzzy AHP method. *Journal of Enterprise Information Management*.

Cavalcanti, G. (2013). Is it a Hackerspace, Makerspace, TechShop, or FabLab? *Make:*.

Comim, F. & Carey, F. (2001). *Social capital and the capability approach: are Putnam and Sen incompatible bedfellows*. EAEPE Conference, Siena.

Conservation X Labs. (2021). *The Digital Makerspace*. Available at: https://conservationxlabs.com/digital-makerspace (accessed: 13 Aug 2021).

Corsini, L. & Moultrie, J. (2018). *The role of Makerspaces for crisis-affected communities: benefits and challenges*. Fab14 + Fabricating Resilience Research Papers Stream, Toulouse, France, pp. 93-101.

Corsini, L., Aranda-Jan, C. B. & Moultrie, J. (2019). Using digital fabrication tools to provide humanitarian and development aid in low-resource settings. *Technology in Society*, 58: 101117. doi: https://doi.org/10.1016/j.techsoc.2019.02.003.

Corsini, L. & Moultrie, J. (2020). Humanitarian makerspaces in crisis-affected communities. *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, 34 (3): 374-386. doi: 10.1017/S0890060420000098.

Cost of Living in Iraq. (2022). Available at: https://www.expatistan.com/cost-of-living/country/iraq (accessed: 2 MAY 2022).

Devictor, X. & Do, Q.-T. (2017). How Many Years Have Refugees Been in Exile? *Population and Development Review*, 43. doi: 10.1111/padr.12061.

Devictor, X. (2019). *2019 update: How long do refugees stay in exile? To find out, beware of averages*. Development for Peace, 28 APR 2022: World Bank.

Dodge, R., Daly, A. P., Huyton, J. & Sanders, L. D. (2012). The challenge of defining wellbeing. *International journal of wellbeing*, 2 (3).

Doin' Good. Available at: https://www.doin-good.com/en/who-we-are (accessed: 13 MAR 2022).

Doin' Good. *Makerspace Lebanon*. Available at: https://www.doin-good.com/en/lernwerkstatt-libanon (accessed: 13 MAR 2022).
Earnest, J. (2015). Post-conflict reconstruction – a case study in Kosovo. *International Journal of Emergency Services*, 4 (1): 103-128. doi: 10.1108/IJES-02-2015-0009.
Field Ready. (2022). *About Field Ready*. Available at: https://www.fieldready.org/about-us (accessed: 11 MAR 2022).
Francioni, F. & Lenzerini, F. (2006). The obligation to prevent and avoid destruction of cultural heritage: From Bamiyan to Iraq. *Art and cultural heritage: Law, policy and practice*, 14: 28.
Ginting, R., Hadiyoso, S. & Aulia, S. (2017). Implementation 3-axis CNC router for small scale industry. *International Journal of Applied Engineering Research*, 12 (17): 6553-6558.
Habibi.works. Available at: https://habibi.works (accessed: 1 MAR 2022).
Holman, W. (2015). Makerspace: Towards a New Civic Infrastructure. *Places Journal*, November 2015. doi: https://doi.org/10.22269/151130.
https://mechanicsinstitutes.org. Available at: https://mechanicsinstitutes.org (accessed: 8 MAR 2022).
Huppert, F. A. (2014). The state of wellbeing science. *Concepts, measures, interventions, and policies: UK John Wiley & Sons*.
Ibrahim, S. S. (2006). From Individual to Collective Capabilities: The Capability Approach as a Conceptual Framework for Self-help. *Journal of Human Development*, 7 (3): 397-416. doi: 10.1080/14649880600815982.
International Organization for Migration. (2022). *Save Lives and respond to Humanitarian Needs*. Geneva, Switzerland. Available at: https://www.iom.int/save-lives-and-respond-humanitarian-needs (accessed: 21 APR 2022).
IOM Global Migration Data Analysis Centre. (2022). *Crisis Movements*. Available at: https://www.migrationdataportal.org/ukraine/crisis-movements (accessed: 13 MAY 2022).
Jabbar, S. A. & Zaza, H. I. (2016). Evaluating a vocational training programme for women refugees at the Zaatari camp in Jordan: women empowerment: a journey and not an output. *International Journal of Adolescence and Youth*, 21 (3): 304-319. doi: 10.1080/02673843.2015.1077716.
Jäger, T. *Home.work*. Available at: https://habibi.works/home-work/ (accessed: 1 MAR 2022).
James, L. (2017, 19-22 Oct. 2017). *Opportunities and challenges of distributed manufacturing for humanitarian response*. 2017 IEEE Global Humanitarian Technology Conference (GHTC).
Keune, A. & Peppler, K. (2018). Materials-to-develop-with: The making of a makerspace. *British Journal of Educational Technology*, 50. doi: 10.1111/bjet.12702.
Kvamsås, H., Neby, S., Haarstad, H., Stiller-Reeve, M. & Schrage, J. (2021). Using collaborative hackathons to coproduce knowledge on local climate adaptation governance. *Current Research in Environmental Sustainability*, 3: 100023. doi: https://doi.org/10.1016/j.crsust.2020.100023.
Lenzerini, F. (2020). Intentional Destruction of Cultural Heritage. In *The Oxford Handbook of International Cultural Heritage Law*.

Lowndes, V. & Polat, R. K. (2020). How do local actors interpret, enact and contest policy? An analysis of local government responses to meeting the needs of Syrian refugees in Turkey. *Local Government Studies*: 1-24. doi: 10.1080/03003930.2020.1825386.
MakerSpace NYC. (2019). *Home: What do you Want to Make Today?* Staten Island, NY. Available at: https://www.makerspace.nyc (accessed: 05.04.2021).
Mayssa Awad, J. A. (2021). *'Part of village life': Ten years on, Syrian refugees still crowd Lebanon's Bekaa valley*. On the Ground: France24. p. 1:59.
Médecins Sans Frontières. (1997). Refugee health. *An approach to emergency situations*.
Melchionne, K. (2017). Aesthetic Choice. *The British Journal of Aesthetics*, 57 (3): 283-298. doi: 10.1093/aesthj/ayx019.
Migration Data Portal. (2022). *Global Trends of Total Forced Displacement (End of 2011 -end of 2020)*. Berlin: Migration Data Portal.
Milner, J. & Loescher, G. (2011). Responding to protracted refugee situations: Lessons from a decade of discussion.
Mosul Space. *Mosul Space: innovation and tech hub*.
Nussbaum, M. (2000). Women's Capabilities and Social Justice. *Journal of Human Development*, 1 (2): 219–247.
Olsson, L., Opondo, M., Tschakert, P., Agrawal, A. & Eriksen, S. E. (2014). Livelihoods and poverty.
Papadapoulos, A. (2020). Calm was restored in the refugee structure in Katsikas. *Epirus Online*. Available at: https://epirusonline.gr/eidiseis/ipeiros/apokatastathike-i-iremia-sti-domi-prosfygon-ston-katsika/.
Preemptive Love. (2021). *Our Work*. Available at: https://preemptivelove.org/our-work/ (accessed: 05.03.2021).
Rass, E., Lokot, M., Brown, F. L., Fuhr, D. C., Asmar, M. K., Smith, J., McKee, M., Orm, I. B., Yeretzian, J. S. & Roberts, B. (2020). Participation by conflict-affected and forcibly displaced communities in humanitarian healthcare responses: A systematic review. *Journal of Migration and Health*, 1-2: 100026. doi: https://doi.org/10.1016/j.jmh.2020.100026.
Removing Unfreedoms. (2007). *The Five Freedoms: Components of the shared international development framework*. Available at: https://www.removingunfreedoms.org/five_freedoms.htm (accessed: 30 MAR 2022).
Riedlmayer, A. J. (2007). Crimes of War, Crimes of Peace: Destruction of Libraries during and after the Balkan Wars of the 1990s. *Library Trends*, 56 (1): 107-132.
Saebi, T., Foss, N. J. & Linder, S. (2019). Social Entrepreneurship Research: Past Achievements and Future Promises. *Journal of Management*, 45 (1): 70-95. doi: 10.1177/0149206318793196.
Sen, A. (1999). *Development as Freedom*. Oxford: Oxford University Press.
Simplemaps. (2022). *Greece Cities Database*. Available at: https://simplemaps.com/data/gr-cities (accessed: 2 MAY 2022).
Sisterhood Products. (2021a). *Being creative is not a hobby it's a way of life! At sisterhood program we create our own opportunities.* sisterhoodproducts (ed.).

Sisterhood Products. (2021b). *Our Ramadan's limited edition candles are now available! Order those amazing handmade pieces and enjoy their soothing cashmere scents.* sisterhoodproducts (ed.): Instagram.
Sisterhood Products. (2022). *Our cookie mold is the perfect gift for the baker in your life. This cookie mold is handmade of Malaysian teak by refugees in Iraq and is as beautiful as it is functional.* sisterhoodproducts (ed.): instagram.
Stewart, F. (2005a). Groups and Capabilities. *Journal of Human Development*, 6 (2): 185-204. doi: 10.1080/14649880500120517.
Stewart, F. (2005b). Horizontal inequalities: A neglected dimension of development. In *Wider perspectives on global development*, pp. 101-135: Springer.
UNESCO. (2021). *Revive the Spirit of Mosul*. Available at: https://en.unesco.org/fieldoffice/baghdad/revivemosul (accessed: 28 APR 2022).
UNHCR. *MADE51 crafted by refugees*.
UNHCR. (2019). *EDUCATION BRIEF: Key considerations on Technical and Vocational Education and Training (TVET)*.
UNHCR. (2021a). *GLOBAL TRENDS Forced Displacement in 2020* Copenhagen.
UNHCR. (2021b). *Refugee Data Finder*. Available at: https://www.unhcr.org/refugee-statistics/download/?url=G4ipE1 (accessed: 13 Mar 2022).
UNHCR. (2021c). *Turkey-Fact sheet September 2021*. In UNHCR (ed.).
UNHCR. (2022a). *Cash-Based Initiatives*. Available at: https://www.unhcr.org/cash-based-interventions.html (accessed: 21 APR 2022).
UNHCR. (2022b). *Greece*. Available at: https://reporting.unhcr.org/greece?year=2022#toc-populations (accessed: 1 MAY 2022).
UNHCR. (2022c). *LEBANON - NEEDS AT A GLANCE - 2022*.
UNHCR. (2022d). *What We Do*. Available at: https://www.unhcr.org/what-we-do.html (accessed: 21 APR 2022).
UNHCR , E. (2009). Conclusion on Protracted Refugee Situations
No. 109 (LXI) - 2009.
UNHCR IM Unit. *Camp Profile: Arbat Transit Refugee Camp, Suleimaniyah, KR - Iraq*: UNHCR The UN Refugee Agency.
USAID. (2022). *MOSUL'S INNOVATORS*
. Available at: https://www.usaid.gov/iraq/program-updates/sep-2021-mosuls-innovators (accessed: 10 APR 2022).
Van Den Hoek, J., Friedrich, H., Ballasiotes, A., Peters, L. & Wrathall, D. (2021). Development after Displacement: Evaluating the Utility of OpenStreetMap Data for Monitoring Sustainable Development Goal Progress in Refugee Settlements. *International Journal of Geo-Information*, 10: 153. doi: 10.3390/ijgi10030153.
World Bank Group. Classification of Fragility and Conflict Situations for World Bank Group Engagement.
Zubair, N., Ayub, A., Yoo, H. & Ahmed, I. (2022). PEM: Remote forensic acquisition of PLC memory in industrial control systems. *Forensic Science International: Digital Investigation*, 40: 301336. doi: https://doi.org/10.1016/j.fsidi.2022.301336.

Appendix 1: Table of interviewees

	Organization	Location of Makerspace	Nationality of program leader	Gender
Interviewee 1	Mosul Space	Iraq	Local	M
Interviewee 2	Mosul Space	Iraq	Local	M
Interviewee 3	Mosul Space	Iraq	Local	M
Interviewee 4	Habibi.works	Greece	International	F
Interviewee 5	Doin' Good	Lebanon	International	F
Interviewee 6	Field Ready	Multiple locations	International	F
Interviewee 7	Field Ready	Turkey/ Syria	Local	M
Interviewee 8	Field Ready	Iraq	Local	F
Interviewee 9	Preemptive Love	Iraq	Local	F

Appendix 2: Staff interview guide

Staff Interview Guide	
demographics	Age Gender Nationality Education Occupation
practices	For how long have you been involved with the makerspace? Can you tell me about how the program began? Can you describe a typical day at the makerspace? What are your daily responsibilities? Which tools are used most frequently? How does the setting and target user impact the design and programming of the makerspace?
engagement	How do users benefit from involvement with the makerspace? How has the community responded to the introduction of the makerspace? What are the barriers you have seen to participation? Have you noticed any qualities in an individual or group that increase likelihood of participation/success?
outcomes/ expectations	How does the makerspace fit unto the organisation as a whole? what are the short term goals of the makerspace? How do you define success in terms of the project? How do you measure success? what have been some successes of the program? Some disappointments? How do you feel the makerspace uniquely addresses the needs of conlflict-affected people? (Why this and not vocational training?) How does this project contribute to the goal of building peace?
future	How would you like to improve this program? Is there a timeline for user involvement? Do you think the makerspace has a permanent place in the community?

Appendix 3: User questionnaire

First name
Age
Gender

Nationality
Education
Occupation/current? Previous?

When did you join the makerspace?

What do you make in the makerspace? Where did you learn to make it?

What skills have you learned there?

How did you become involved with the makerspace?

Were there any things that made it hard (or easy) to join the makerspace? Tell me about them.

Why do you choose to participate in this makerspace?

Have you participated in a vocational training program?
If so, how does the makerspace compare?

How has your family/community responded to your participation?

Has the makerspace affected your expecations for your future? Your family? How?

How has the makerspace impacted your economic situtation?

How has the makerspace impacted your mental/emotional life?

Do you make things for use in your home/community?

How long do you think you will participate in the makerspace?

Do you think the makerspace has a permanent place in the community?

Norges miljø- og biovitenskapelige universitet
Noregs miljø- og biovitskapelege universitet
Norwegian University of Life Sciences

Postboks 5003
NO-1432 Ås
Norway