

Infrastructural Inaccessibility

Tech Entrepreneurs in Occupied Palestine

Bjørn, Pernille ; Boulus-Rødje, Nina

Published in:

ACM Transactions on Computer-Human Interaction

DOI:

[10.1145/3219777](https://doi.org/10.1145/3219777)

Publication date:

2018

Document Version

Peer reviewed version

Citation for published version (APA):

Bjørn, P., & Boulus-Rødje, N. (2018). Infrastructural Inaccessibility: Tech Entrepreneurs in Occupied Palestine. *ACM Transactions on Computer-Human Interaction*, 25(5), 1-31. [26]. <https://doi.org/10.1145/3219777>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain.
- You may freely distribute the URL identifying the publication in the public portal.

Take down policy

If you believe that this document breaches copyright please contact rucforsk@kb.dk providing details, and we will remove access to the work immediately and investigate your claim.

Infrastructural Inaccessibility: Tech Entrepreneurs in Occupied Palestine

PERNILLE BJØRN, University of Copenhagen, Denmark
NINA BOULUS-RØDJE, Roskilde University, Denmark

Abstract

In this paper, we examine the fundamental and taken-for-granted infrastructures that make tech entrepreneurship possible. We report from a longitudinal ethnographic study of tech entrepreneurs situated in occupied Palestine. By investigating this polar case of tech entrepreneurship, we identify critical infrastructures which are otherwise invisible and go unnoticed. We propose *infrastructural accessibility* as a method to identify available and absent infrastructures in concrete trans-local situations. Infrastructural accessibility leads us to identify multiple dimensions of critical infrastructures necessary for the success of tech start-ups. This includes infrastructures related to location, community, funding, digital platforms, politics, and history. Our study shows how these multiple dimensions of infrastructural accessibility shape the everyday practices of tech entrepreneurs. Furthermore, our study reveals how Palestinian tech entrepreneurship is characterized by infrastructural *inaccessibility* due to missing infrastructures related to mobility, legal frameworks, payment gateways, and mobile Internet. Infrastructural *inaccessibility* seriously limits tech entrepreneurs' potential to succeed in creating a long-term sustainable tech industry.

Categories and Subject Descriptors: **K.4.3 [Computer-Supported Collaborative Work]**

General Terms: CSCW, politics, ethnography, Palestinian, entrepreneurs, infrastructures, accessibility, visibility, mobility, tech start-up, innovation, occupation

Additional Key Words and Phrases: Participatory design

1. INTRODUCTION

Tech entrepreneurship is typically presented as something which is associated with Silicon Valley (Welter et al. 2017), with West Coast IT workers engaging in cultural settings depicted by colourful interiors (Meel and Vos 1999), and shaping our digital futures (Pearce 2013) with an interest in the contemporary art of Burning Man (Turner 2009). The discourse of tech entrepreneurship centres around concepts such as 'fast failing', 'scaling globally', 'minimal viable products', and 'lean start-up' (Blank 2013). Thus, being able to pitch ideas, create business cases, and build prototypes is viewed as a generic global trend of tech innovations, where meritocracy and technical skills are considered the fundamental driving forces. As expressed by Michael Arrington, the founder of TechCrunch, 'success in Silicon Valley, most would agree, is more merit driven than almost any other place in the world. It doesn't matter how old you are, what sex you are, what politics you support or what colour you are. If your idea rocks and you can execute, you can change the world and/or get really, stinking rich' (Reagle 2017). Tech innovations tend to be portrayed as existing in a vacuum, detached from local circumstances, neglecting the importance of the socio-technical infrastructures which characterise Silicon Valley. Interestingly, the Silicon Valley culture is being mimicked around the world, with innovation hubs, incubators, and accelerators decorated with whiteboards, glass walls, post-it notes, and sharpies (Irani et al. 2010). The assumption is that tech entrepreneurship can develop anywhere in the world because of the available distribution platforms which, for example, enable App developers in Finland to sell their digital products to users in Africa. Technology innovations are perceived as having the ability to cross international borders owing to the existence of large global digital platforms such as AppStore and PayPal. Thus, the infrastructure of the Internet makes digital products accessible across the world, reaching peoples' local settings and private devices.

In this paper, we critically examine the phenomenon of creating and mimicking global tech entrepreneurship and explore the infrastructures that hold global tech innovation afloat. Well-functioning infrastructures tend to move into the background and become inaccessible for scrutiny, except during breakdowns (Star 1999). Thus, we investigate the taken-for-granted infrastructures that support tech entrepreneurs by shifting the focus away from the centre of Silicon Valley and zooming into the fringes of the global tech industry. Breakdowns are more likely to exist at the fringes and reveal the nature of the infrastructures outside the well-oiled machine of Silicon Valley.

Thus, we explore tech entrepreneurship in Palestine and use this as a polar case to study entrepreneurship as it takes place in the periphery. This is an interesting case, as Palestine is typically not associated with tech entrepreneurship. Furthermore, there are only a couple of Human Computer Interaction (HCI) studies on Palestine (Aal et al. 2014, Stickel et al. 2015), and their focus is not explicitly on tech entrepreneurship. Palestinian tech entrepreneurs are situated within the politically contested territory of Palestine (primarily the West Bank), which has been occupied by the Israeli government for almost 50 years. Palestinian tech entrepreneurs have never experienced life without occupation, and they envision digital technologies as having great potential in helping them build a stable and semi-independent economy and decreasing the extremely high unemployment rate. Technology is considered to be ‘one of the only sectors with the potential to grow under the status quo conditions of the Israeli occupation’ (Economy 2016). While the Palestinian high-tech sector is still in its infancy, an increasing number of new initiatives and programs have been established only in the past few years. Palestinian investors and entrepreneurs have strong faith in IT, viewing it as having the power to *‘push the Palestinian economy and improve the chances of having a resolution for the conflict. [There is a] belief[] that more robust and strong Palestinian economy will improve the chances to reach peace... [and that it will help] convince Israelis that Palestinians are not enemies. Basically, they are normal people who want to...have normal lives and establish businesses’* (Yousef, Ramallah, July 2015).

While we often hear the voices of Palestinian activists or Palestinian terrorists, the voices of Palestinian tech entrepreneurs are rarely heard in public media and academic discourse (Boulus-Rødje et al. 2015). By providing space for these voices, we introduce into HCI an unnoticed growing sector of tech entrepreneurship. More importantly, we gain significant insights into the underlying taken-for-granted and otherwise invisible infrastructures which serve as the core scaffold of global tech entrepreneurship and technology design. Being a polar case with inadequate infrastructures, studying Palestinian entrepreneurship presents a unique opportunity to explore the fundamental role that global infrastructures play in the tech entrepreneurship scene. Furthermore, the case provides the possibility of exploring unnoticed sites of design (Bardzell et al. 2017), as well as the pertinent role that political conflicts, power relations, and marginal voices play in technology design. The following research question guides our work: *What are the characteristics of the taken-for-granted infrastructures which are fundamental for keeping global tech entrepreneurship afloat?*

From the literature, we identified five types of infrastructures that are crucial for the functioning of global tech entrepreneurship. These include *infrastructures of location* (Bjørn et al. 2017, Welter et al. 2017), *infrastructures of community* (Hui and Gerber 2017), *infrastructures of funding* (Lins and Lutz 2016), *infrastructures of digital platforms* (Belleflamme, Lambert et al. 2014), and *infrastructures of politics and*

history (Bijker et al. 1987). Furthermore, we identify additional types of infrastructures that are crucial for enabling entrepreneurs to reach both local and global users as well as investors. These additional infrastructures include *legal frameworks, mobility, payment gateways, and mobile Internet*. These were pertinent in our empirical data due to the absence of ‘breakdowns’. Thus, despite the general assumptions that digital products can easily cross national and international borders, the *visible* and physical bordering mechanisms (e.g. checkpoints, roadblocks, walls, gates and fences) are further strengthened by the *invisible* mechanisms regulating the digital borders of Internet, telecommunication and money flow.

To keep afloat, Palestinian tech entrepreneurs have to constantly reposition themselves and their technological innovations in order to manoeuvre the *infrastructural inaccessibility*, which serves as the foundation for their work. Our study shows that tech entrepreneurship under occupation is characterized by infrastructural *inaccessibility*, which severely restricts Palestinian entrepreneurs by introducing unwanted invisibility and immobility through digital and physical border mechanisms. Thus, in this case, both visibility and mobility become equally important. To put it bluntly, it is difficult to access something when one’s mobility is restricted, and it is even harder to access something that is invisible. We propose *infrastructural inaccessibility* as a method to conceptualize the limitations and constraints of tech entrepreneurship when crucial infrastructures do not exist or are broken. When discussing infrastructural inaccessibility in the global tech innovation scene, it is important to keep in mind that it includes both the possibility of *reaching the outside world* and the possibility for *the outside world* to reach Palestine, thus it encompasses local sites of innovation within the global tech scene and making the localized tech entrepreneur globally accessible.

The contribution to HCI is multiple. Firstly, we join others in unpacking the different ways tech entrepreneurship is accomplished around the globe (Ames et al. 2014, Lindtner et al. 2014, Shklovski et al. 2014, Irani 2015) by providing new theoretical underpinnings that are critical for how we approach tech innovation in HCI. Secondly, we unpack the multiple dimensions of infrastructures, which are essential if we are to include peripheral locations in the global tech economy. Finally, we propose infrastructural inaccessibility as a way to capture the asymmetric accessibility which is shaped by invisible digital mechanisms. Infrastructure inaccessibility is the key that controls the access to critical socio-technical infrastructures, shaping tech entrepreneurs’ space to manoeuvre and their potentials to become successful.

The remainder of the paper is structured in the following manner: First, we discuss existing literature on infrastructures to identify the fundamental infrastructures which generally foster tech entrepreneurship both in HCI and related fields. Then, we introduce our method, empirical setting, data sources, and analytical approaches. This is followed by the results section in which we unpack our empirical findings and explore the infrastructural constraints that are shaping tech entrepreneurship and are the result of the long-standing occupation of Palestine. Finally, we introduce and discuss infrastructural inaccessibility and characterize the taken-for-granted infrastructures which are fundamental for keeping the global tech entrepreneurship afloat.

2. INFRASTRUCTURES FOR TECH ENTREPRENEURSHIP

Infrastructures serve as the foundation for interactions and collaborations between heterogeneous distributed actors who are involved in a common engagement. While the engagement can assume many different forms, the infrastructures are the scaffolds that make the interaction possible in open-ended ways. Infrastructures are the ubiquitous persistent socio-technical systems which ensure the delivery of all kinds of services (Mainwaring et al. 2004). Studying infrastructures is a core concern because technologies shape and are shaped by the multiple infrastructures within our societies. HCI research has a long tradition for examining infrastructures in different domains including, for example, infrastructures for scientific work (Bietz et al. 2010, Steinhardt and Jackson 2014), infrastructures for elections (Boulus-Rødje and Bjørn 2015), breakdown of infrastructures after natural disasters (Patterson 2015), infrastructures of healthcare (Ellingsen and Monteiro 2003, Langhoff et al. 2018), infrastructures of displacement (Ahmed, Mim et al. 2015), and infrastructure of repair (Rosner and Ames 2014). Recently, the infrastructure perspective has also been utilized to understand entrepreneurial activities in the Blockchain domain (Jabbar and Bjørn 2017, Jabbar and Bjørn 2018). The core assumption underlying infrastructures across these diverse domains is that they go unnoticed when they function well and blur into the background of everyday interactions. Thus, studies on infrastructures focus on unpacking the hidden characteristics that constitute infrastructures.

Infrastructures enable tech entrepreneurs to build, engage, and develop new innovations, practices, and ideas. This implies that when tech entrepreneurs build and invent new technological innovations, they depend upon diverse sets of infrastructures, for example, different technological platforms which allow entrepreneurs to focus on developing their innovations, rather than on infrastructures. Therefore, infrastructures are taken for granted, as they are embedded in multiple structures, social arrangements, and technologies (Star 1999). Externally, it might appear as if infrastructures function effortlessly, as they are seamlessly integrated into everyday engagements and structures. However, this is not the case. Infrastructures only *appear* as effortless engagements, while in practice they require and depend upon important invisible labour often executed by unnoticed actors (Bowker and Star 2002).

Infrastructures embody standards that are built upon certain classifications, shaping all communicative and collaborative interactions. Classifications are often built to support specific domains, for example, the categorization of reasons for visiting an emergency department of a hospital (Bjørn and Balka 2007). However, classifications can also assume a more general form, supporting, for example, electronic socket designs, transportation structures, or Internet protocols (Akrich et al. 2002). Infrastructures become visible primarily during breakdowns. Thus, investigating broken infrastructures can help us fully comprehend and identify critical and diverse sets of infrastructures that are crucial for tech entrepreneurship. It is only in the situations of breakdowns that we get to explore the installed base which serves as the foundation. Standards which are embedded within the installed base of the information infrastructure enable certain types of interactions while restricting other types of interactions. Breakdowns provide interesting empirical sites of investigation as they enable the identification of important infrastructures that fall outside the standard. Thus, to identify the important infrastructures that keep global tech entrepreneurs afloat, we need to explore residual types of entrepreneurs (Ahmed et al. 2015). We do this by exploring the case of Palestinian tech entrepreneurs.

The question then is, how can we use the breakdown situations existing in our polar case of the Palestinian tech entrepreneurs to identify the critical infrastructures that foster global tech entrepreneurship? To address this question, we consulted existing literature in HCI and related fields and identified several types of infrastructures, which we explore through the case of tech entrepreneurship in Palestine. As infrastructures are multiple and diverse, we have chosen to focus specifically on identifying the ones that are pertinent to designing and innovating technology in Palestine. Prior work on Palestinian tech entrepreneurship indicated the importance of funding and organizational support as particularly critical parts of the ecosystems that support entrepreneurship (Barbar and Russell 2015), along with other elements such as human resources, market potential, and legal and governmental policies. We identified from the literature five particular infrastructures that could be used to investigate how specific infrastructures emerged in the case of the Palestinian tech entrepreneurs. These five infrastructures are infrastructure of location, infrastructure of community, infrastructure of funding, infrastructures of global digital platforms, and infrastructures of history & politics. Analysing our empirical data required us to create classifications of infrastructures that were meaningful for our case. Thus, aspects related to human resources are under the category of infrastructures of community, while aspects related to market potentials are included in infrastructures of global digital platforms. Infrastructures are critical for enabling and fostering different types of interactions for people and technologies. Therefore, our interest lies in situations where infrastructures neither enable nor foster Palestinian tech entrepreneurship.

Infrastructures of location have been identified as an important structure for tech entrepreneurship. Geographical co-location of strong capabilities and skills within certain domains fosters interactions and innovations across entities. For example, the software development centre in Bangalore (India) (Krishna, Sahay et al. 2004) is known for co-locating highly-skilled software development experts for various domains. Co-locating software developers not only supported a strong increase in IT businesses in Bangalore but also attracted several international companies (e.g. Intel, IBM, and Microsoft) who chose to place their branches within; this has turned into the electronic city of Bangalore, which is in close proximity to global Indian software companies (e.g., TCS, Infosys, and L&T InfoTech). Geographical proximity fosters and supports exchange of technical expertise. Similarly, the fast-growing city of Shenzhen (China) attracts and supports the global tech manufacture industry by providing a unique eco-system for tech start-ups, with access to standardized and cheap electronics enabling fast prototyping (Lindtner et al. 2015). In the case of the Silicon Valley, close proximity of universities and tech entrepreneurship fosters creativity, making San Francisco a world centre for entrepreneurship (Welter et al. 2017). Thus, when analysing our empirical case, we must consider the role of eco-systems that are developed and supported in the geographical location and the proximity of potential resources available near Palestine (e.g. Israel and Jordan).

Infrastructures of community are important for tech entrepreneurs, since having access to people, resources, and skills is critical for obtaining technical ideas out of the laboratory and into practice. The infrastructures of communities include the availability of education and training possibilities. Communities that foster tech entrepreneurship value social support, exploration, and empowerment, supporting

entrepreneurs in developing relevant skills and self-efficacy (Hui and Gerber 2017). To fully succeed in the tech world, entrepreneurs need strategic skills and the ability to perform a range of diverse tasks, such as publicity, communication, manufacturing, management (ibid), as well as installing hardware, fixing cables, understanding policies, and dealing with emerging challenges. Tech entrepreneurs enact entrepreneurial activities by engaging, or circumventing, their domain and field (Jabbar and Bjørn 2017), thereby making communities of expertise and network opportunities critical. Thus, when analysing our case, we must consider which infrastructures of community are available in Palestine.

Infrastructures of funding are a crucial factor for the survival of all tech entrepreneurs, since many new start-ups build upon the fundamental idea of identifying potential economically viable ways to support the growth of a business based upon a technological product. There are several sources of funding available for tech entrepreneurs, namely venture capital or crowdfunding. Start-up investments from venture capitalists often relate to competitions and incubators (Lins and Lutz 2016), while crowdfunding is based on the ability to share the idea through global digital platforms and get individuals to support the entrepreneur prior to having a finished product (Belleflamme et al. 2014). Getting access to venture capital has been found to be the privilege of certain types of people within specific networks, while discriminating others (Lins and Lutz 2016). For example, a German study of 3.137 new ventures found that female entrepreneurs with university degrees and a high research and development profile receive less venture capital than their male counterparts, when taking education and experience into account (Lins and Lutz 2016). Nevertheless, we are all familiar with the image of tech entrepreneurs who live in their parents' basement to reduce expenses, or of those who have two jobs (one paying the bills and the other supporting their start-up dream). Thus, for this paper, it is important to analyse how the socio-economic background and geo-political situation impact the infrastructures of funding available for Palestinian entrepreneurs.

Infrastructures of global digital platforms have been growing in the last decade, with platforms such as Google and PayPal, enabling interactions across geographical distances. Furthermore, crowdfunding platforms, such as Kickstarter, were created to support not only financial flow, but also the creation of future communities of customers (Belleflamme et al. 2014); while other platforms, such as Etsy, were created to enable start-ups to distribute all types of small artisan products (Hui and Gerber 2017). Thus, the digital distribution of technological products is made possible through these digital global platforms. In particular, distribution platforms such as AppStore and Google Play are making it possible for tech entrepreneurs to share their digital products globally and instantaneously. This implies that when investigating the infrastructures in Palestine, we must pay attention to the role and availability of the digital platforms.

Infrastructures of politics and history shape standards and classifications, as they are concrete manifestations of infrastructures. Infrastructures evolve over time, and standards have long history shaping their concrete structures (Latour 1987, Bijker 1992). For example, the eco-systems of software outsourcing in Bangalore (India) is based upon the challenge of the Y2K problem, and the manufacturing eco-system in Shenzhen (China) is based upon the outsourcing of digital manufacturing in 1980, supported by a political change in China. History and politics are significant for the ways in which infrastructures are shaped and, thus, impact tech entrepreneurs'

everyday interactions. Thus, when analysing the infrastructures shaping the Palestinian tech entrepreneurs, we must take into account the history and politics of the region.

3. METHOD

Drawing upon empirical insights from a longitudinal ethnographic study of the Palestinian tech entrepreneur community, we explore the infrastructures that enable or constrain their everyday interactions. During the period between June 2014 and May 2017, we travelled to the West Bank in Palestine once a year (the length of stay varied between 1 week to 2 months), to interview, observe, and experience the working conditions and challenges of Palestinian tech entrepreneurs based in Ramallah and East Jerusalem. Our research method is based upon ethnographic perspectives (Randall et al. 2007) and multi-sited approaches (Williams et al. 2014, Bjørn and Boulus-Rødje 2015), where we explore Palestinian tech entrepreneurs as they are situated in their contexts, while considering the various sites of interests which are part of shaping the field of technology design. In particular, we paid attention to the ways in which the tech entrepreneurs describe and articulate their everyday work situation, as well as the workarounds involved. In this manner, we wanted to explore the trans-locality of the Palestinian tech entrepreneurs' situations, thus zooming in on the asymmetric relationships within the local circumstances (Bjørn et al. 2017). We wanted to understand the situation from their perspective, drawing upon their experiences (Blomberg et al. 1993, Blomberg and Karasti 2013), and using their own vocabulary. As an analytical tactic, we also position ourselves in different ways to experience the kind of situational control and contextual circumstances that the tech entrepreneurs described to us. This included passing different types of checkpoints (e.g. Hizma and Qalandia), in different ways (i.e., car, walking), during different periods (e.g. during Ramadan or a highly tense political period), and carrying different kinds of travelling documents (European passport, Israeli-Arab Blue ID card, and Palestinian Green ID card). All data was captured in text or audio, combined with written memos, and followed by reflective conversations (Bjørn and Boulus 2011).

3.1 Data Sources

Over the course of four years (2014–2017), we visited and interviewed Palestinian tech entrepreneurs and collected rich data. The majority of our interviews were conducted in Ramallah, with a few interviews with tech entrepreneurs based in East Jerusalem. In total, we conducted 32 formal interviews with informants (some were group interviews) from 19 start-ups, 2 Venture Capitalists, 1 hackerspace, 1 incubator, and 6 other informants (e.g. academics) who were knowledgeable about the start-up sector. Interviews were conducted in Arabic, Hebrew, and English. Twenty-eight interviews were fully transcribed and four interviews were partially transcribed. The decision as of which interviews to fully transcribe and which to partially transcribe was based upon the type of interview and the informant (e.g. interviews with academics were only partly transcribed). All our informants were entrepreneurs in the age range of 20–50 years, who have skills and expertise in creating digital products and services, with a dedication to have an impact, earn money, and develop the region. To protect the anonymity of the informants and start-up companies, they were assigned fictional names. We also participated in two conferences in Palestine (2015 and 2017), meeting various start-ups and entrepreneurs, and learning about their visions and challenges.

Finally, we collected a large number of observations notes, pictures, and other artefacts (e.g. maps), which helped us to fully comprehend the complex local context. This data, along with the embodied experiences we acquired from traveling in the area and passing through checkpoints, provided us with a better understanding of what it means to live and work in the region (Boulus-Rødje, 2018).

Table 1. Data sources of the ethnographic fieldwork conducted in Ramallah and East Jerusalem

Empirical case	2014	2015	2016	2017	total
Interviews	7	21	7		32 Interviews
Informants	Start-ups	Start-ups Venture Capitalists Hackerspace	Start-ups Academics Hackerspace	Academics Start-ups	28 informants
Site visits	Ramallah +	Ramallah Jerusalem	Ramallah Al-Bireh	Hebron	Ramallah, East Jerusalem, Al-Bireh
Number of researchers in the field	1 (A)	3 (A, B, C)	1 (B)	1 (A)	3 (A, B, C)
Workshops and Conferences	Workshop 1 Copenhagen	Workshop 2 Jerusalem Workshop 3 Oslo Conference 1 Ramallah		Conference 2 Hebron	3 Workshops 2 Conferences
Observations	Yes	Yes	Yes	Yes	
Document analysis	News Websites	News Websites	News Websites	News Websites	News Websites

3.2 Data Analysis

While analysing the data, we read carefully through all the empirical material (interviews, notes, memo, articles, etc.) in order to identify breakdown situations where the different types of infrastructures became apparent and noticeable. The analytical work began with going through all the details and highlighting the themes across the various data. In practice, all the interview transcriptions were printed out and placed into two large folders following a chronological structure. Then, the first author went through the complete material while making annotations (highlighting texts and using post-it-notes). Through this work, the important categorizations for understanding the context was initiated, thereby leading to the gradual emergence of particular categories (e.g. global digital platforms). This was followed by a process where empirical write-ups were created, while the digital files combined with the paper printouts were used to sharpen the focus on certain categories. Larger text descriptions analysing specific categories in the data were created, thereby leading to the emergence of the structure of the result section. At this stage, we imported all the data into Nvivo and ran different query strategies to fully capture how the various identified categorizations emerged differently across the data. In cases where the empirical data did not fully unpack the situation, we conducted various searches across news, websites and other sources of data, to gain a deeper understanding of the situation. The analysis was conducted by both authors. In certain cases, we contacted our informants to obtain more precise insights and further clarifications. Finally, we followed a validation process whereby individual emails were sent to informants, inviting them to comment and provide feedback on the manuscript. We received

several responses from informants, including clarifications and updated information; all of which were incorporated in the paper.

During the analytical process, we were specifically interested in exploring the ways in which the breakdown of infrastructures shapes the context of the tech entrepreneurship. Furthermore, we wanted to identify new types of infrastructures which were not identified in the literature but played an important role in our empirical case. In particular, we wanted to see how critical infrastructures were similar or different from what we had identified in the literature. Thus, we searched specifically for empirical insights exploring the infrastructures of location, community, funding, digital platforms, politics, and history. It was through our analytical work and several empirical write-ups and rich descriptions, that we ended up with the theoretical concept of infrastructural accessibility. This enabled us to articulate the Palestinian tech entrepreneurs as being a case of infrastructural *inaccessibility*, seriously constraining their potentials to develop financial and economic stability and supporting the local Palestinian society.

4. RESULTS

In order to identify the characteristics of the taken-for-granted infrastructures that are fundamental for keeping global tech entrepreneurship afloat, we began by examining the different types of digital products developed in Ramallah. Our analysis resulted in the identification of four types of infrastructures which are crucial for global tech entrepreneurship but are typically taken for granted. These infrastructures are related to mobility, legal framework, payment gateways, and mobile Internet. We have dedicated one section for each type of infrastructure to provide detailed explorations of the breakdown in these infrastructures.

4.1 Digital products as a potentially new profitable infrastructure

Clearly digital products provide different opportunities for Palestinian tech entrepreneurs when compared to physical products. However, the question that remains is whether digital products can provide the Palestinian entrepreneurs with stronger potentials to realize their business on a global scale, similar to tech entrepreneurs based in other locations in the world.

Digital products are not subject to the same type of control as physical products. They are potentially 'free' to travel outside Palestine, supported by digital platforms and the Internet infrastructure. Digital products have the possibility of bypassing physical checkpoints, metal detectors, roadblocks, and soldiers. Therefore, investing in tech start-ups and digital products provides the opportunity for entrepreneurs to develop semi-economic independence and self-sufficiency. The emerging tech start-up scene in Palestine is fast gaining grounds and becoming a central place to showcase that it is possible to view Palestine, and more specifically Ramallah, as a serious option for setting up a tech company. The incubators and investors view Palestine as a test bed for digital products. The opportunity to scale and then build up profitable income is crucial, if tech entrepreneurs want to develop a strong economy. Thus, one of the major challenges for investors and incubators is to develop ideas that can travel beyond the local context, target a larger population and ultimately become profitable:

'Because generally speaking, most of the ideas that we get...are focused on problems that are local, so even if you have a very good app that is solved in local problem-platform, it's not necessarily something that's applicable to the region or even the world. So, what we try to get them to do, is to think about their apps or their start-ups in a way that is more global or at least regional, so that they start thinking about solving larger problems that target a larger customer base and that could be profitable that can scale and grow' (Nadia, Ramallah, July 2015).

Many of the digital products developed by Palestinian tech entrepreneurs are designed to solve a specific problem encountered in the local context of Palestine. An example of such a product is SoMeNGO, which is a social media application developed by two Palestinian tech entrepreneurs who base their business idea on supporting NGOs and foreign-aid organizations working in the West Bank. NGOs need to ensure that their employees are safe when traveling around the West Bank. However, employees are constantly and unavoidably exposed to dangerous events, encountering violent incidents resulting from clashes between the Israeli military and Palestinian citizens. Alerts often do not come until an official media outlet picks up the event, which is usually too late, putting at risk the lives and activities of NGO's employees on the ground. SoMeNGO has built an Android application which collects social media data available in three languages (Hebrew, Arabic, and English) from diverse public feeds (e.g. twitter) related to the geographical location of the feed and focuses on incidents and clashes reported by local people, for example, reports on Israeli roadblocks on Nablus road (a central road connecting major cities in the West Bank). The SoMeNGO application does not only collect data but also correlates the results with official calendar dates for important events in the region. For example, May 15th marks an important and highly tense day in the region. While in Israel it is referred to as the Day of Liberation, (Yom Ha'atsmaout), celebrating the Day of Independence, the same date is referred to as 'the Day of Catastrophe' (yawm al-Nakba) in Palestine; the day commemorates the displacement of over 700,000 Palestinians in 1948. By combining social media data with calendar information and running the results through a machine learning algorithm, the SoMeNGO application not only provides real-time alerts to the user about concrete potential dangerous locations but also makes predictions for increased-risk areas at different points in time.



What is interesting about the SoMeNGO application is that the idea grew out of the concrete socio-political context of living and working under occupation. While the co-founders of SoMeNGO emphasize the importance of scaling the application and applying their algorithm to other countries, the application does not automatically scale to other places as it is bound to the local and situated contexts of a territory existing under military occupation.

While digital products are potentially able to transcend checkpoints and reach a larger user-group outside the West Bank, very few digital products developed in Palestine are of a general nature and, thus, able to address the needs of a larger user-group outside Palestine. Most digital products, such as SoMeNGO, are bound to the local context. Furthermore, we found that the very idea of using Palestine as a test-bed to develop products that can subsequently travel globally might eventually be problematic, since the concrete circumstances of Palestine directly impact the development of the digital idea, requiring serious adjustments to even be tested; thus, decreasing the potential of scaling the digital product globally. This was the case with POSTAL.

The POSTAL application was intended to solve problems related to the poor infrastructure for mailing and distributing packages within the West Bank. Many streets in the West Bank and Ramallah have no names, despite the fact that the Municipality of Ramallah has officially introduced a street-name system. Instead, sending and receiving post and packages across the West Bank is based upon a system, where the address refers to a neighbourhood or a known public place (e.g. Al Manara square, Arafat's tomb, Al Masyoun). Furthermore, there are very few postal services in the West Bank, and only one in Ramallah servicing approximately 27,000 citizens. The basic idea for the POSTAL application was to expand the potential places for delivery of packages to shops, cafes, restaurants, and other places that are easily accessible across the city and the West Bank. The POSTAL digital platform was

intended to provide a digital infrastructure which was strongly connected to the existing infrastructures of shops, neighbourhoods, and public places, extending and improving transportation service of packages.

'We thought [of] having some kind of collection points distributed across the city, so you can use it as your address, and [it] is open for long hours with friendly staff, so you can go there at your own convenience and pick up your package [...] So If you want to order a package, usually you put your address and...your phone number...,because most of the time they will call you and tell you: "come get it"...But if it's a well-known address, like for example Zaman coffee shop, which everyone knows...they will deliver it there, so it's easy for you. And we choose a collection point that is near-by you so you can easily get it [...] Amongst our competitors are a company called Amazon-lockers, they have lockers [...] We don't provide lockers' (Khaled, Ramallah, July 2015).

Upon further exploration of their business idea and talking to potential customers, the tech entrepreneurs behind POSTAL quickly identified a need for such a service in the area, thereby making this a potentially strong business case. However, upon continuing their research, they realized that the problem was not merely the lack of existence of collection points as such; rather, it was the ability to have access to online products in the first place.

'We found it, for example [that when] we use Ali Express, if you choose 'Palestine' then the price for couriers gets very high, and some don't deliver to Palestine. But if you put 'Israel', it's cheap [...] We started to do the collection point thing. We didn't get any traction, maybe one user who used it only, so we decided that in order to encourage people to use the collection points, we will provide them with another service which, we called assisted purchase' (Khaled, Ramallah, July 2015).

As it turned out, the lack of traction was a dual problem of both not being able to order goods online, and not being able to easily transport these into the West Bank. Transporting physical goods across the checkpoints is not easy, as Israeli customs control all import and export of products into Palestine, imposing high taxes and notoriously delaying or confiscating items at the border. Thus, ordering goods online to be shipped to Ramallah is not always possible. While American Amazon does not ship to Palestine, Chinese Ali Express does make shipments to Palestine. However, to avoid high transport prices, the customer needs to select the country 'Israel' from the dropdown menu. This implies that to order goods online, citizens in Ramallah would have to ship these to an address in Jerusalem (Israel), and then find a way to transport the goods through the checkpoints and into Ramallah. Thus, the tech entrepreneurs behind POSTAL began transforming their idea from merely collection points towards assisted purchase. The idea behind assisted purchase is that POSTAL helps both with ordering goods online and with transporting these into Ramallah. Their new business idea received strong interest, making it appear as a solid business case. However, when this business idea met the complicated realities on the ground and when they had to practically find distribution infrastructures between Jerusalem and Ramallah, further complications occurred:

'For the assisted purchase, we got good traction...but we faced other difficulties. For example, one of them is...the high price, because when it [the product] comes through the Israeli customs, it [entails] a lot of taxes, and sometimes they keep it there for a very long time. We ordered...nutrition supplements for one person and 4-5 months [passed by and] we... still did not get it' (Khaled, Ramallah, July 2015).

The transportation of goods to the West Bank implies dealing with Israeli customs and other set of restrictions that are beyond the control of the Palestine tech entrepreneurs

(e.g., checkpoints, travel permits). These issues made the business idea less viable. The digital solution was based upon a locally situated problem, just like SoMeNGO; however, the complexities in solving the problem were far too difficult and resulted in no clear solution. This was not due to technical constraints but due to political constraints that physically manifested through the political infrastructures of the region.

'If you remember our original value proposition is collection points and we were not able to market that, so the assisted purchase is just something [we used] to help with the original value proposition. Assisted purchase is not something that we want because it's limited to Palestine. If you go to Jordan it's not a problem. So, when we faced a lot of problems with that, we [decided that we] don't want to solve this problem [since] it's not our original problem. So, we decided to move away from it' (Khaled, Ramallah, July 2015).

Going back to viewing Palestine as a test bed before going global, we also see that even if POSTAL would have managed to find a suitable solution for assisted purchase of online goods in the West Bank, this solution will not be able to scale globally since the situation is not applicable to the rest of the region. Although the digital platform of POSTAL was in high demand, it was not possible to solve the infrastructural needs required to create a digital platform organizing collection points. When we interviewed the co-founder of POSTAL the following year, they had moved away from the idea of assisted postal services for people in the West Bank and had begun looking into digital platforms based on shared economy for transporting packages solely internally in the West Bank:

'Because we don't have control over the tax and Israel, we thought about delivering inside Palestine [...] We will leverage the existing taxi drivers and also in the future we are going to [provide services similar to] ...Uber but for packages. So, if you have a private car and you drive between Nablus and Ramallah, for example, you deliver it [the package] for a small fee' (Khaled, Ramallah, July 2016).

It is difficult to say whether the focus of the tech entrepreneurs on localized problems was a result of their everyday experience of living under occupation (SoMeNGO), or whether it is a result of viewing Palestine as a test-bed which unavoidably brings highly contextualized limitations that reduce scalability (POSTAL). However, it is evident that the majority of the digital products developed by Palestinian tech entrepreneurs were to address local challenges, despite the efforts of venture capitalists to emphasize the importance of viewing the Palestinian market as a test-bed before going global. Palestinian digital products are forced to adjust to the local circumstances, and by addressing contextual contingencies, their digital products are less scalable. Therefore, despite high expectations, most digital products created by Palestinian tech entrepreneurs do not reach the global market easily.

4.2 Mobility infrastructures

Travel permits to cross checkpoints are issued by the Israeli government based on individual assessments and arranged through several different categories of identity cards and document permits. Each ID card has a certain colour, stipulating the mobility of Palestinians and accessibility to certain geographical locations at particular points in time. There are three colours of ID cards. A blue ID card is given to Jewish or Israeli-Arabs (Palestinians residing in Israel), granting them freedom of movement. A blue ID card is also given to the Palestinian residents of East Jerusalem (referred to

as ‘a Jerusalem ID’), indicating ‘Arab’ under nationality and ‘blank’ under citizenship. Palestinian Jerusalemites are granted ‘temporary residency’ by Israel. The green ID card is given to Palestinians residing in the West Bank, and the orange ID card is given to those residing in the Gaza Strip. The tech entrepreneurs in Ramallah might hold a blue Jerusalem ID, a Palestinian passport (Green ID), a Jordanian travel document, or an Egyptian Laissez-passer. Although many tech entrepreneurs hold an additional foreign passport, as they lived or studied abroad, they are prohibited from using the foreign passport when entering Palestine. Given the IT infrastructure connecting all airport security and checkpoints, it is easy to control whether travellers carrying an international passport also have a Palestinian ID. Although Palestinian tech entrepreneurs holding a foreign passport are able to travel freely internationally, their mobility within Palestine, their own home country, is limited. Limited mobility is important, particularly for investors:

‘At the end, especially investors...who have...a business [as the] bottom line for their investment, they are focusing...on getting back their money. But what happened is that...people who have International passport or Jerusalem IDs have a better chance of traveling outside of Palestine and gaining more experience’ (Yousef, Ramallah, July 2015)

Knowing the colour of the ID card and type of travel document of the Palestinian entrepreneur is of importance for investors in terms of who is more likely to gain access to international experience and who is more likely to increase risks on investment:

‘If you’re an investor who does not have complete freedom of movement, you shouldn’t get into this business because a lot...depends on your ability of being able to meet with entrepreneurs, build these relations, have these face-to-face conversations, build your networks in the region, whether it is in the Middle East, in the US or Europe [...] At the co-founder’s levels or the CEO levels, I think it’s also a big issue although there are...some solutions there. I think...the bigger issue really is around the ability of start-ups to attract talent from outside... [for example] from Dubai or Jordan...to come and live in Palestine, the reality of the [political] conflict introduces substantial hurdles for you ...It is, it is a real serious problem and we faced it in at least two of our start-ups, so far, and as these companies grow they’re going to face these hurdles even more’ (Mahmood, Ramallah, July 2015).



Mobility is important for Palestinian tech entrepreneurs, CEOs, investors and venture capitalists. But mobility goes both ways. While it is important for Palestinians to travel outside of Palestine, it is equally important for international tech experts or foreign clients to be able to enter Palestine.

'If you want to get a client from Germany...Of course you can develop the software. You can send him the software. You don't have the Israeli Influence at all. Zero. But, it's not how business is done practically [...] Now, you call a client from Germany: "I am from Ramallah". Closing a deal, usually happens through face-to-face, communication, not...by phone; especially good payment...Nobody will pay \$200.000...for a country they never heard of [...] They need to come here. Or you have to visit them. So, by default, you need the Israelis to approve it...So even if a German company...wants to visit...They will tell him at the airport: "Hey, what's the reason for you stay?" "I'm going to Ramallah". "Ah, ok, wait" two-three hours, and they never come back' (Tamer, Ramallah, July 2015).

The hampered accessibility of internationals into the West Bank implies that Palestinians cannot meet co-founders and investors. We were told that such meetings are typically arranged in Jerusalem, if the Palestinian entrepreneur is able to obtain a permit to enter Jerusalem. However, it is important for an investor to come physically to Palestine:

'The investors want to sit with the founders. They want to see the company. They want to visit the company [...] so imagine a businessman who wants to come here and invest \$20 million on tourist visa. Who is crazy to do that? At any time...he can get refused at the border. "Sorry. You are not allowed to come" ...That's of course different in Israel. They give him permanent residence if he wants to invest in Israel' (Tamer, Ramallah, July 2015).

Many tech entrepreneurs emphasize the limited experience and exposure to the global high-tech sector—in particular, the lack of access to getting experience in the areas of sales and marketing at an international level. Palestinian companies have proven themselves as being competitive in outsourcing, particularly in testing; however, they are not able to scale, conduct market analysis, and get their own international

customers (Samir, Ramallah, July 2015 and Lina, Ramallah, July 2016). Thus, bringing in international expertise and attracting individuals with funds and knowledge of the global tech scene is critical if the tech businesses in Palestine are to participate in the global market. However, at the end of the day, even when Palestinians manage to convince respected experts to come to Palestine and a permit is successfully obtained, the border control might choose to ignore it: *'It depends on the Israeli officer at the shift. So, all your business [...] depends on the mood of the officer'* (Tamer, Ramallah, July 2015). The inability to bring international resources from abroad makes it difficult to create strong bonds to support exchanging knowledge and expertise:

'If I want to hire for example a foreigner to work in a Palestinian company, he can't get a permit to work [...] So even at Bir Zeit University, you see good professors who can't come to work at Bir Zeit...' (Tamer, Ramallah, July 2015).

While tech entrepreneurs with a Jerusalem Blue ID can, in principle, pass through Ben-Gurion Airport in Israel, this option was not chosen by any of the tech entrepreneurs we interviewed. There is an alternative route to entering the West Bank, namely, the Jordan bridge:

'When traveling through the Israeli airport we get all sorts of humiliation, all sorts of... you lose your dignity travelling through that airport, so most of us tend to use the bridge which is King Hussein Bridge, which crosses from Jericho to Jordan and we use the Jordanian airport' (Ghassan, Jerusalem, July 2015).

Palestinian entrepreneurs are often forced to travel through Jordan even though it typically costs three times the price of travelling through Israel, and the travel time increases dramatically. Nevertheless, the Jordan Bridge is an important access point that allows Palestinian tech entrepreneurs to reach the world:

'I actually have a Jerusalem ID, I have a Jordanian passport and I have a Serbian passport. But for all...my legal work I use my Jordanian passport and...my Serbian passport. [...] I can go through Ben Gurion airport [...] But I normally go through Jordan [...] because...it's a headache to go through Ben Gurion. There are a lot of security checks and it's much tougher you know. It's quicker in terms of travel time but it's a lot of more headache to go through Ben Gurion [...] It's also cheaper [to go through Ben Gurion] but...it's not worth it [...] So but basically, the common thing is to go through Jordan because most of the people in Palestine can't go through Ben Gurion' (Yousef, Ramallah, July 2015).

Furthermore, when a tech entrepreneur has an appointment, for example, at the American Embassy to obtain a visa, access to cross the checkpoint and have the meeting at the embassy might be prohibited citing security restrictions:

'To be honest with you I'm not allowed to enter Jerusalem, to enter Israel. I have security restrictions to enter Jerusalem. When I went to the US last year, I went to Jordan to have an interview with the US embassy, and I paid more than 1000\$ for a hotel and travelling, despite [the fact that it would have] taken me just one hour to have the interview here at the US Embassy in Jerusalem' (Mazen, Ramallah, July 2015).

What is important to note is that the mobility restrictions introduce two challenges with different consequences. One challenge is the immobility limiting the Palestinian tech entrepreneurs; however, another challenge is the immobility of internationals to visit Palestine and their inability to bring much-needed knowledge and expertise on international market dynamics. While Palestinian tech entrepreneurs have developed various workarounds over the years to manage their constrained mobility

00:17

(e.g. traveling through Jordan bridge instead of using Ben Gurion airport), these do not solve the limited mobility of internationals, particularly investors and venture capitalists. Thus, despite Palestinian tech entrepreneurs' ability to foster innovative ideas and technical expertise (e.g., making them competitive within the outsourcing market), they are unable to develop global digital products, as Palestine is not easily accessible to the outside world. Mobility is required both from within Palestine and from outside.

4.3 Legal infrastructures

Of all the tech entrepreneurs that we interviewed, there was one company who managed to create a viable business idea, which had reached beyond the local Palestinian test-bed and attracted external venture capital funds. This company, GAMES, was successful in attracting venture capital, hiring people, and establishing a strong base, which enabled them to further develop their business. The first success for GAMES was an Android game called REPRO, where a cartoonist character fights to win the human reproduction race by fertilizing the egg. REPRO is neither a political product, nor is it bound to the local context of Palestine. It received high attention, particularly after it was featured in the US news. Despite the success of GAMES, the instability in the region had crucial influence on GAMES investors:

[For] the investors, the stability of the region is very important basically because they know, like in any start-up they invest in...they probably will not excel or make up their money until like 5 or 7 years later. And If there is a big risk of a war breaking out or...another invasion by the Israeli forces, this basically puts the whole business in danger. And even if they don't lose the company, the fact [is that during] the last few invasions, people couldn't work for months. It basically cripples the company and delays their time to market...losing the opportunity [and eventually] increas[ing] the risk' (Yousef, Ramallah, July 2015).

In Ramallah, GAMES occupies an entire floor in an incubator and has hired several software developers and designers. The CEO explains how he loved playing games as a child and how creating a start-up for developing games was a dream coming true. Since the product is digital and free from the local context and geographical constraints found in Palestine, using the AppStore and Google Play are obvious global distribution platforms. However, a new constraint emerged, namely the legal infrastructure in Palestine.

'The Palestinian labour law...and corporation laws are not investor-friendly and they don't have the capability that investors expect in terms of...shares power, voting power, and all this kind of stuff. But...the Palestinian law is [based on] the Jordanian law of 196[4, where you] basically...have either public companies or private companies. In private companies, all shareholders have the same...voting power. You don't have these special provisions which makes it very difficult for investors to invest in a purely Palestinian company. And this was a big problem for us, because it cost us a lot to actually register in the US. We had to have lawyers in the US...[and] we paid a lot of money for them to handle the investment details. The other thing is the IP laws, which are almost non-existent in Palestine and in a gaming company where IP is almost everything, the company investors want to protect the IP. So, for these two factors we had to register the company in the US, and up until now, all the companies who are seeking investments are doing almost the same, either registering in the US or Dubai or UK' (Yousef, Ramallah, July 2015).

Despite succeeding in developing a global digital product and successfully attracting funds, Palestinian tech entrepreneurs are challenged by the outdated legal framework,

which is based on the 1964 Jordanian law. This law is inapplicable to the tech start-up domain, as it is mostly relevant for small family local businesses selling goods. The law introduces multiple challenges, for example, *'you don't have the freedom to establish any form of company. You cannot establish like a one-person company for example, if you are a sole entrepreneur working'* (Nadia, Ramallah, July 2015). The law also introduces challenges to investors as it does not allow the possibility to have shareholders and stakeholders among cofounders and investors. *'Often investors don't want common-shares, but rather refereed shares, which gives them the power to veto even if they invested a small % in the company'* (Tamer, Ramallah, July 2015). Usually, investors request extra rights when making their investment. They might only invest in a minority share (10%), but they typically want to ensure that the company is not getting into debt, thereby requiring greater decision rights (>10%) than their investment. The Jordanian law does not permit this practice of refereed shares. This implies that investors are unable to prove their ownerships of shares, introducing further issues related to equity investments: *'There is nothing that regulates investments like equity investments in Palestine, so you have Portfolio investments being regulated, stock investments being regulated, but equity investments are not regulated'* (Nadia, Ramallah, July, 2015). Furthermore, this law does not protect intellectual property (IP) rights, introducing problematic issues not only for investors but also for the tech entrepreneurs who develop the products:

'If an entrepreneur invests in a Palestinian company...and he decides to close [the company] ...take all the code and put it into a new company, I'm not protected. My money is gone and the same code that was used to develop my [investment], can actually be used by another company. And I have no stake in that company so, that's the intellectual property problem that investors face when they work in Palestine' (Nadia, Ramallah, July 2015).



As a result of the outdated law, venture capitalists are not willing to risk investing in Palestinian companies as they do not have protection rights. The implications of all the legal challenges discussed above are that many tech start-ups end up registering their companies abroad. All the entrepreneurs we talked to over the four years, who had managed to attract foreign capital, were asked to register their companies outside of Palestine (e.g. Europe or the United States).

00:19

'If we look at the portfolio [of the] start-ups [supported by a Palestinian VC] they have to register in the US. And the moment they...do that, that's when the problems start. Because you already have a company over here, you have an IP associated with this company, and then you have to get into this whole issue of selling your IPs to the American company...and then manage, or regulate, the relationship between the US entity and the local entity. What happens is, that the US entity either end up owning the Palestinian entity or...creating a service contract with the Palestinian entity. Then, [the Palestinian company] is asked to develop the code and [they get] payed for the code development. And that's how the Palestinian company is able to pay salaries, rent office space, etc.' (Nadia, Ramallah, July 2015).

Registering Palestinian start-ups outside of Palestine, while still having the physical location and workforce within Palestine, provides the opportunity for the companies to hire local employees, thereby contributing to an increasingly growing tech community in Palestine. Furthermore, this contributes to the Palestinian economy as employees pay their taxes locally. However, potential profit and cooperate taxes end outside of the country:

'That's actually bad because, it's only the American company that get[s] valued and increases the evaluation. Then, when there is an exit—either an acquisition or an IPO—it's the American company that get[s] all the money [...] the Palestinian economy will not benefit from anything that is associated with it [the company]' (Nadia, Ramallah, July, 2015).

Because the current legal framework does not protect Palestinian Tech entrepreneurs, foreign investors can, at any time, move their projects abroad since the start-up is already registered abroad. One of the co-founders (Toufik, Ramallah, July 2015) of a tech company that was registered abroad explained to us how he was degraded to an employee level once the company received investment. Since the company was originally registered in the US, he was told that his name could not be added. His lack of knowledge about the American legal infrastructure in the tech business, the misinformation he received, coupled with the fact that he cannot be protected since the company was registered abroad led to the unfortunate situation of him losing the company that he had co-founded. Although he won several international prizes as a co-founder, he did not have any official legal proof of his co-founder position.

Despite several attempts made by tech entrepreneurs to meet with representatives from the Palestinian Authority (PA) in order to resolve these issues and update the law, these have not been successful. Nevertheless, the Palestinian entrepreneurs hope to showcase that start-ups have the potential to be beneficial in supporting the local economy, and that this will lead the PA to acknowledge the importance of changing this law. The implication of this outdated law is that these companies do not contribute fully to internal economic development in Palestine, leaving the poor infrastructure unchanged despite the potentials.

4.4 Payment gateway infrastructures

Global distribution platforms such as AppStore, PayPal and Amazon are all platforms that enable small tech entrepreneurs to distribute their products worldwide and build their business. A digital product can be distributed globally regardless of the geographical location of its production. However, in Palestine, the situation is very

different as they do not have full accessibility to infrastructures for distributing and monetizing their digital products.

If we begin by examining the digital platform iOS AppStore—designed as a distribution and monetizing platform for global digital products—it requires customers who want to download and buy an app (or do in-app purchase) to have a billing address in the country where the customer resides, and the customer must be physically located in that country at the time of purchase (Figure 1 below displays a screenshot from Apple support website). Palestinian customers living in the West Bank do not have a formal billing address, since Palestine is not an independent country but an occupied territory. If a Palestinian customer uses a friend’s address (e.g. in Jerusalem) and registers his friend’s billing address under their name while choosing Israel as the country, downloading the app will still not work since the Palestinian customer is physically based in the West Bank, which does not match the country of the billing address. Paying for an app or using in-app-purchase requires the customer to be geographically located in the country of the billing address at the time of purchase. The workaround of traveling to Jerusalem from Ramallah to download and purchase digital products is also not an option, since it entails passing checkpoints, which, as explained earlier, is not a simple task.

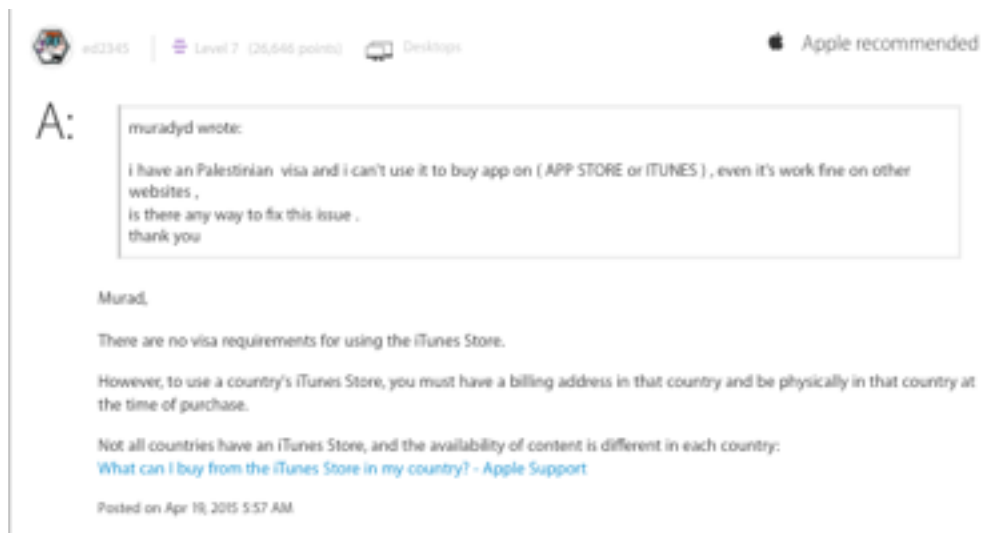


Figure 1: Screenshot of the Apple support website

iOS AppStore is not the only global distribution platform that makes it challenging for Palestinian tech entrepreneurs to monetize their digital products. Other payment platforms introduce similar constraints. For example, PayPal does not work for Palestinians in the West Bank or Gaza, but it does work for the 588,00,000 Israelis living in the 227 settlements and settlement outposts located throughout the West Bank. There have been several attempts at changing PayPal policy to extend its services to Palestine. For example, in 2016, the Americans for a Vibrant Palestinian Economy, an organization that advocates for investing in Palestine, wrote a letter to PayPal, which was signed by 43 Palestinian tech firms to the CEO of PayPal:

‘PayPal’s absence is a major obstacle to the growth of Palestine’s tech sector and the overall economy. While other payment portals are available, there is no replacement for the trust and familiarity that PayPal inspires among potential users, particularly those that are

unfamiliar with Palestine-based companies. Without access to PayPal, Palestinian entrepreneurs, non-profits, and others face routine difficulties in receiving payments for business and charitable purposes. Moreover, PayPal's absence is problematic for the overall Palestinian economy as tech is one of the only sectors with the potential to grow under status quo conditions of the Israeli occupation which severely restricts the internal and cross-border movement of goods and people. Indeed, by entering the Palestinian market, PayPal has the opportunity to make a significant contribution toward alleviating the destabilizing unemployment rates of over 25% in the West Bank and 40% in Gaza' (Butcher, 2016).

Even though an online petition was launched under the heading 'Tell PayPal to end its discrimination against Palestinians' and received 18,000 signatures, the company refused to make any specific commitment to change the situation. Higgs, a PayPal representative said that *'it is a complex issue from a compliance and regulatory standpoint,'* and *"that's not to say that we're not serious about our business and democratizing financial services for the people all around the world, not just Palestine'* (Rubin 2017). Due to lack of payment gateway infrastructures, Palestinian tech entrepreneurs have difficulties in monetizing their digital products internally in Palestinian.

'There is no payment gateway so far in Palestine so we have to rely on payment gateway in Jordan to be able to get our money, and it was very complex. Our money was going to Lebanon, then to Jordan, then to Palestine, and it was very expensive to get the money. And then the transaction cost itself was too high because you have this one supplier who actually controls the market. They can charge whatever prices they wish, so that was a big problem for us' (Nadia, Ramallah, July 2015).

Transferring funds from international sources into Palestine is a complex and expensive process. Money moves through several countries in the Middle East, before eventually reaching its Palestinian destination. The situation is equally complex and cumbersome when examining money flow within Palestine, namely from Gaza to the West Bank. Money transfer from Gaza is highly restricted by the Israeli authorities. A tech entrepreneur, who works closely with non-profit organizations based in Gaza (e.g. USAID), explains the procedure entailed in transferring money from Gaza to his company in the West Bank:

'[The Gazan customer] needs to [get an] authorization letter from JOBPORTAL [stating] that he is allowed to transfer or to deposit money directly to [our] bank account, and I have to indicate the reason for depositing the money. It's complex. Ok? [Then] I will sign an authorization letter, and the organization has to give me the authorized person with his ID, and I will send it to the bank. And the bank will ask that person to deposit [his money]. It's very complex...This is because we don't have online payment gateways, like we don't have a PayPal. [...] This affects me... because about 30% of my revenue is lost. [...] Because we can't collect the money directly, we have to...scan invoices and send them via e-mail [along with] our bank details, and we then wait for the money to transfer' (Ammar, Ramallah, July 2015).

As evident from the above account, the lack of money gateway infrastructures in Palestine coupled with the highly tense political situation in Gaza, introduce additional cumbersome paperwork, along with high costs and delays for money transfer:

'They didn't accept our credit cards in amazon [...] So if you want to buy something online, and you don't have a credit card, [...] we order things and we were able to deliver...about

700\$ in revenue...Amazon and eBay, didn't accept our credit cards so we weren't able to find a solution for that, because we have Palestinian credit cards' (Ammar, Ramallah, July 2015).

Thus, it is evident that Palestinian tech entrepreneurs are severely impacted by the lack of access to global payment infrastructures. Tech entrepreneurs, who end up registering their companies abroad, are able to access payment gateways and receive funds from global customers, but not from local Palestinian customers. Local customers do not have access to purchase Palestinian digital products on the most common platforms. In cases where digital products are developed for Palestinian users—which is the case for a majority of the examples—tech entrepreneurs have to find workarounds to accommodate the lack of payment gateways to even earn money in the first place.

4.5 3G Mobile Internet infrastructure

Clearly, the lack of global payment infrastructures constrains Palestinian tech entrepreneurs; however, what is even more critical is the lack of access to 3G and mobile Internet. Although 3G was introduced globally over ten years ago and currently many countries are preparing for 5G, Palestine did not have access to the 3G infrastructure even in 2017. The lack of 3G in the West Bank is not a technical problem, since it is available in the Israeli settlements and for mobile users with an Israeli SIM card. In fact, Israeli SIM cards are on the Palestinian market, with over 400,000 cards accounting for a 25% share in the Palestinian digital market (Amer 2017). So, what exactly is the problem?



In 2015, the Israeli government and the PA negotiated a deal to permit the 3G infrastructure in Palestine. The agreement was a principle decision, as the negotiations of how to actually implement mobile internet in practice required an overwhelmingly large number of details and discussions related to lands, maps, and frequencies. According to the agreement, Palestinians would be provided with 20 megahertz (MHz) of 3G frequencies. The first 10 MHz are allocated exclusively for Palestinian use to be shared by two Palestinian cell providers (Jawal and Wataniya), and the second 10 MHz are to be shared by the Palestinian companies and two Israeli

companies (Cellcom and Pelephone) (Rasgon 2016). Currently, Israel already has 10 MHz allocated to four companies offering mobile Internet for Israeli citizens within and outside the occupied territories. Since international standards limit the allocation of MHz in each country to a total of 60 MHz, 20 MHz was all that was left. Determining precisely how to allocate the frequencies depends on geographical agreement related to maps and borders. As was stated by Suleiman Zuhairi, the Palestinian Authority Deputy Telecommunications Minister, *'it is unbelievable how many maps we have reviewed and the amount of details we have discussed on all of them. It's painstaking work'* (Rasgon 2016). These complex details and maps are crucial in order to prevent a potential overlap between the networks. If the overlap is too large, both networks will fail. However, the entangled geography between Palestinian cities and villages, which border Israeli cities and towns, makes it a difficult task, and special arrangements need to be made by Ericsson Israel, which is managing the technical process of how to share the 10 Mhz. Back in 2016, a new challenge had arisen, and according to Zuhairi, 'Ericsson is demanding control over many parts of the Palestinian network in the West Bank, where there is no potential for overlap' (Rasgon 2016). In an email statement, Ericsson simply wrote a general response, claiming that it is acting in accordance with the regulator and with the customers. Although two years have passed by since the agreement to obtain 3G in Palestine was made, no concrete implementations can be seen on the ground.

What does the lack of 3G imply for the Palestinian tech entrepreneur? First, it implies that users can only access and use these digital products when there is an available Wi-Fi connection:

'3G is a big problem because for the last service that we are going to provide, which is transporting stuff, we were thinking about building a mobile application, because we don't have 3G, we're not able to test it here' (Khaled, Ramallah, July 2015).

However, Palestinians tech entrepreneurs are known for having strong resilience, for developing creative workarounds to overcome various barriers, including the one imposed by the inaccessibility to the 3G infrastructure. One such company is JOBPORTAL, which is the single most used Palestinian job portal specializing in providing advertisements for jobs by organizations and companies located in Palestine. In other words, JOBPORTAL is a widely popular platform for recruiting people.

'After 4 years, we got more than 10,000 visitors per day which is good traffic for us to charge the employers for the service [...] we have 3000 active employers, international NGOs, [employers from the] private sector and governmental institutions [...] For example Premiere Air International French NGOs working here in Ramallah, they posted during the last 2 months three jobs actually for Yemen, Sudan and Ukraine' (Ammar, Ramallah, July 2015).

The CEO of the company explains how in the first four years the job portal service was free of charge, and it was only after being contacted by the Norwegian Refugee Council working in Gaza asking for the price for using the service that the company began to charge employers who wished to advertise jobs. This service of providing a platform for job advertisement was particularly useful for NGOs in Gaza, because *'after the events [the sieges on Gaza] ...problems occurred between Fatah and Hamas, and Hamas prevented all local newspapers to enter Gaza'* (Ammar, July 2015). Therefore, JOBPORTAL provided a platform, which was missing thus far, both for employers and

job seekers. However, having this kind of service in such a highly political and contested territory is not that simple. The CEO invested strong efforts to ensure that the platform is free of any conflicts, corruption, information abuse, scams, etc. For him, guaranteeing quality for all job postings is essential to ensure the continuation for his services. This work includes requiring each company that wishes to post a job, to register locally in Palestine. It requires a tedious process of verification, where job-posters first provide their registration number, and then JOBPORTAL calls each company and employer to verify that they are indeed registered. If the job-posters are not registered, they reject the postings:

‘We ask them to provide us with the registration number even if we know them, personally [...] It’s about trust. People trust our service. We have more than 50,000 resumes [...] we need to send a message to those people that [JOBPORTAL] trust businesses and that you can trust it- you can send us your...personal data, your CV, and I will not sell it or send it to any registered company or employer’ (Ammar, Ramallah, July 2015).

Furthermore, employers are not permitted to post ads directly on the portal. Instead, the ads are sent to staff in JOBPORTAL, who check if the information is correct and reliable.

‘No one can post [directly] on our portal. [This] policy is [put in place in order] to prevent scams [...] the average daily jobs in our website is about 10... We receive more 30 posts daily [but] we delete 20 posts and we accept only 10 posts [...] For example...an Israeli company contacted me, but when I checked the e-mails...in LinkedIn [I discovered that they are] working for the Israeli security forces. I am not stupid to post their ad. I will not destroy my business [...] Ok, I lose \$1000 but I keep my business [...] we have a clear policy and there should be no mistakes [...] Our Website states explicitly that ‘[JOBPORTAL] is not influenced or supported by any political party or organization in Palestine’ (Ammar, Ramallah, July 2015).

The job portal rejects any requests from the Israeli security service, Hamas, or other organizations that might jeopardize the portals’ integrity and quality. Ensuring integrity is increasingly important, particularly since the job portal has launched an additional service that assists job seekers in creating their CV, thus creating a large database of people and their skills which can be matched with job postings. Keeping all such information secure is utterly critical when living and working under occupation. However, apart from the challenge of keeping information safe and secure, the lack of access to the 3G Internet infrastructure makes it difficult for job seekers, in, for example, Gaza to get access to the service. To accommodate these challenges, JOBPORTAL created ‘mobile Internet services’, a new service which provides access to their job portal platform utilizing another technical infrastructure, namely SMS.

‘It’s a replacement of 3G [...] It is already tested and we will launch it within 2 weeks. The SMS...have already more than 2050 subscribers. This is the first service provided in Palestine to overcome the problems of 3G and the electricity in Gaza and in Jordan Valley where people can’t connect to the Internet [...] After the success of this service, we sat down with Jawwal [Palestinian telecom company] and developed a new system for delivering jobs adds to mobile phones. This service is called [JOBSERVICE]...We ask people to subscribe to this [service, and when they] get a message about a job post, they can open the full job description, on our portal even if they don’t have an internet connection. [...] It’s without Internet; it’s infra net. And we charge a small fee per day’ (Ammar, Ramallah, July 2015).

The SMS service overcomes two major obstacles. First, it provides an infrastructure that allows ‘mobile Internet service’ where none exists. Second, it provides a payment income model for JOBPORTAL, since paying for the services is done through the

00:25

telecom operator's infrastructure of 'pre-paid minutes'. Furthermore, the service enables the residents of Gaza to access the Internet, affording a new service that operates regardless of poor infrastructure (e.g., internet access and stable electricity). While the workaround of providing mobile Internet service through SMS is fully functioning, it is still not a sufficient solution:

'SMS can't solve anything. It's just a simple service. It can't work instead of 3G. You...can send something to a short code and get some kind of reply, or we can push for example hundreds of SMS to other users. This is what we can do and this is very limiting. Whereas if you have 3G, you can open your application, do whatever you want, and get immediate response. This is not possible through SMS' (Ammar, Ramallah, July 2015).

Clearly, the business model of JOBPORTAL will be impacted when the 3G infrastructure, hopefully and eventually, will be available in Palestine, since their technology is based upon the 'lack of Internet'. However, JOBPORTAL is currently gearing up to welcome 3G, as they are investing in a new website and an app (Ammar, Ramallah, July 2016). If the 3G dream should fail to become a reality in Palestine, these investments and efforts will be wasted.

The tech start-up scene in Palestine is indeed promising, and Palestinian tech entrepreneurs demonstrate resilience by finding creative workarounds for the missing infrastructures for mobility, legal framework, payment gateways and Internet. However, these local initiatives are not enough for tech entrepreneurs to develop a strong economy for the region and be financially sustained in the long term. As emphasized by a senior entrepreneur, *'the fact that we are resilient doesn't mean that everything is fine (...) the high-tech sector is a sexy sector and people pick up on it very quickly. But I'm truly tired of it being used to beautify the occupation. This will not change the fact that we still have a master-slave relationship with Israel'* (Nidal, Ramallah, July 2015). Nidal reminds us that the fact that there is Internet in Gaza does not mean that they are not under siege. Thus, these various entrepreneurial and technological initiatives are not solving the core problem for tech entrepreneurs, which is 50 years of occupation.

The political situation always makes its presence felt in the everyday lives of Palestinian tech entrepreneurs, and while we did not formally discuss during the interview the concrete political events that were taking place during our fieldtrips, it was evident that everybody was fully aware of the situation at all times. Our interests in the interviews were to learn about the infrastructural breakdowns relevant for their tech businesses, but political aspects did surface unavoidably during and after the interviews. However, most of our interviewees did not want to directly discuss politics, but rather focus on the tech entrepreneurship scene. Nevertheless, it is undeniable that the political situation surrounding Palestinian tech entrepreneurs makes them an interesting polar case for studying critical infrastructures for tech entrepreneurship.

5. DISCUSSION: INFRASTRUCTURAL INACCESSIBILITY

Previous research encourages us to explore the fundamental infrastructures for tech entrepreneurship in terms of location (Krishna et al. 2004, Lindtner et al. 2015), community (Hui and Gerber 2017), funding (Lins and Lutz 2016), digital platforms (Belleflamme et al. 2014), and historic-political infrastructures (Akrich 1992). By

exploring the case of tech entrepreneurship in Palestine, it is evident that the geographical location has a major impact on the infrastructural landscape which shapes the everyday concerns of the entrepreneurs. Geo-political concerns are of significance for technology development. Geographical clustering and eco-systems are crucial for shaping the potentials for success with tech entrepreneurship (Søderberg et al. 2013, Lindtner et al. 2014, Welter et al. 2017). The available infrastructure of geographical locations shapes the high-tech industry differently around the world, and the case of the Palestinian tech entrepreneurs provides insights into the peripheral tech scene, on the outer boundaries of what we typically consider sites of design (Bjørn and Boulus-Rødje 2015).

5.1 Infrastructures of control

By exploring the trans-locality (Bjørn et al. 2017) embedded in the historic and political infrastructures (Latour 2005) of the everyday work situations of the Palestinian tech entrepreneurs, we find that the everyday presence of visibly available control mechanisms—such as the separation wall, ID cards, barbed wires, and checkpoints—are a constant manifestation of infrastructures, reflecting upon what it means to work under occupation. Interestingly, the infrastructures of control mechanisms are, to a certain extent, invisible most of the time for the tech-entrepreneur. They disappear into the background and are embedded in their daily work in mundane ways (Star and Strauss 1999). However, these infrastructures of control become visible in situations where they break down or when the entrepreneurs realize that they are not able to act as expected (e.g. when they realize, that they are unable to distribute their digital products via iOS AppStore or use PayPal). In such situations, Palestinian entrepreneurs encounter problematic situations on the ground, as they find out that they are neither able to monetarize their digital products nor use Palestine as a test-bed for digital innovations. These problematic situations arise only after trial and error, since the local situation is entirely different than that in other places around the world (e.g. the case of POSTAL). The controlling infrastructures is an inseparable part of life in Palestine. However, while the wall and checkpoints shape what is accessible and achievable for the tech entrepreneurs, it does not mean that they give up trying to reach the world. Just because they are not given a permit to pass a checkpoint, this does not mean that they stop travelling abroad. Instead, they find ways to work around the physical and digital constraints. They find ways to overcome the infrastructural inaccessibility that is shaping their everyday work and interactions.

5.2 Infrastructures produce asymmetric relationships

Despite being geographically placed in close proximity to Israel—one of the top start-up nations in the world (Fraiberg 2017)—there is a lack of synergy and interactions between Israeli and Palestinian tech entrepreneurs; this is true not just across the wall between Jerusalem and Ramallah, but also between Israeli and Palestinian tech entrepreneurs located in West and East Jerusalem. Thus, the infrastructure of community (Hui and Gerber 2017) in the occupied region is segregated with only a few successful interactions (Boulus-Rødje et al. 2015). A few international tech companies such as Microsoft or Intel organize events, where both Israeli and Palestinian tech entrepreneurs are invited. However, while interviewees who had participated in such events appreciated the opportunity to be exposed to other tech communities, they found these events to be of little relevance to their settings. Visiting Israeli tech entrepreneurs who enjoy strong and stable infrastructures did not help them tackle their entirely different local context with poor and dysfunctional infrastructures.

During such events that are organized by international companies, the infrastructures that enables interactions and potential collaborations across heterogeneous people, locations and professions (Bowker and Star 2002), demonstrate the asymmetric relationship existing between the occupier and the occupied. Thus, while the infrastructure of occupation mostly blends into the background in everyday mundane interactions, it suddenly appears during such events and encounters.

5.3 Intangible digital infrastructures

While it might not be so surprising that the location, community, and historic-political infrastructures are of significance, it is interesting that in daily practice, these challenges did not emerge as articulated problems. Instead, what did emerge and was pertinent to the tech entrepreneurs in their everyday work was the intangible digital infrastructures. This refers to the infrastructures related to funding, such as payment gateways and monetarizing digital products, all of which related back to the inaccessibility of fundamental global digital platforms. It was the intangible digital infrastructures which caused the daily concerns and discontinuities for the ways in which the tech entrepreneurs planned and executed their companies. We propose to characterize the impact of these digital intangible infrastructures as producing *infrastructural inaccessibility* which seriously jeopardizes Palestinian tech entrepreneurs' opportunity for global success.

The infrastructural inaccessibility of the Palestinian tech entrepreneurs is fundamentally shaped by the lack of access to a useful legal framework, payment gateways, and mobile 3G Internet. The inaccessibility to relevant legal frameworks supporting tech entrepreneurship in Palestine forces tech entrepreneurs to register their companies abroad. From a financial perspective, it would be in the interest of the PA to change, develop, and implement a new legal framework to protect start-ups; however, it appears that its political priorities lie elsewhere (e.g., dealing with the occupation), leaving the tech entrepreneurs in limbo. While they want to create new and financially strong companies which can help support local economy and build the society, infrastructural inaccessibility related to legal frameworks and IP rights results in transferring the taxes of successful tech companies outside the local economy. Surely, the employees of the tech companies based in Ramallah get their pay check and thus pay income taxes locally, while company taxes and IP rights end up elsewhere, which can potentially create problems for Palestinian tech entrepreneurs in the long run.

The infrastructural inaccessibility to global money transfer shapes the everyday work of the tech entrepreneurs in different ways. First, the prolonged time required for transferring money internationally to Palestine is particularly significant for companies registered abroad, which are paying local salaries (all of which are companies that successfully receive venture capital or earn their money from customers outside Palestine). Second, the infrastructural inaccessibility to payment gateways is significant in terms of growing a business based on customers within Palestine, since Palestinians cannot use global platforms (e.g., AppStore) to pay for digital content. This forces Palestinian companies to create alternative forms of payment structures, such as the subscription membership for SoMeNGO or the SMS payment structure developed by JOBPORTAL. However, while infrastructural accessibility to payment gateways (e.g. AppStore) exist for customers outside Palestine

to Palestinian digital products (as is the case of GAMES), infrastructural *inaccessibility* to Palestinian digital products exists for customers *within* Palestine (as is the case of SoMeNGO, POSTAL, and JOBPORTAL), which is the primary market for a majority of the tech start-up companies.

Finally, the infrastructural *inaccessibility* to 3G mobile Internet shapes the type of digital products created by the tech entrepreneur. For example, we saw how the job portal was designed to provide Palestinian customers access to the digital product using SMS, when the global market would use mobile Internet. Thus, the lack of access to the 3G infrastructure causes the very idea of utilizing Palestine as a test-bed before scaling their products to become impossible; this is because the fundamental design of the digital product needs to be differently implemented for users within, versus outside, Palestine. The infrastructural *inaccessibility* internally in Palestine is not equivalent to the infrastructural *accessibility* that exists outside the occupied territories.

5.4 Infrastructure of visibility and mobility

Infrastructural *inaccessibility* shapes visibility in different ways. From outside the West Bank, investors and global customers only see and have access to the political conflict through media coverage. Therefore, from the outside, one would not imagine Ramallah as a place for a newly rising tech entrepreneurship scene. We saw examples where the Palestinian tech entrepreneurs chose to purposefully hide their location. All the tech companies have websites presenting their digital product, but the geographical location of some companies is not made official. This is due to the fact that the word 'Palestine' has typically negative associations with the political conflict and instability in the region, thereby leaving the ordinary Palestinian tech entrepreneur in a mental struggle regarding whether to make visible who they are and where they are based.

While visibility clearly provides justification and acknowledgement to the work conducted (Suchman 1995), it also opens up potential risk of increased monitoring and control. Clearly, the controlling infrastructures are omnipotent; thus, Palestinian tech entrepreneurs who make themselves visible might put their business at risk. Invisibility does have certain advantages, particularly when working under occupation, since it makes it easier to do the necessary workarounds required when infrastructural *inaccessibility* limits their work. By being invisible, the risk of not obtaining travel permits or experiencing bureaucratic harassment is kept invisible from international stakeholders. Thus, mobility might be supported by invisibility, at least to a certain extent, particularly when interacting with the multiple technological artefacts of checkpoints, ID cards, and permits. As a necessary strategy, tech entrepreneurs are forced, to a certain extent, to submit to the status-quo of occupation, even in situations where their rights are clearly violated. Otherwise, they risk attracting attention to themselves, thereby jeopardizing their own mobility, which can in turn decrease their opportunity to participate as equal partners in the world of digital product development. Working under occupation is manifested in infrastructural *inaccessibility* and manoeuvring this complex situation is considered, by some entrepreneurs, as best done through purposeful invisibility, despite the contradiction it may raise in terms of the basic need to be visible to build a customer-base and make their product publicly available. In our peripheral case, the infrastructure of visibility is entirely different from the way visibility is produced at the centre of innovations. Here, successful tech entrepreneurs from the centres of 'tech

innovations' like Silicon Valley are globally known, visible, and, in some cases, treated like superstars—as in the cases of Steve Jobs, Mark Zuckerberg, and Bill Gates (Welter et al. 2017).

Therefore, it is evident that the infrastructure of mobility for Palestinian tech entrepreneurs is limited, as is the mobility of their digital products, which despite lacking physical presence, still cannot easily cross the checkpoints. Passing a tangible thing (e.g. human bodies or physical goods) across checkpoints requires workarounds and finding ways to circumvent the infrastructures of control. Digital control mechanisms (e.g. inaccessibility to 3G and payment gateways) are added to existing bordering mechanisms (e.g. checkpoints, walls, gates, and fences) by forming less visible, yet much more intrusive and obstructive, mechanisms for regulating telecommunication, Internet, financial services, and other forms of digital control of mobility manifested through low-tech restrictions like ID cards (Tawil-Souri 2011). There is one more important aspect of infrastructural inaccessibility, which is important, namely the restriction for internationals from *outside* to travel and gain access to Palestine. Global actors, potential investors and venture capitalists, all of who are interested in engaging with Palestinian entrepreneurs do not have easy access into Palestine. By not being visible on global platforms and by not having a presence in the start-up scene, the barrier for attracting investors, knowledge, and expertise is high. While Palestinian entrepreneurs will find workarounds to travel outside of Palestine (e.g. using the Jordan bridge), outsiders experience travelling to Palestine as a cumbersome and tough journey, leaving only few who are willing to go through the trouble. Thus, venture capitalists with an interest in making a business investment would rather have Palestinian entrepreneurs register their companies abroad, instead of dealing with the existing infrastructural accessibility and the local Jordanian law. However, these workarounds, which are necessary for the tech start-up scene, also normalized leaving the current situations unchanged.

Clearly HCI research cannot resolve the fundamental geo-political problems of over 50 years of occupation in Palestine. We do not believe that, we, as HCI researchers can eliminate physical and digital constraints and control mechanisms. However, we echo others (Roedl et al. 2015) who state that this does not imply that HCI can simply put its head in the sand and pretend that tech entrepreneurship is exempt from geo-political structures and infrastructural inaccessibility, and the profound impact of this on the designers of technologies working at different trans-local sites.

First, when we acknowledge that tech entrepreneurship is a transnational effort enacted differently across the world—for example, in Taipei, Taiwan (Bardzell et al. 2017); Accra, Ghana, Kingston; Jamaica (Avle et al. 2017); Shenzhen, China (Lindtner et al. 2014), or Copenhagen, Denmark (Jabbar and Bjørn 2017)—we need to consider the diverse local circumstances which constitute the infrastructural accessibility of the particular geographical location, while taking into account the political, technological, economical, and social aspects that shape tech entrepreneurship.

Second, the polar case of Palestinian tech entrepreneurs introduces important sociotechnical design challenges for global platforms. Our case makes it pertinent how the design of platforms was developed to facilitate monetization of the digital product globally and embeds certain constraints that cause biases towards particular

geographical locations. For example, the AppStore requirement of being physically located in the country of your bank account restricts Palestinian users in significant ways. Digital platforms have clear exclusive characteristics that restrict accessibility and visibility by design, hiding the inequalities inscribed within the tech scene. Thus, we confirm prior work which argues that technologies, their classifications, and algorithms are political (Winner 1986, Suchman 1994, Bjørn and Balka 2007). We have illustrated how the issues of infrastructural inaccessibility to global digital platforms are not only of technical nature, as they are various potential technical fixes to the issues discussed above. However, it is important for HCI researchers to understand that even if there is a technological fix to a problem, it does not necessarily mean that it will be fixed, since global geo-political concerns shape and are shaped by digital technology. This suggests that apart from continuing to make progress by developing new technologies, HCI research must also pay attention to the political considerations which are at play when digital technologies are designed and executed with different types of trans-locality (Bjørn et al. 2017).

Finally, when considering the close relationship between HCI research and the global tech industry, we might be able to utilize one of the core strengths of the HCI community to benefit Palestinian tech entrepreneurs. Large global tech companies—such as Google, PayPal, Microsoft, Yahoo etc.—participate in HCI research events as sponsors and active participants in the community. Access to these global companies can open up a new space for discussions and negotiations, for example, at HCI research events, where local concerns are potentially brought forward to these global companies. Such discussions may potentially result in changing the current situation and perhaps enable Palestinian tech entrepreneurs to gain infrastructural accessibility to global digital platforms.

6 CONCLUSION

Before we turn to the conclusion, we want to bring a brief update on the situation in Palestine. In Spring 2018, 3G finally became available through Palestinian mobile companies and PayPal now works for private customers but not merchants. Users can transfer money from a Palestinian bank account to PayPal to purchase products but they cannot transfer money from PayPal to a Palestinian bank account. Further, developers still cannot use iOS AppStore to monetarize their innovations, and the legal frameworks have not changed. During the years that we conducted our interviews, it was evident that GAMES was the company which many entrepreneurs perceived to be a successful start-up in the West Bank, as they received positive coverage in foreigner media outlets, had strong physical visibility occupying an entire floor with several developers, and received venture capital. Unfortunately, GAMES has now shut down.

In this paper, we introduced infrastructure accessibility as a means to identify existing and absent infrastructures in concrete situated circumstances. We propose infrastructural accessibility to assist HCI researchers in identifying the critical infrastructures that are crucial for tech entrepreneurship in concrete trans-local circumstances. Infrastructural accessibility makes it possible for us to pay attention to what is pertinent in the particular case through the exploration of breakdowns by which the infrastructure becomes visibly available. Our analysis led us to identify the critical types of infrastructures which need to be addressed (through socio-technical design and interventions) if we are to improve the conditions underlying our case of tech entrepreneurship. Finally, by exploring a polar case, we were able to gain insights

into some of the more taken-for-granted infrastructures which are part of the installed base in other trans-local situations and, thus, not so easily visible and accessible.

Given the circumstances, the following question arises: What is the motivation for investing so much time, effort, resources, and funds in Palestinian tech start-up companies? To put it bluntly, why go through all the trouble with such high risks on investment? There is a strong belief among the investors, incubators, and tech entrepreneurs that the technological sector provides potential opportunity to build a robust and semi-independent Palestinian economy which can help to create a path for peace in the region. Thus, apart from creating revenues for entrepreneurs and helping them become successful, there is a larger hope underlying the investment in technological development, namely, finding a way to live a normal life, support their families, and help in establishing a financial stable society.

Palestine has the opportunity to become a viable and successful entrepreneurial ecosystem with technology at the centre (Barbar and Russell 2015). However, the Silicon Valley model is not universally applicable; thus, instead of imitating what happens *outside* Palestine, the challenge is to develop viable infrastructures in the trans-local economic and political situation *within* Palestine.

The question remains as to how HCI researchers can potentially have an impact on the current geo-political infrastructures in Palestinian? Obviously, resolving the regional conflict related to the contested geo-political constraints is beyond the scope of HCI. However, there are concrete agendas for which we, HCI researchers, might be able to garner attention for through our research.

Future research in the HCI community would benefit from exploring the complexity of tech entrepreneurship as it is enacted in concrete practices and embodied in actual people and across varied localized contexts around the world. This would provide us the unique possibility of exploring questions such as ‘How do tech entrepreneurs resist political constraints in different parts of the world?’ What are the emancipatory potentials of tech entrepreneurship in politically contested geographies and other overseen places in the world? What potential efforts can HCI researchers invest in providing access and visibility to tech entrepreneurs from within and outside with limited infrastructural accessibility supporting participation in global tech innovation, thereby mitigating the exclusion of certain populations? With these questions in mind, we hope to raise awareness for the possibility of an interesting and exciting future for HCI research, as it happens in various overseen cases of tech entrepreneurship around the world.

ACKNOWLEDGEMENTS

We would foremost like to thank all the tech entrepreneurs, who spent time talking to us over the many years of research. Without them, we would never have been able to explore the special case which Palestinian tech entrepreneurship entails. We would also like to acknowledge Ibrahim Abu Kteish, who provided important and valuable feedback on earlier versions of the manuscript. Further, we want to acknowledge the feedback and discussions with Ingrid Erickson, Naja Holten Møller, Maria Menendez-Blanco, and Stina Mathiassen. Finally, we would like to thank Ahmad Ghazawneh, for helping us carry out some of the interviews in 2015. This study was supported by three research projects: *ConflictIT* received funds from the Danish Agency for Science, Technology and Innovation: International Network program, grant no: #4070-00010B; *NexGSD*: ‘Next Generation Technologies and Processes for Global Software Development’, #10-092313 received funding by the National Council for Strategic Research, Ministry of Science, Innovation and

Higher Education in Denmark; and the *FESTEM* research project which is a newly initiated project in 2018 funded by the European Union to rethink teaching and learning in higher education in Palestine.

REFERENCES

- Aal, K., G. Yerosusis, K. Schubert, D. Hornung, O. Stickel and V. Wulf (2014). Come_in@ palestine: adapting a german computer club concept to a palestinian refugee camp. In *Proceedings of the 5th ACM international conference on Collaboration across boundaries: culture, distance & technology* ACM: 111-120.
- Ahmed, S. I., N. J. Mim and S. Jackson (2015). Residual mobilities: Infrastructural displacement and post-colonial computing in Bangladesh. *CHI'15*. Seoul, Korea, ACM: 437-446.
- Akrich, M. (1992). The de-scription of technical objects. *Shaping technology - building Society: Studies in Sociotechnical change*. L. Bijker. Cambridge Massachusetts, MIT Press.
- Akrich, M., M. Callon and B. Latour (2002). "The key to success in innovation Part 2: The art of choosing good spokespersons." *International journal of innovation management* 6(2): 207-225.
- Amer, K. A. (2017). "West Bank to get 3G mobile service." *Al-monitor - Palestinian Pulse* <http://www.al-monitor.com/pulse/originals/2017/04/israeli-palestinian-agreement-3g-in-west-bank-wataniya-gaza.html>.
- Ames, M., J. Bardzell, S. Bardzell, S. Lindtner, D. Mellis and D. Rosner (2014). Making cultures: Empowerment, participation, and democracy - or not? Panel: CHI: One of a CHInd. Toronto, Canada, ACM.
- Avle, S., S. Lindtner and K. Williams (2017). How methods make designers. *CHI*. Denver, CO, USA, ACM.
- Barbar, A. and C. Russell (2015). Funding and support for ICT start-ups in the Middle East: A case study of Palestine. *The 8th International Conference for Entrepreneurship, Innovation and Regional Development*. Sheffield, UK: 580-593.
- Bardzell, S., J. Bardzell and S. Ng (2017). Supporting cultures of making: Technology, policy, visions, and myths. *CHI*. Denver, CO, USA, ACM.
- Belleflamme, P., T. Lambert and A. Schwienbacher (2014). "Crowdfunding: Tapping the right crowd." *Journal of Business Venturing* 29: 585-609.
- Bietz, M., E. Baumer and C. Lee (2010). "Synergizing in cyberinfrastructure development." *Computer Supported Cooperative Work (CSCW): An International Journal* 19: 245-281.
- Bijker, W. (1992). "The social construction of fluorescent lighting, or how an artifact was invented in its diffusion stage." *Shaping technology/Building society*: 75-102.
- Bijker, W., T. Hughes and T. Pinch (1987). *The social construction of technological systems: New directions in the sociology and history of technology*, MIT Press.
- Bjørn, P. and E. Balka (2007). *Health Care Categories have Politics too: Unpacking the Managerial Agendas of Electronic Triage Systems*. ECSCW 2007: Proceedings of the Tenth European Conference on Computer Supported Cooperative Work, Limerick, Ireland, Springer.
- Bjørn, P. and N. Boulus (2011). "Dissenting in reflective conversations: Critical components of doing action research." *Action Research Journal* 9(3): 282-302.
- Bjørn, P. and N. Boulus-Rødje (2015). "The multiple intersecting sites of design in CSCW research." *Computer Supported Cooperative Work (CSCW): An International Journal* 24(3): 319-351.
- Bjørn, P., A.-M. Søderberg and S. Krishna (2017). "Translocality in Global Software Development: The Dark Side of Global Agile." *Human-Computer Interaction* 10.1080/07370024.2017.1398092.
- Blank, S. (2013). "Why the Lean start-up changes everything." *Harvard Business Review* 91(5): 63-72.
- Blomberg, J., J. Giacomi, A. Mosher and P. Swenton-Hall (1993). *Ethnographic Field Methods and their Relation to Design. Participatory Design: Principles and Practices*. D. Schuler and A. Namioka. London, UK, Lawrence Erlbaum Associates Publisher: 123-155.
- Blomberg, J. and H. Karasti (2013). "Reflections on 25 years of ethnography in CSCW." *Computer Supported Cooperative Work (CSCW): An International Journal* 22(4-6): 373-423.
- Boulus-Rødje, N. (2018). "Stuck with my body at Qalandiya checkpoint: Reflections upon conducting fieldwork in an uncertain field site." *SAGE Research Methods Cases*.
- Boulus-Rødje, N. and P. Bjørn (2015). Design challenges in supporting distributed knowledge: An examination of organizing elections. *CHI*. Seoul, Korea, ACM.
- Boulus-Rødje, N., P. Bjørn and A. Ghazawneh (2015). "It's about Business, not Politics": an ethnographic study of an Israeli-Palestinian web start-up. *International Conference of Critical Geography*. Rammallah, Palestine.
- Bowker, G. C. and S. L. Star (2002). *Sorting Things Out: Classification and Its Consequences*. Cambridge, The MIT Press.
- Economy, A. f. a. V. P. (2016). "Letter to PayPal President and CEO Daniel H Schulman." (<http://a4vpe.org/pages/a-letter-to-paypal.php>).
- Ellingsen, G. and E. Monteiro (2003). "A Patchwork Planet Integration and Cooperation in Hospitals." *Computer Supported Cooperative Work (CSCW): An International Journal* 12(1): 71-95.

- Fraiberg, S. (2017). "Start-up nation: Studying transnational entrepreneurial practices in Israel's start-up ecosystem." *Journal of Business and Technical Communication* **31**(3): 350-388.
- Hui, J. and E. Gerber (2017). Developing makerspaces as sites of entrepreneurship *CSCW*. Portland, OR, USA.
- Irani, L. (2015). "Hackathons and the making of entrepreneurial citizenship." *Science, Technology, & Human Values* **40**(5): 799-824.
- Irani, L., P. Dourish and M. Mazmanian (2010). Shopping for sharpies in Seattle: Mundane infrastructures of transnational design. *ICIC'10*. Copenhagen, Denmark, ACM.
- Jabbar, K. and P. Bjørn (2017). Growing the Blockchain information infrastructure. *CHI2017*. Denver, CO, USA.
- Jabbar, K. and P. Bjørn (2018). Infrastructural Grind: Introducing Blockchain technology in the shipping industry. *ACM GROUP*. Sanibel Island, Florida, ACM.
- Krishna, S., S. Sahay and G. Walsham (2004). "Managing cross-cultural issues in global software outsourcing." *Communications of the ACM* **47**(4): 62-66.
- Langhoff, T. O., M. H. Amstrup, P. Mørck and P. Bjørn (2018). "Infrastructures for healthcare: From synergy to reverse synergy." *Health Informatic Journal* **24**(1): 43-54.
- Latour, B. (1987). *Science in action: How to follow scientists and engineers through society*. Cambridge, Massachusetts, Harvard University.
- Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory*, Oxford University Press.
- Lindtner, S., A. Greenspan and D. Li (2015). Designed in Shenzhen: Shanzhai manufacturing and maker entrepreneurs. *Critical Alternatives: 5th decennial Aarhus Conference*. Aarhus, Denmark, ACM: 85-96.
- Lindtner, S., G. Hertz and P. Dourish (2014). Emerging sites of HCI Innovation: Hackerspaces, Hardware startups & Incubators. *CHI*. Toronto, Canada, ACM.
- Lins, E. and E. Lutz (2016). "Bridging the gender funding gap: Do female entrepreneurs have equal access to venture capital?" *International Journal of Entrepreneurship and small Business* **27**(2/3): 347-365.
- Mainwaring, S., M. Chang and K. Anderson (2004). Infrastructures and their discontents: Implications for Ubicom. *Ubicom, LNCS 3205*. N. Davies, E. Mynatt and I. Siio. Nottingham, UK, Springer-Verlag Berlin Heidelberg: 418-432.
- Meel, J. v. and P. Vos (1999). "Funky offices: Reflections on office design in the 'new economy'." *Journal of Corporate Real Estate* **3**(4): 322-334.
- Patterson, D. (2015). "Haitian resiliency: A case study in intermittent infrastructure." *First Monday* **20**(8).
- Pearce, T. (2013). "...So it really is a series of tubes' Google's data centers, Noo-politics and the architecture of hegemony in Cyberspace." *Enquiry* **10**(1): 43-53.
- Randall, D., R. Harper and M. Rouncefield (2007). *Fieldwork for design: Theory and practice*. London, Springer.
- Rasgon, A. (2016). "What ever happened to the Palestinian 3G deal?" *The Jerusalem Post* **December, 28, 2016**(<http://www.jpost.com/Israel-News/What-ever-happened-to-the-Palestinian-3G-deal-476732>).
- Reagle, J. (2017). "Naive meritocracy and the meanings of myth." *Ada - A journal of Gender, New Media & Technology*(11): <http://adanewmedia.org/2017/2005/issue2011-reagle/>
- Roedl, D., S. Bardzell and J. Bardzell (2015). "Sustainable making? Balancing optimism and criticism in HCI discourse." *Transaction on Computer-human Interaction (TOCHI)* **22**(3).
- Rosner, D. and M. Ames (2014). Designing for repair? Infrastructures and materialities of breakdown. *Computer Supported Cooperative work (CSCW)*. Baltimore, MD, USA, ACM: 319-331.
- Rubin, J. (2017). Why does PayPal discriminate against Palestinian? *The Electronic Intifada*. <https://electronicintifada.net/content/why-does-paypal-discriminate-against-palestinians/20611>.
- Shklovski, I., J. Vertesi and S. Lindtner (2014). "Introduction to this special issue on Transnational HCI." *Human-Computer Interaction* **29**(1): 1-21.
- Söderberg, A.-M., S. Krishna and P. Bjørn (2013). "Global Software Development: Commitment, Trust and Cultural Sensitivity in Strategic Partnerships." *Journal of International Management* **19**(4): 347-361.
- Star, S. L. (1999). "The ethnography of infrastructure." *American Behavioral Scientist* **43**: 377-391.
- Star, S. L. and A. Strauss (1999). "Layers of Silence, Arenas of Voice: The Ecology of Visible and Invisible Work." *Computer Supported Cooperative Work (CSCW): An International Journal* **8**: 9-30.
- Steinhardt, S. and S. Jackson (2014). Reconciling rhythms: Plans and temporal alignment in collaborative scientific work. *CSCW*. Baltimore, Maryland, USA, ACM.
- Stickel, O., D. Hornung, K. Aal, M. Rohde and V. Wulf (2015). 3D printing with marginalized children - An exploration in a Palestinian refugee camp. *European Conference on Computer Supported Cooperative Work (ECSCW)*. Oslo, Norway, Springer.
- Suchman, L. (1994). "Do Categories Have Politics? The language/action perspective reconsidered." *Computer Supported Cooperative Work (CSCW): An International Journal* **2**(3): 177-190.
- Suchman, L. (1995). "Making Work Visible." *Communications of the ACM* **38**(9): 56-64.
- Tawil-Souri, H. (2011). "Colored identity: The politics and materiality of ID cards in Palestine/Israel." *Social*

Text **29**(2): 67-97.

Turner, F. (2009). "Burning man at Google: A cultural infrastructure for new media production." New Media & Society **11**(1&2): 73-94.

Welter, F., T. Baker, d. Audretsch and W. Gartner (2017). "Everyday entrepreneurship—a call for entrepreneurship research to embrace entrepreneurial diversity." Entrepreneurship Theory and Practice **41**(3): 311-321.

Williams, A., S. Lindtner, K. Anderson and P. Dourish (2014). "Multisited design: An analytical lens for Transnational HCI." Human-computer interaction **29**(1): 78-108.

Winner, L. (1986). Do Artifacts have Politics? The Whale and The Reactor: A Search for Limites in an age of High Technology. L. Winner. Chicago, University of Chicaga Press: 28-40.