School of Public Policy

accelerator labs

GRASSROOTS INNOVATION:
An Inclusive Path to Development

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LSE Capstone Report for UNDP Accelerator Labs

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LSE Capstone Team

LSE Capstone team consists of five graduate students at the London School of Economics and Political Science pursuing a master's in public administration. We come from a number of different professional backgrounds and countries including the United States, Indonesia, Iran, Guatemala, and Singapore.

David Bernstein

Kavita Seshan

Dinar Ayu Adeline

Pouria Arasti

Amory Gonzalez Juarez

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Abbreviations

AL	Accelerator Lab – singular
ALs	Accelerator Labs – plural
GI	Grassroots innovation – singular
GIs	Grassroots innovations – plural
ICT	Information and Communication Technology
IP	Intellectual Property
IPR	Intellectual Property Rights
OECD	Organisation for Economic Co-operation and Development
R&D	Research and Development
SME	Small and Medium Enterprises
UN ESCAP	United Nations The Economic and Social Commission for Asia and the Pacific
UNDP	United Nations Development Programme
WIPO	World Intellectual Property Organization

Executive Summary

We define Grassroots innovations (GIs) as "indigenous solutions, created by actors in civil society and supported by limited resources, which aim to address local situations and often achieve sustainable development." GIs, essentially bottom-up solutions occurring in informal, non-market settings, rarely feature in the mainstream innovation policies that focus on rent-seeking firms in developing innovative processes and services designed for conventional markets. GIs, on the contrary, have a different motive altogether. GIs highlight the importance of psychological and social processes of creativity in innovation, and collectively, as a movement, GIs drive socially inclusive innovation processes. Local communities come together to share their ideas on the knowledge, processes, and outcomes involved in product development when a need emerges, often in response to perceived social injustices and issues concerning the environment arising from mainstream innovation models. Famous examples include the Honey Bee Network in India and the technologies for social inclusion movement in Latin America.

In this study, we worked with UNDP Accelerator Labs (UNDP AL) to explore what contextual characteristics and set of policies can promote grassroots innovation. We employed a mixed-method approach that involved qualitative and quantitative data gathering techniques. The revelations from our literature review, compounded by the complexity of our task, which involved the participation of 7 different countries worldwide, and the fact that GIs is a heavily understudied topic, made us realise that a framework to understand GIs in a way we could apply in our research was non-existent. We decided to develop a conceptual framework and used it to interview 7 different UNDP ALs worldwide. In some instances, GIs and policy professionals, to better understand the GI landscape in each of those countries. We also co-developed a survey with UNDP AL which we sent to the UNDP AL staff we interviewed and GIs from those countries. Due to time and logistical constraints, the findings from the survey do not draw causal inferences of any kind. They are purely descriptive statistics that yield valuable insights that we use to support what we learned from the interviews. We then discuss the implications derived from insights we received from both the interviews and the survey.

Our survey results confirmed what we learned from the interviews in almost all framework domains except IPR. There was no consensus among those we interviewed on its significance. The survey results also suggest that financial capacity and institutions and communications and promotional facilities are the most significant impediments faced by GIs, followed by education and training and technological advancement, consistent with what we learned from the interviews. Conversely, financial support, such as tax incentives, when received, can be key enablers that promote GIs.

Context specificity and intercultural diversity make it nearly impossible to develop a set of applicable recommendations that is replicable from one context to another. Yet, we do our best to provide a set of policies recommended in three levels: National Governments, Initiatives, and Local Authorities. Our findings also include a one-page SWOT analysis with tailored policy recommendations for each of the 7 countries we interviewed. We believe our study sets up a foundation for future research based on GI and has implications for policymakers when considering the range of innovation systems it encompasses. We advocate that countries designing innovation policy should be mindful of GIs and include them in a way that will allow GIs to thrive.

1 Introduction

1.1 Background

Public policy supporting mainstream innovation activities have historically focused on instruments that support Research and Development (R&D) and the commercialisation of innovative products and solutions. However, such policy instruments would be inapplicable for grassroots innovators (GIs), which are essentially community-based initiatives that solve context-specific problems. Enacted by local actors, GIs can provide tailored solutions to pressing issues that can quickly gain momentum with the right support. Through developing innovative solutions, GIs create a sense of solidarity and trust in the communities they serve by validating and authenticating the potential benefits of their output. GIs continuously work towards improving the solution through co-development and co-ownership, and repeated cycles of iteration. Our research further argues that policies concerning GIs can also have country-specific characteristics that need further synchronisation. Our findings and analysis suggest that the use of mainstream innovation policy instruments to support grassroots initiatives are not adequate.

1.2 Objectives and Research Question

Our research seeks to explore what contextual characteristics and set of policies can promote grassroots innovation. As part of our research, 7 different UNDP Accelerator Labs, namely, the Philippines, Ecuador, Colombia, Bosnia and Herzegovina, Iraq, Kenya and Ghana, agreed to participate. We interviewed UNDP Accelerator Lab (UNDP AL) staff and, in some instances, grassroots innovators and policy professionals to understand the process and nature of GIs. The revelations from our literature review, in addition to the insights we gathered from prominent academics in the field, led us to develop a conceptual framework that we used for our analysis and to derive policy recommendations. We also co-developed a survey with UNDP Accelerator Labs and distributed it to the countries we interviewed to support our findings. The 7 participating Accelerator Labs also agreed to distribute the survey to GIs in their respective countries. The survey results yield relevant descriptive statistics that support our findings from the qualitative interviews that we conducted.

1.3 Policy Problem and Research Justification

Aside from existing theories of GIs based on the concepts of non-linearity and strategic niche management (e.g. Geels and Raven, 2006; Hargreaves et al., 2013; Seyfang & Longhurst, 2013), GIs is an understudied topic. The purpose of this study is to showcase the relevance of GIs and their contributions, highlight their challenges, and propose that countries should devote time and resources to creating conditions where GIs can be nurtured.

1.4 Outline

This report is structured as follows. In Chapter 2, we discuss the policy problem that underlines this research. Next, we develop the study design and methodology described in Chapter 3. The literature review is delivered in Chapter 4. Furthermore, we establish a contextual framework in Chapter 5. Then, we build the quantitative analysis in Chapter 6 and the qualitative analysis in Chapter 7. Finally, Chapter 8 concludes and provides the policy recommendations.

2 Policy Problem

Grassroots innovation has historically been a critically understudied research topic. Contemporary studies in innovation tend to focus on private-sector innovations that present significant scalability opportunities. However, there is limited insight into the innovations springing up amongst individual citizens and communities. Part of the reason for this lack of research interest is the difficulty in measuring GI since GI comes in all shapes and sizes, and there is no stereotypical innovator that is easily picked out of a crowd.

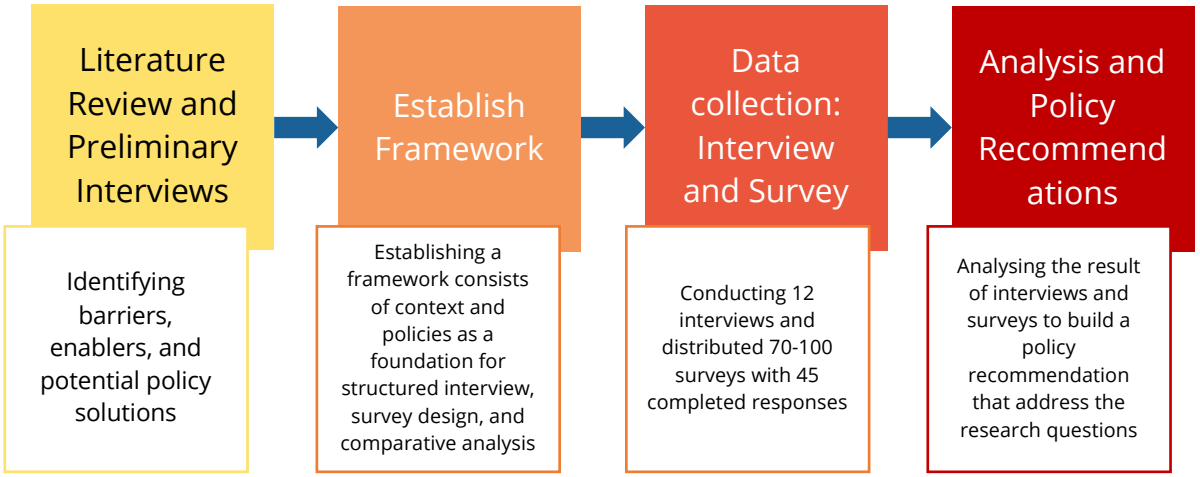
Whilst these aspects of GIs make it difficult to study and quantify, GIs lend a great deal of potential. In developed countries, grassroots innovators tend to innovate for more utilitarian reasons. Professor Eric Von Hippel at MIT has been studying what he refers to as "user innovation" in the United States and found that the motivating factors for individual innovators tend to be more altruistic and "hedonic" (pertaining to self-satisfaction) (von Hippel, 2017). In developing countries, GIs are pervasive due to large informal economies. The innovators often create solutions to everyday societal issues that governments fail to address (Gupta, 2020).

There is much to learn from GIs being carried out by the plethora of extraordinary individuals and communities worldwide. Their distinctive motivations yield unique solutions to problems sometimes neglected by typical large-scale innovations and can offer vast benefits to both developed and developing countries. The absence of supporting literature and a comprehensive framework in this field represents a policy problem that we would like to address in this research. We hope our study will assist governments in both developed and developing countries to help promote GI as a means to drive economic growth, increase ecosystem sustainability, and reduce inequality (OECD, 2009, 2011).

3 Study Design and Methodology

We conducted the research using the mixed-method approach. First, we carried out a thorough literature review and preliminary interviews with experts and lecturers in innovation to help us identify barriers and potential policy solutions. Second, we establish a framework that consists of context and policies as a parameter for the interview and survey. Finally, after the data collection process from surveys and interviews, we run a comparative analysis across countries to propose a set of policy recommendations. Our research design is illustrated in Figure 1.

Figure 1 - Study design



3.1 Qualitative Design and Data Collection

This study relies heavily on the body of literature of innovation. The literature review aims to summarise, analyse, evaluate, and synthesis the sources (Onwuegbuzie et al., 2010). We carried out a thematic analysis of "innovation" in general and "grassroots innovation" in particular, focusing on academic journals, secondary sources, and grey papers. This desk research was the first step to understand the theories of innovation that build the conceptual framework.

To finalise the framework, we conducted semi-structured interviews (Appendix 2) with experts in GI. The interviews were recorded and transcribed verbatim (summary in Appendix 5). These initial interviews built our understanding of the perspective, causal logic, worldview, and experience before extracting the fact for an analytic research design (Lamont & Swidler, 2014). Then, we designed the structured interview (Appendix 2) according to our framework.

The structured interviews are used to collect rich and detailed data that could expose the subject's stories on the field they are working on (Lee Ann Fujii, 2017). We conducted interviews with 7 UNDP Accelerator Labs across continents, 4 further interviews with innovators from two different countries, and one interview with a government institution. According to the LSE Data Management Plan, our interviews were conducted with participant and data confidentiality.

The interview transcripts were summarised and analysed to answer the research question and provide policy recommendation. In addition, we provide a case study of each country that contributed to this research using a SWOT analysis. The case study approach is commonly used when investigating a contemporary phenomenon that contains deep understanding and applies within its real-world context (Yin, 2014). We chose SWOT analysis due to its capability to consider internal and external factors that could assist the country's future planning (Leigh, 2010).

3.2 Quantitative Design and Data Collection

Our quantitative analysis covers two things. First, the analysis of each country's contextual background. To be able to formulate a policy recommendation, we conducted a case-oriented contextualised comparison. This case study method is designed to explain any similarities or commonalities across cases regardless of their dissimilar outcomes, which serves more than theory testing but theory elaboration (Tilly, 1984). To carry out the comparison, we obtain the data for each country's parameters for the year 2020 from published indicators (Appendix 4). The result of the comparison allows us to provide a focused policy recommendation for each country.

Second, the analysis on the factors that support GI which we identified in our framework. The analysis is based on the results from a survey that we designed according to the framework and evaluated with the UNDP AL' team (detail of survey question in Appendix 3). The survey was distributed to approximately 70-100 respondents connected to the 7 UNDP AL we worked with. We received 88 answers, yet we eliminated 43 responses that did not complete the survey within 40 days of the circulation. We used the survey data and qualitative analysis results from the interview to build the main analysis and formulate policy recommendations that address the research question.

4 Literature Review

Before delving into primary research in GI, we looked into the available academic literature to better understand the context in which GIs develop. Although research regarding innovation in a broader and more top-down sense is extensive, research pertaining to GI is fairly sparse. In this literature review, we seek to identify and analyse what policies or contextual characteristics can enhance or inhibit innovation in the broader sense, and more specifically, GI, in developing countries. GI is a particularly conditional subject – one that varies significantly between and even within countries. It is important to recognize that every country has its barriers towards promoting innovation and no one policy or solution is applicable everywhere. However, in studying the spectrum of literature on the subject, we can draw inferences between countries of similar background and identify solutions that may be more broadly applicable.

4.1 What is Grassroots Innovation?

Grassroots innovations can be described as home-grown inventions or novelties created by everyday people and used to address challenges that directly or indirectly influence their lives. Formally, we define GIs as "indigenous solutions, created by actors in civil society and supported by limited resources, which aim to address local situations and often achieve sustainable development."

This definition is derived from several academic pieces focusing on the study of GI. Our inclusion of the term "indigenous solutions" is inspired by Anil Gupta's (2011) description of GIs as informal local and indigenous innovations by the people. In our definition, indigenous solutions are not meant to be understood as "native" solutions (although they can be). Instead, they are intended to be solutions that occur naturally in a given place. In a paper shedding light on the potential impact GIs can have on sustainable development, Sefang and Smith (2007) comment that grassroots initiatives tend to "operate in civil society arenas and involve committed activists" (p. 585). Sefang and Smith (2007) go on to highlight that GIs are often driven by social need, with a "resource base that is pluralistic and often sparse" (Sefang & Smith, 2007). Additionally, they note that GIs often experience "limited commercial activity [...] and mutual exchange" (p. 591). While not a prerequisite of GI, those that seek to achieve sustainable development are particularly desirable. Smith et al. (2015) describe GIs as "informal phenomena" including different network

architectures and a broad diversity of social actors. The authors also highlight that GI movements tend to use alternative strategies of knowledge production.

4.2 How Does Grassroots Innovation Differ from Broader/Classical Innovation?

Classical innovation is rather broad in scope. The Global Trade & Innovation Policy Alliance labels it as "the improvement of existing, or the creation of entirely new, products, processes, services, and businesses or organization models (GTIPA, 2019). Similarly, Edler and Fregberg (2016) define innovation as "the introduction of new solutions in response to problems, challenges, or opportunities that arise in the social and/or economic environment" (p. 3). Historically, classical innovation has often been used to describe new inventions or practices occurring in the private sector. However, instead of focusing on practices that may generate greater profits, GIs often confront "existential obstacles that market and institution-based niches do not" (Boyer, 2018, p. 33). While classical innovation tends to focus more on large scale, institution-backed technological advances, GI (also referred to as "social innovation") is understood through the everyday practices of individuals (Howaldt & Schwarz, 2010).

GIs and innovators have been around for centuries. The earliest humans were grassroots innovators who created new inventions, ideas, and systems to solve common societal problems. While GI dominated early human history, in contemporary history the focus has shifted from grassroots innovators to higher-profile, collective innovation efforts undertaken by private institutions, often driven by market-based incentives. Anil Gupta (2011) notes that "much of the literature is on the innovations for the people. Much less is available on innovations by the people." Indeed, GI has not been as common a research subject in recent years, but that is not to say its study is unimportant. GIs are special because they are often driven by curiosity, altruism, and the desire to solve common problems. These unique drivers of GI yield benefits that are more directly shared with their fellow community members.

4.3 What are the Potential Barriers to Grassroots Innovation in Developing Countries?

Overall, barriers to innovation and specifically to GI differ significantly by context. Thus, it would be inadequate for us to generalise the barriers grassroots innovators encounter in their journeys. Yet, here we introduce some of the most relevant findings presented by different researchers and academics.

While exploring community-based initiatives and their roles in governing energy transitions, Seyfang and Haxeltine (2011) identify four main barriers: 1. the capacity to create a strong network and build strong links with other actors; 2. constraints related to securing funding and time availability of the members; 3. growing the movement by creating broader public involvement and incorporating new members, that also erodes their capacity to institutionalise and consolidate; and 4. governance and learning challenges related to maintaining momentum and developing the group and their dynamics. Furthermore, they identify that as these organisations grow and gain more followers, they are more prone to encounter fundamental clashes of practices, values or ideas. Finally, as they expand, GIs find it hard to sustain a socio-technical space and diffuse their counter systemic ideas into an unsustainable regime or forming a niche.

Jonesa, Seetb, Acker & Whittle (2019) analyse the barriers encountered by art centres in remote indigenous communities, finding that Grassroots innovators also lack the managerial and entrepreneurial skills to deal with the social-cultural-commercial trilemma. Competition between different organisations and social enterprises with the same goals but different practices, the intrinsic cultural differences such as the understanding of hierarchy, and the suspicion over outsiders to the community working locally, raise additional complications for these grassroots innovators and the sustainability of their projects. Jonesa et al. (2019) also report that culture plays a fundamental role in solving the ideological tensions, particularly since dealing with conflicts can lead to violence if not properly managed. The lack of clarity in how leaders and members of the organizations interpret these paradoxes blur the boundaries of work-life balance, causing entrepreneurs to burn out. Finally, Jonesa et al. (2019) also state that local problems can affect social interactions, such as low levels of formal education or alcohol and drug abuse. Thus, some support dealing with the cultural tensions on both

sides is required to create community-based relationships that lead to integration and improved development opportunities for the organization and its different stakeholders.

Meanwhile, Smith, Fressoli & Thomas (2012) describe three challenges that grassroots innovators encounter. First, grassroots innovators need to be equipped with the capacity to serve the specificities of the locality in which they operate while at the same time pursuing a broad scale diffusion of their solutions. Secondly, grassroots innovators need to be adequate to the situations they are looking to transform. Lastly, grassroots innovators need to work with project-based solutions that pursue social justice goals while their solutions are rooted in systems and structures of political and economic power. The authors suggest grassroots innovators face additional challenges as they incorporate values and aspirations coherent with the local context, including political and economic realities while developing social-technical solutions that are also functional. Furthermore, as they have to internalise social justice principles that also consider changing the underlying structure that causes injustices, their viability is constrained by the political and economic structures they are looking to transform. The authors caution against developing a framework too rigid or prescriptive, as it can distort, constrain or exclude forms of grassroots knowledge that can be considered inconvenient. Smith et al. (2012), however, point out that existing metrics and institutions of innovation are currently causing that effect, highlighting the importance of framing in building a more inclusive concept of innovation, given that mainstream innovation competes for influencing the innovation policy agenda. Table 1 summarises the main challenges identified and how they relate to this theory.

Table 1 - GI challenges, framings, and knowledge production from Smith et al. (2012)

Grassroots innovation challenge	Framing of grassroots innovation	Forms of knowledge emphasised
Locally-specific, yet widely-applicable	*Grassroots ingenuity*: Grassroots creatively coping for local absence of provision through existing market and state processes (Kaplinsky, 2010; Gupta et al., 2003; Bhaduri and Kumar, 2011).	*Ethnographic*: - Needs unmet by markets and states - Livelihood conditions and responses - Pragmatic sustainability improvements - Augmentation opportunities for bottom-up solutions
Appropriate to, yet transforming situations	*Empowering inclusion*: Pioneering socially just and environmentally sustainable economies and societies (Seyfang and Smith, 2007; Dagnino, 2009; Abrol, 2005)	*Instrumental*: - Socio-technical practices under different value systems - Capabilities and resources required - Economic, social and environmental performance and feasibility under different contexts - Production and maintenance requirements
Project-based solutions, yet seeking structural change	*Structural critique*: By trying to do things very differently, grassroots movements make visible the structural impediments to inclusive innovation (Dickson, 1974; Rybczynski, 1980).	*Critical*: - Institutional misfits - Lack of infrastructure - Economic and political structures - Potential allies and antagonists

Finally, Hossain (2018) states that grassroots innovators are constrained by a triple tension in connecting three highly interrelated issues: scaling up, success and sustainability. He argues that funding could be a barrier to developing, maintaining and expanding GI. The author points out the difficulties grassroots innovators encounter in diffusing their practices and ideas beyond their local niches into the larger part of society. He suggests that innovation projects require different local skilled workforces, support for research and aid in protecting intellectual property. As grassroots innovators rely on the early stages of volunteering work and lack appropriate infrastructures or institutional support, their growth could pose challenges related to losing popularity with their local citizens and alienating the community they are serving. Hossain (2018) notes that a key challenge is moving from the community level to mainstream adoption. Even if this is accomplished, success as a grassroots innovator will remain difficult to measure. He also points out that grassroots innovators find intrinsic and extrinsic challenges to scale up and succeed. On the intrinsic side, he mentions internal organisation, skill requirements, vulnerabilities such as key team members leaving the organisation, significant reductions in funding, high turnover levels among volunteers and local or national policy changes. On the extrinsic side, he highlights how GIs are context-specific, depending on their members' ideological commitment, geographical rootedness, and competition. He points out that grassroots movements also face the additional challenge of achieving their long-term goals as they often lack the long-term commitment required.

Overall, the academic literature seems to treat GIs as social movements and not as innovations per se. Grassroots innovators empower local communities while promoting a virtuous circle where personal culture and entrepreneurial skills merge, preserving and promoting local culture. In that sense, language and framing play important roles in encouraging or discouraging innovation.

4.4 What Policies have Historically Been Shown to Promote Innovation, Particularly in Developing Countries?

It is difficult to quantify which policies promote GI, as GIs are difficult to measure. The literature points towards problems that need solving and historically utilised policy solutions to encourage broader sector innovation. However, there is still no substantial information available pertaining to the empirical study of GI. Additionally, although there

is a significant amount of information about innovation policy in developed countries, much of this information is "not directly applicable to developing countries because of the nature of challenges the latter are facing" (Aubert, 2005, p. 6). Developing countries tend to experience more unique challenges, which can require more targeted solutions.

This section will outline and evaluate a series of policy solutions that have been highlighted in academic literature before finally providing a series of contextual examples involving these policy solutions in the following section. We want to emphasise that there is no single strategy or policy destined to be successful for every country. As outlined in a PricewaterhouseCoopers (2010) report on the subject of innovation policy, "each country has distinctive assets and deficits that shape the context in which a government crafts its own strategy" (p. 4). This is even more applicable when comparing developing countries, which differ drastically in many facets. We seek to integrate the importance of context throughout this report while also drawing connections between environments that may benefit from similar solutions.

4.4.1 Tax Incentives and Grants

Tax incentives and grants towards private sector actors have long been targeted as potential policy tools to promote innovation. Tax incentives have proven effective in promoting innovation in many developed countries, but it is not clear whether they are effective in developing countries. A report by the World Bank Institute points out that tax incentives are not particularly helpful for most developing, low-income countries (Aubert, 2005). This is especially the case in countries with a large informal sector and/or a poorly equipped tax administration (Aubert, 2005). In these situations, countries may benefit more from grants and guaranteed resources provided to research bodies (Aubert, 2005). Borras and Edquist (2019) share similar sentiments in their paper regarding holistic innovation policy. In a report published by the United Nations University, Sunil Mani (1999) claims that while tax incentives and grants can help promote innovation in developing countries, tax incentives may be preferable when the government wants to shift more financial risk to the private companies. However, Mani (1999) also explains that tax incentives or credits might be easier to abuse and "cannot be targeted at R&D projects with large spillover effects, unlike direct funding programmes" (p. 23).

In contrast, Goedhuys et al. (2015) claim that tax incentives might be preferable to smaller private firms, as these incentives provide immediate financial aid as opposed to grants, which require time and effort to apply for. They go on to claim that tax incentives aimed at increasing R&D in smaller firms would not "suffer from the presence of deadweight loss" because of the reduced size of these firms' budgets (Goedhuys et al., 2015, p. 84). In his paper on innovation systems for economic growth, Charles Edquist (2014) points out that tax incentives and grants might benefit larger companies more than smaller ones who need the support.[14] As a solution to this issue, Edquist (2014) points to Cyprus, whose government created a "stepwise strategy whereby new and more risky industries receive a fair share of the [grant] budget, enabling them to prove themselves in order to receive more funding" (p. 22). Finally, a report published by the OECD (2020) found that R&D tax incentives "have impacts within and across for inducing companies to engage in R&D for the first time and modifying levels of R&D for companies that already perform R&D" (p. 66). This report also finds that smaller businesses responded better to R&D tax incentives than larger companies (OECD, 2020). However, these results come from a study population of developed countries and might not represent other, less developed countries.

In summary, tax incentives focused on R&D growth stand to provide the greatest amount of benefit to developing countries with strong tax administrations and developed private sectors. However, R&D grants may be more prudent in countries with large informal economies, weak tax administrations, and high levels of inequity between large and small firms. R&D grants also provide more potential to help grassroots innovators looking to enter the formal economy.

4.4.2 Strengthening Intellectual Property Rights

Most sources agree that strong intellectual property IPR are beneficial for promoting innovation in developed countries. However, the use of IPR to support innovation in developing countries are controversial. While some claim that strong IPR are crucial in encouraging new firms to enter the formal economy, others disregard their efficacy towards smaller-scale, grassroots innovators

The use of IP laws may not yield significant results in developing countries for several reasons. Firstly, similar to the case of tax incentives, IP laws are only effective if a government can enforce these laws. Even in countries where IP is heavily protected by the law, like Bangladesh, these laws will not yield results if they are not followed (GTIPA, 2019). Additionally, IP laws have the potential to be most effective in markets where extrinsic or monetary motivations drive innovators. However, in areas where intrinsic motivations drive innovators, IP laws will lack efficacy. Studies of grassroots and user-led innovators, particularly in developing countries, point to intrinsic motivations as the dominant driver of innovative activity. One such study conducted in India found that very few innovative efforts are motivated by purely extrinsic incentives (Bhaduri & Kumar, 2011). Instead, a significant portion of innovative efforts were inspired by purely intrinsic drivers (like the joy of work, duty to social commons, and autonomy) (Bhaduri & Kumar, 2011). The study also observed that "intrinsic motivation is most highly rated at the stage of idea generation," the first stage of the innovation process (Bhaduri & Kumar, 2011, p. 51). This could imply that when grassroots innovators are deciding whether or not to enter the innovation marketplace, they are less likely to be influenced by IP laws or monetary incentives (Bhaduri & Kumar, 2011). However, motivating factors may differ between developing countries.

Despite recent resistance to the use of IP laws to promote innovation in developing countries, the Center for Strategic and International Studies asserts that arguments against IP laws exaggerate the costs and risks associated with IPR (Lewis, 2008). The report claims that "countries with inadequate IP protection place an invisible ceiling on their own growth by creating disincentives for both domestic innovators and foreign investors" (Lewis, 2008, p. 40). While this report does acknowledge the argument that IP laws neglect to provide sufficient support to traditional or indigenous sources of knowledge, the response to this position is that it is important to legally protect these traditional sources of knowledge (Lewis, 2008). This would appear to be slightly counterintuitive, as these sources of knowledge are extremely beneficial because they are openly shared and not privately owned. It may be possible to introduce these traditional sources of knowledge into the public domain, but this raises further complications. The World Bank Institute provides an interesting compromise to the two sides of the IP argument. Their report

brings up the possibility of using utility models or petty patents for innovations in developing countries (Aubert, 2005). These forms of intellectual property protection exist for a shorter duration but still provide adequate protection and "are more easily obtained and target a lower level of inventiveness" (Aubert, 2005, p. 26).

4.4.3 Improving Access to Information and Communications Technology

For many developing countries, improving access to information and communications technology (ICT) can be one of the most impactful policies to promote innovations of all kinds. Without widespread access to communication forums, such as the internet, prospective innovators might lack the inspiration or tools to pursue their projects. Active innovators will have a more difficult time developing and spreading their innovations in the formal market or elsewhere. However, improving access to ICT can be costly and difficult. Even in some more developed countries, access to ICT can be sparse in rural areas that are less densely populated or areas that exhibit geographical limitations to ICT infrastructure. Nevertheless, it is still important to prioritise access to ICT as an area of policy emphasis in developing countries.

Zerfass and Huck-Sandhu (2007), in their paper on innovation, communication, and leadership, comment that "systemic cooperation and communication with various involved stakeholders becomes essential" concerning innovation (p. 110). They go on to comment on the ubiquity of communication networks in modern innovation. New technologies and processes are no longer created by single actors but instead by "a broad network of relevant stakeholders (p. 110). Although this paper focuses on private sector innovation, their remarks ring true for grassroots innovators as well. In all countries, user-led innovations are supported and permeated through the use of ICT. Access to Informal and formal methods of communication, often via the internet or cell phone, provide vast amounts of knowledge, unique perspectives, and the elevated potential for collaboration.

Improving ICT infrastructure is cited as increasing innovation, productivity and fostering socio-economic development (Bankole & Mimbi, 2017). Ayoub Yousefi (2011) state that "ICT can foster innovation and reduce poverty by making available an empowering wealth of information to economic agents in developing countries" (p.581). Yousefi (2011) points to studies by the OECD that highlight the direct economic impact of ICT investments on

growth in GDP growth. He acknowledges, however, that investment in ICT infrastructure can be a significant barrier for developing countries). These costs will likely continue to decrease with the advent of newer and more efficient ICT. Improving ICT infrastructure can continue to be hampered by several other barriers, including inadequate electricity supply, lack of ICT skills, high illiteracy, ineffective regulatory bodies, and corruption (Touray et al., 2013). It may be necessary to address these issues in concurrence with cost or geographical constraints. Although expanding ICT infrastructure may be difficult, it has proven instrumental in promoting long-run innovation in nearly every context. ICT offers forums of discussion and collaboration for individuals across countries and continents, enabling community members to become more effective and efficient innovators.

4.4.4 Establishing and Supporting Administrative and Regulatory Bodies

Administrative and regulatory bodies can play an important role in fostering a burgeoning formal economy and significantly impacting smaller-scale innovators. If provided the necessary resources, these bodies can facilitate greater ease of bringing innovative solutions to the formal marketplace. This is accomplished by creating a streamlined process of establishing and running a business, enforcement of regulations on taxation, and the instillment of an easily navigable and a reliable regulatory system. Although these regulatory bodies can serve to assist small-scale innovators seeking to enter the formal market, they may not provide substantial benefit to grassroots innovators, who often tend to work and innovate in informal marketplaces.

Regulations can both positively and negatively affect innovation, depending on the way they are structured and enforced. For example, regulations that inhibit anti competitive behaviour can diversify market structures, ensuring newer firms can enter the formal market (OECD, 1996). Yet, some claim that anti-competitive regulations can slow the rate of technological progress and innovation (OECD, 1996). A research paper looking at a specific labour regulations in France that impacts firms with more than 50 employees found that this discretionary regulation significantly hampered innovation amongst firms directly below the regulatory cutoff (Aghion et al., 2019). While it is not entirely clear whether regulations that seek to level the business playing field are beneficial towards innovation, they are likely not highly desirable in most developing countries, particularly

those without any clear domestic powerhouse corporations. Above all, regulatory and administrative bodies must create regulations and systems that are reliable and straightforward. When regulations become complex and costly to navigate, they can prohibit small-scale innovators from entering the market. Additionally, the reliability of a regulatory infrastructure can encourage increased investment from international firms. Contractor et al. (2020) find that foreign direct investment decisions are often motivated by regulatory and institutional factors. When regulations change constantly or are not enforced, foreign firms may be less likely to invest, as they see the economic environment and governmental environment as volatile.

Administrative bodies should work hand-in-hand with regulatory bodies, ensuring structured and transparent business processes. The World Bank's Ease of Doing Business rankings provide clear indicators of what beneficial regulatory environment. They utilise administrative cost and time of starting a business, cost and duration of construction permits, property registration difficulty, complexity and cost of taxes, import and export costs, and contract enforcement, among others, to measure how conducive a regulatory environment is to economic success (The World Bank, 2019). Developing countries tend to score lowest on these indicators, but there are some exceptions. Overall, this index highlights the potential importance of simplistic and cost-efficient business regulations. This is particularly important for countries with new and burgeoning private sectors. Simplifying the process of starting a business can enable more innovators to reach the formal marketplace.

4.4.5 Strengthening Access to and Quality of Education

Improving education quality and access can be highly beneficial to virtually all countries. However, education systems must be changed in the manner most befitting of their circumstances. Effective education can provide citizens with the tools to help them become successful innovators and better prepare them for life outside of the classroom. However, it is not always clear what type of education will be the most effective.

Looking at education's impact on development, a paper by Gruber and Kosack (2014) highlights that developing countries should shift focus towards increasing spending on primary education. The authors suggest that most developing countries should focus on

quality and not solely enrolment rates, as increases in enrolment can result in increased future inequality. This tends to be the case in countries where there is "tertiary tilt," meaning "educational resources are concentrated on students in higher education" (Gruber & Kosack, 2014, p. 253). In countries where education spending is more focused on primary schooling, the relationship between primary school enrolment rates and equality is positive (Gruber & Kosack, 2014). Inflated spending on tertiary/higher education is a problem in many developing countries. For example, the average Sub-Saharan African country spends nearly 21% of their education budget on tertiary education, with only 3% of the tertiary-aged population enrolled in tertiary schools (Gruber & Kosack, 2014). This research suggests that increased primary education funding and quality can result in a more equitable citizenry, providing more opportunities and training to those who might otherwise be left behind. This would undoubtedly be beneficial for grassroots innovators, many of whom may not have the ability to attend higher education. Some academic papers specifically look to study the links between basic education and innovation in developing countries. One such paper examining farmers in rural areas of Ethiopia found that more educated farmers were significantly less risk-averse than those without education (Knight et al., 2010). This is a positive outcome, as there is a substantial risk-aversion among African farmers (Knight et al, 2010). Knight et al. (2010) find that "both schooling and attitudes toward risk were found to be important for innovation" (p. 19).

While increasing spending on primary education will likely serve to benefit grassroots innovators, improving tertiary education has been shown to promote private sector innovation in more developed contexts. A paper analysing the impact of education on innovation in China found that workers who attended secondary and tertiary schools were more innovative (Chi & Qian, 2010). Additionally, the paper discovered that increases in tertiary education enrolment were correlated with increases in patent applications (Chi & Qian, 2010). However, in the case of China, the positive effect of tertiary education appears to have diminishing marginal returns to productivity and innovation (Chi & Qian, 2010). Higher education institutions can serve as hubs of more formal research and innovation. Still, funding for higher education should consider the proportion of the population with access to this education and the extent to which there is room for growth.

Lastly, implementing tailored, skills-based education and training is important to improving innovation outputs. Borras and Edquist (2015) find that developing competencies among the workforce is essential to ensuring long term economic growth and innovation. However, they specify that countries and regions need to identify for themselves what knowledge, skills, and experience will be most useful to their innovation systems in the immediate and long-term future (Borras & Edquist, 2015). It may be necessary to develop a comprehensive monitoring body that actively identifies how skills-based education should be tailored to changing national and regional needs (Borras & Edquist, 2015). This skills training will likely be best accomplished at the school level rather than by firms. Private firms may prioritise skills and innovations that immediately impact their productivity rather than those that build toward long-run future benefits.

5 Conceptual Framework

5.1 Background of Conceptual Framework

Prior studies have identified both enablers and barriers to GI (Jones et al., 2019; Seyfang & Smith, 2007; Smith et al., 2012). However, only a few established frameworks to analyse and investigate GI. In the light of understanding how GI works in the field, we interviewed some experts in grassroots or user-led innovation. Inspired by these different frameworks and approaches in analysing GI, we designed our analytical framework to address our research question, conduct the interviews and case studies, and provide policy recommendations.

Brem and Wolfram (2014) found that there have been very few academic discussions on innovation approaches from emerging markets. They argue that GI has low sophistication, accomplished intuitively by providing a solution to a problem in the environment or community (Gupta, 2008). However, they classify GI as high in sustainability due to its claimed objectives and role in market orientation as it tends to attract international NGOs to invest in them.

Smith et al.(2017) develop a qualitative framework consisting of context, framings, spaces and strategies, and pathways to analyse six GI networks worldwide. First, they argue that broader historical and political-economy context were vital as predominant directions in the development of innovation. It also provides an opportunity for grassroots alternative innovation to emerge. The second dimension, framings, analyse GI through their shared meaning and interpretation. Framings represent how an action could motivate the actors to build alternative pathways (Leach et al., 2010). Next, they look into spaces and strategies to identify the place where the innovation emerges. Spaces may not always be physical. Any social and institutional arena, such as community group and university, could be considered spaces. Pathways, the last dimension, is how they analyse the GIs developed over time, transforming from vision to practice to achieve the goals (Smith et al., 2010).

Gupta (2019) proposed a framework describing factors that contribute to the feasibility and value of GI. She recognised three antecedents of GI come from different sources, namely: (1) the innovator itself through the level of education, motivation, and other personal traits; (2) environment through the local culture and interpersonal networks; and

(3) market through demand potential. GI, she argued, would develop to a sustained form with support from different organisations and stakeholders through funding, marketing, and organisational support. She emphasises that a sustained value of GI could be either commercial or non-commercial value.

Given the identified need for GI workshops, UN ESCAP published a workbook that documents policies and strategies derived from the Honey Bee Network in 2020. The workbook gives policy recommendations to discover, promote, support, and protect GIs. It is highlighted in this literature that not every GI needs to be commercialised. Hence, social diffusion is suggested. This workbook, however, does not take any contextual difference into account. The idea was built on India's stable indigenous innovation network, which might not be applicable to other countries. We incorporate the recommendations in our framework and develop it further with a contextual perspective.

In addition to analysing existing frameworks in the literature, we conducted a few interviews with GI experts to understand the complexity of the matter in the real world. Align with his book, Adrian Smith argued that different innovations emerging at the local level could share the same agenda and expectation. This shared motivation forms a network that will support innovation at a higher level. The role of the networks is what develops many GI movements, such as Honey Bee Network and People's Science Movement. Eric von Hippel also suggests to view innovation at the individual and system-level. In developing countries, different individual innovations work simultaneously to form a bigger system-level innovation. Individual-level innovation is not necessarily commercialised; hence it is difficult to measure the value. To understand different innovation developments among countries, one should conduct a deeper investigation on innovation-sharing platforms such as Github.

In summary, Brem and Wolfram's research gives clear criteria to distinguish GI from other types of frugal and indigenous innovation. Yet, it does not explain the motivation of emergence nor actions to help it develop. Smith et al.'s literature provides compelling reason to focus on contextual background. However, the context is not sufficient to analyse what supports the innovation to develop. Gupta gives a set of moderating factors that contributes to sustained GIs. Similarly, UN ESCAP provides a set of recommendations

for the government to promote GIs. Both Gupta and UN ESCAP, however, do not offer contextual roles in the emergence of GIs.

As a result of our exhaustive research and interviews on GI frameworks, we concluded that we need a comprehensive framework. We propose a framework that incorporates two main drivers of GI, the contextual background and the set of policies from either government or innovation networks.

5.2 Design of Framework

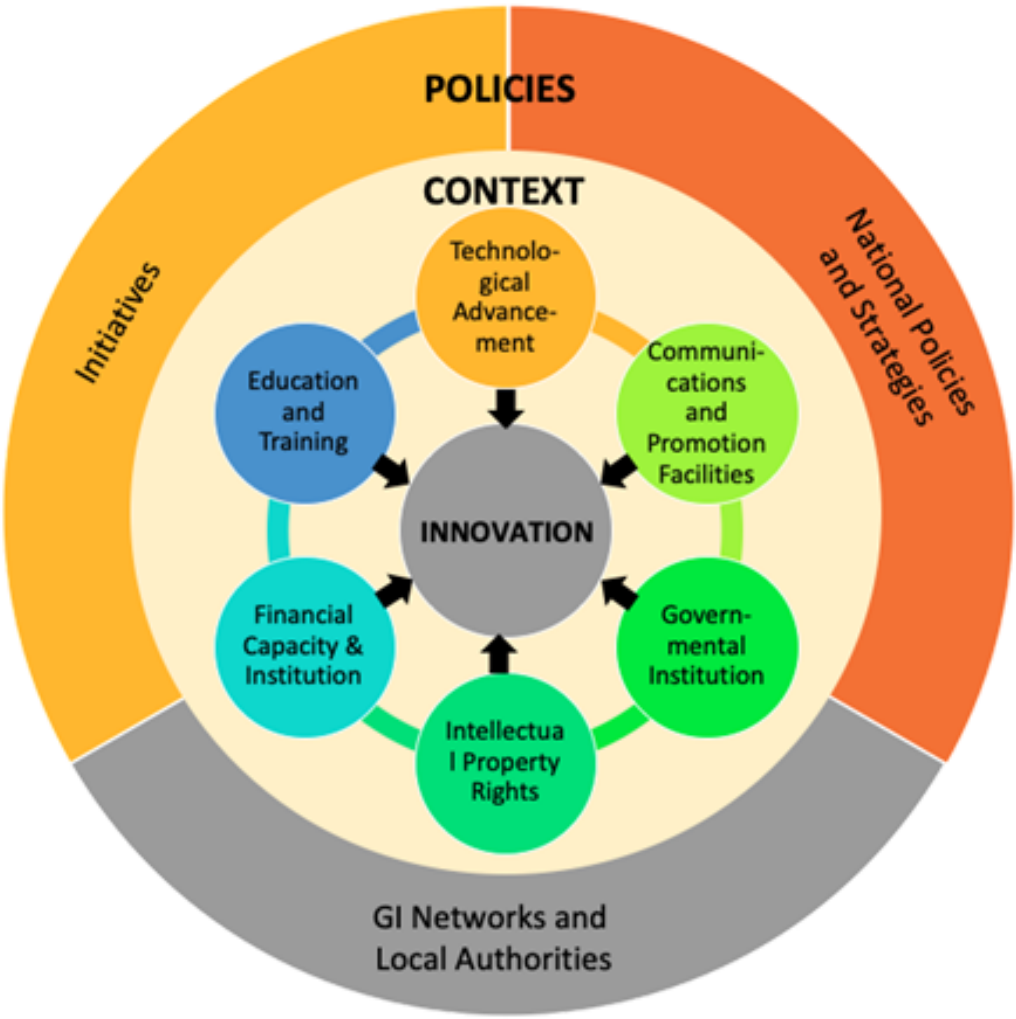
As previously mentioned, the field of GI has been studied and explored very briefly both by academics and practitioners. We reached out to several of these academics and practitioners and explored existing literature and case studies, to help us construct our framework. Each academic, practitioner and piece of literature filled out some empty spaces in our puzzle, leading our framework to materialise in Figure 2.

5.3 The Logic

Grassroots innovation is not an independent phenomenon. Technological advancement, sustainability, and scalability of innovations strongly rely on the surrounding environment. From the very early stages of an innovation being developed to its sustainability and growth stages, the environment shapes its path towards success. Grassroots innovators innovate to the level that their surrounding economic, social, political and technological contexts allow them to do so.

The key to supporting and encouraging GI is to effectively assess and improve the contextual elements that greatly impact the emergence, sustainability, and growth of innovation. In other words, any third party intervention should primarily address the context, not the innovation process. In an innovation-averse environment, direct interventions should be extended to help innovators overcome the hostile environment, which implies solving a problem of inefficiency. Moreover, the sustainability of direct interventions is highly questionable as direct interventions have little contribution to the improvement of innovation environments, causing innovators to rely on governments' support permanently.

Figure 2 – Conceptual framework of this research



5.3.1 Context

Our research finds six contextual aspects of a locality that could directly and significantly impact GIs' flourishment. The first aspect we found is the level of **Technological Advancement**. Technological Advancement refers to both access to high-tech products in local markets and the production of such products inside hosting countries and regions. To the extent, innovators have access to high-tech products, their ability to deliver more effective, more sustainable, and more diverse innovations improves. On the other hand, firms should stand on the same or higher technological advancement level as innovators to support innovations for their sustainment and growth stages. We have also differentiated between local and national levels of technological advancement to address federalism and transportation issues.

Once an innovator successfully materialises his/her idea in the form of an initial prototype, a preview version of an online platform, or a pilot implementation of a large-scale programme, communication becomes central to the sustainment and growth stages of the innovation. At the sustainment stage, communication helps ideas propagate at the regional level. Hosting communities and their surrounding neighbourhoods are primary markets for GIs. Without proper communication within these communities, innovators will fail to secure their necessary market share and sustain their innovation. The same logic applies to the growth level, where targets of communication are firms and businesses. We found three important elements in **Communications and Promotion Facilities**: Access to ICT networks and products, density of community relations (which addresses average distance between the host and the surrounding communities), and business promotion culture (to bring the cultural aspect into consideration).

Under **Governmental Institutions**, three different aspects of political institutions in the hosting country with three different impact mechanisms are discussed. The first element is the Level of Decentralisation. Bardhan and Mookherjee (2006) discuss the trade-offs of decentralisation in developing countries regarding public services provision. As a desired consequence, more decentralised governments can respond more promptly to public needs and demands. On the other hand, however, decentralisation reduces national governments' control over local governments' financial affairs and can lead to budget leakage and corruption. Further, the Rule of Law allows innovators to plan and to ensure their business rights are protected. And finally, under Social Actions and Civil Society, we assess the ability of innovators to speak up, demonstrate their needs, and demand governmental support.

We separately assess intellectual property right regulations and their enforcement. Implications of **Intellectual Property Rights** for GI have been subject to academic debates. Some academics argue that comprehensive Intellectual Property (IP) rights and their strong enforcement have positive impacts on GIs because innovators are likely paid by firms and businesses acquiring their ideas. On the other hand, other academics (including Eric von Hippel from MIT) believe that being copied by non-innovators in

hosting and neighbouring communities is a method of propagation for GIs and helps them sustain and grow. With strongly enforced IP rights, the copying process will be harmed, and some innovations will not reach the sustainment stage as a result. We look at IP rights enforcement at business and individual levels to be able to analyse both arguments.

Innovation is not a costless process. Developing and refining prototypes, promoting innovative products and services, and large-scale provision all need financial resources. Resources may come from innovators savings or outside sources. Under **Financial Capacity and Institutions,** we assess how properly grassroots innovators have access to financial resources. We also look at the tax rates as a means for encouragement/discouragement of innovation.

Additionally, **Education and Training** are vital for the process of innovation. Education systems are designed to teach pupils how to socialise, read, write, and be creative, which is the central skill for all innovators. Professional training provides innovators with the necessary knowledge of tools, products, and services around them to materialise their ideas. This enables innovators to deliver more sophisticated innovations.

5.3.2 Policies

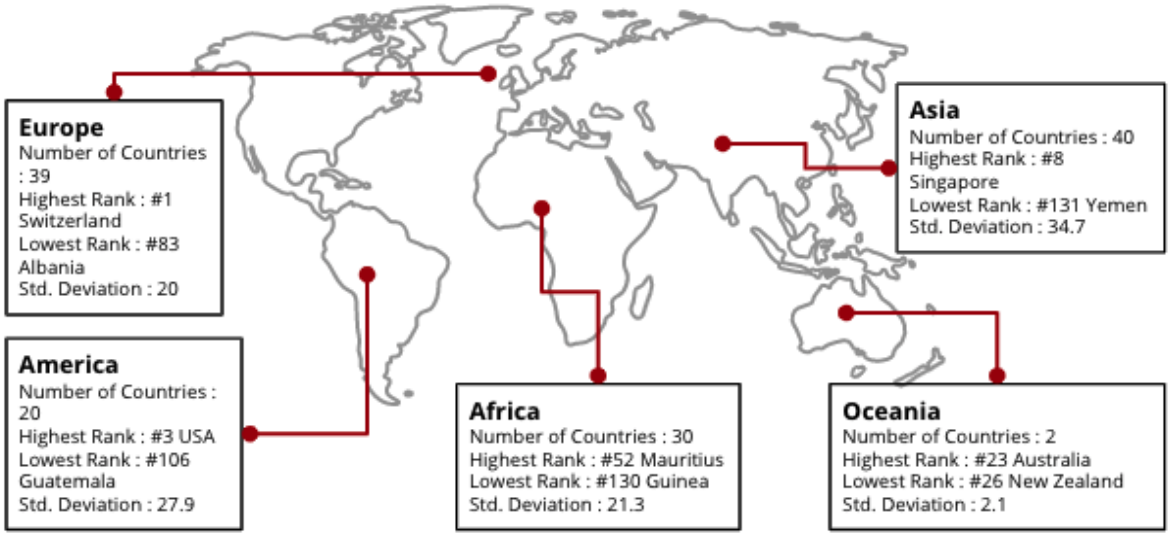
Our framework considers three policy-making and implementation levels: national **Governments**, governmental and non-governmental foundations and **Initiatives**, and **Local Authorities and Grassroots Innovation Labs**. National governments can support GIs by institutionalising their support agenda, introducing and passing bills (e.g. tax exemptions or budget dedication), or providing primary infrastructure. Foundations and initiatives are designed as less bureaucratic bodies that relate governments to GI networks and local authorities, handle public budgets dedicated to GIs, and assess the overall situation regarding GIs in the country. On the local level, local authorities and innovation labs manage on-the-ground operations and advocate for more extensive support from governments and international organisations.

6 Quantitative Analysis

6.1 Overview of Context

At a glance, the innovation ecosystem across continents varies significantly. According to the WIPO's 2020 Global Innovation Index (GII) as illustrated in Figure 3, Asia is the continent with the highest standard deviation of innovation rank, representing the largest gap of innovation ecosystem among countries. Putting aside Oceania as an outlier, Europe is the continent with the least inequality of innovation-supporting ecosystem among its nations. On average, countries in Africa have the lowest range of ranks, followed by America and Asia.

Figure 3 - Worldwide innovation ecosystem according to WIPO (2020)



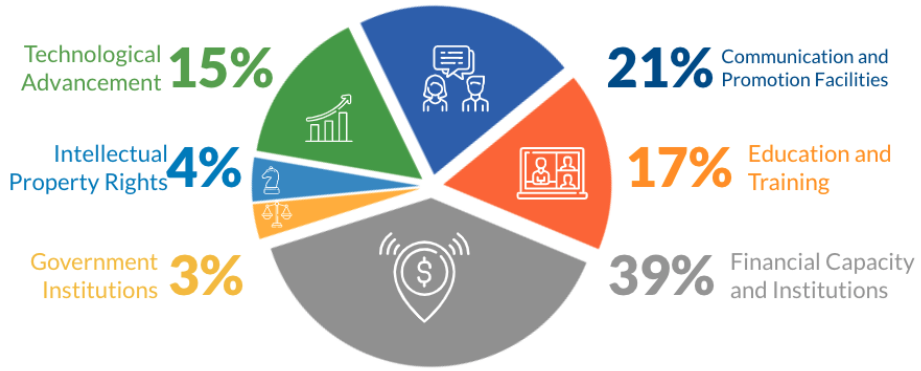
Our preliminary research shows that it is difficult to individually analyse the emergence of innovation from the context of where it emerges. To formulate a fitting policy recommendation, an in-depth analysis of each country's context is necessary. As mentioned in the framework, we categorise the context into six parameters: technological advancement, communication and promotion facilities, governmental institutions, IPR, financial capacity and institutions, and education and training. The findings across each context would justify the policy option that each country should address. However, there was minimal data on Iraq. Therefore, the context analysis is limited to the other six countries.

6.2 Overview of Survey

In addition to contextual ecosystem analysis, the justification of our policy recommendations stems from the survey results. According to the innovators and the other supporting parties of innovation, our survey resulted in a set of enablers and barriers of GI. By identifying the barriers experienced by people in the field, we could prioritise the critical aspects to resolve. On the other hand, the enablers identified through the survey could be a starting point to create an ecosystem supporting GI.

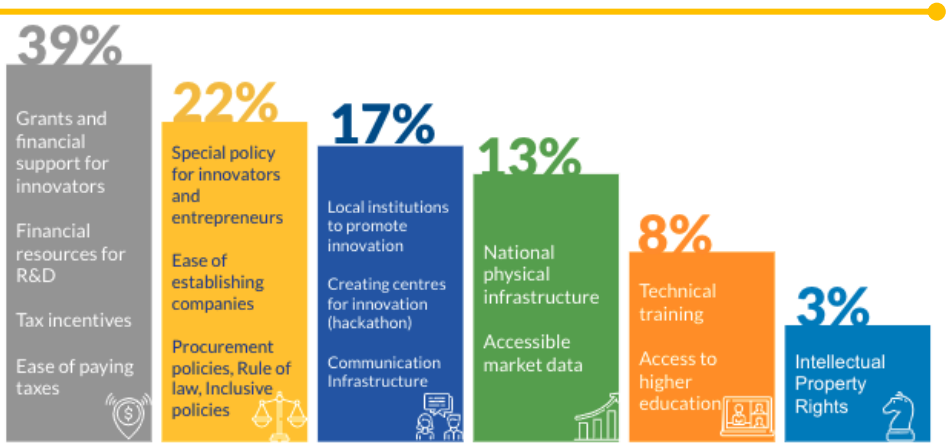
The survey was in circulation for about 40 days, and we received 45 complete responses. We distributed the survey to seven UNDP AL which they further distributed to approximately 10-15 grassroots innovators or people that are involved in the network. From these responses, we obtained a range of barriers that may affect the growth of a GI. Illustrated in Figure 4, we identified that the financial capacity and institution is the most significant barrier, followed by communication and promotion facilities, education and training, and technological advancement. Interestingly, our survey result shows that IPR and government institutions are not dominant barriers for GI.

Figure 4 - Barriers to GI according to survey



On the other side, the respondents see the role of financial support for innovators, including tax incentives and the simplicity of the tax system, as a primary enabler for GI, shown in Figure 5. Government institutions surfaced as the second dominant enabler, followed by communication and promotion facilities, technological advancement, and education and training. Similar to the barriers, IPR seem to take a neutral stance; neither motivating someone to innovate, nor promoting innovation to grow.

Figure 5 - Enablers of GI according to survey



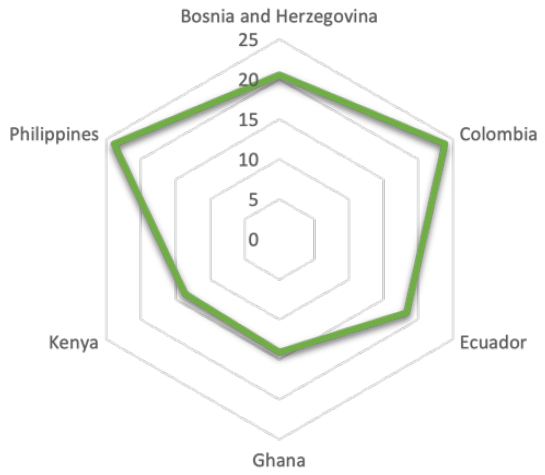
6.3 Technological Advancement

In general, our framework investigates four parameters when explaining a country's technological advancement: general infrastructure, ecological sustainability, R&D, and the capability of a country to foster its knowledge and technology into outputs (detail in Appendix 4). If we look at GII worldwide data, there is a strong sense that countries with good infrastructure have a higher capability to translate the knowledge they obtain into outputs. Furthermore, there is a large disparity between North America and South America, and Eastern Asia with the rest of Asia. Europe has the best infrastructure and knowledge creation on average.

Table 2 - Technological advancement parameters in six countries

Parameters	Philippines	Bosnia and Herzegovina	Kenya	Ghana	Colombia	Ecuador
General infrastructure	24.6	22.7	15.4	19.2	21.7	23.3
Ecological sustainability	29.7	35.9	16.3	22.7	45.5	30.8
Knowledge and technology output	35.1	21.2	18.4	12.6	17.9	12.3
R&D	6.2	2.3	4.5	1.9	9.9	6.8

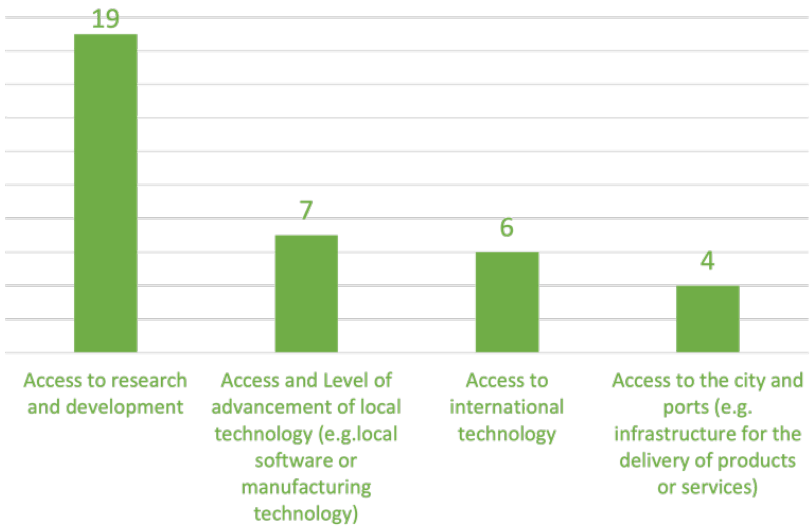
Figure 6 - Technological advancement context across countries



As shown in Table 1, we found that the Philippines, Ecuador and Bosnia and Herzegovina have the best infrastructure and ecological conditions among the countries that participated in our research. The Philippines also has the highest score for translating their knowledge and technology outputs. Ghana and Bosnia and Herzegovina need to improve their R&D to catch up with other countries.

Our survey results, illustrated in Figure 7, show that 15% of total votes from the respondents perceive technological advancement as a barrier to GI. The main concern is access to R&D. They also express some concern about access to local and international technology. Infrastructure, represented in access to the city and ports, does not appear to be a concern for GI to emerge and flourish, which contradicts what the literature suggests. On the other hand, 13% of the respondents suggest technological advancement, which ranks fourth, is an enabler. Finally, contrary to what the literature suggests, national physical infrastructure and accessible market data were not perceived as impactful to help the innovation grow.

Figure 7 - Technological advancement barriers to grassroots innovation



6.4 Communication and promotion facilities

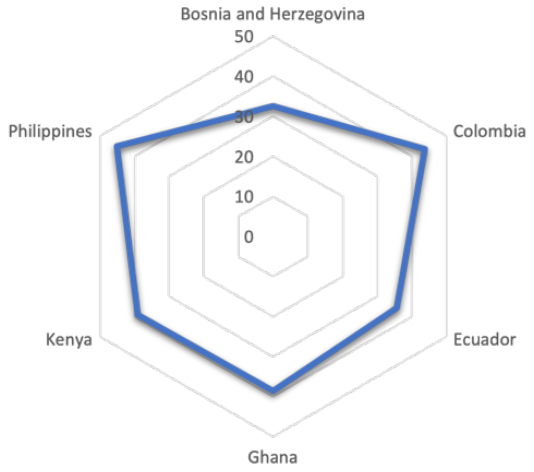
Studies show that ICT plays a prominent role in promoting innovation in both developed and developing countries (Touray et al., 2013; Bankole & Mimbi, 2017). Access to ICT is essential for innovators to communicate and connect with users, producers, and other stakeholders. In general, most countries have at least 50 out of 100 people who own a mobile phone subscription. Regardless of whether they can access the Internet, most world populations are familiar with using mobile phones for communication. There are a multitude of opportunities for countries to develop further technologies or policies leveraging this massive number of mobile subscriptions if not through the Internet.

Table 3 – Communication and promotion facilities parameters in six countries

Parameters	Philippines	Bosnia and Herzegovina	Kenya	Ghana	Colombia	Ecuador
ICT score	68.9	52	44.8	55.6	71.9	57.9
Innovation linkages	21.3	13	33.4	21.5	15.5	13.4

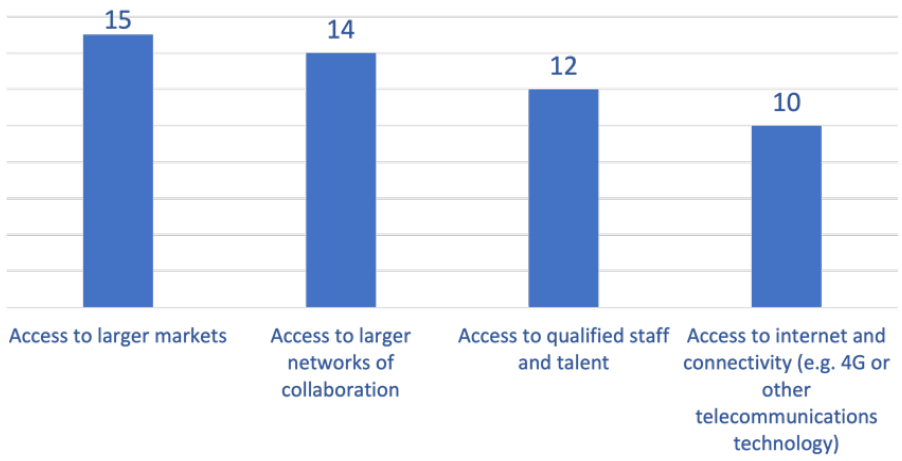
We measured two parameters provided by GII when comparing communication and promotion facilities. First, the ICT score includes the level of ICT access, the use of ICT, online government service, and e-participation in the country. Second, the innovation linkage represents the collaboration level of the university, industry, and various cluster developments. As seen in Table 2, Colombia and the Philippines have the highest ICT score, exceeding Bosnia and Herzegovina. Kenya appears as an outlier due to its low ICT score despite having the highest innovation linkages among the six. This is due to Kenya's university and industry collaboration that generates innovations (Jowi et al., 2017).

Figure 8 - Communication and promotion facilities context across countries



In our survey, communication and promotion facilities are the second-highest barriers to GI. As illustrated in Figure 9, our respondents feel that access to larger markets, access to more extensive networks of collaboration, access to qualified staff and talents, and access to the internet are barriers to innovation. In line with what the literature suggests, grassroots innovators need to have a channel to communicate with other innovators and the consumers if they want to develop the product or service. On the other hand, our respondents suggest that communication and promotion facilities could be vital enablers. The facilities that enable GI are not limited to the Internet and social media. In fact, physical form of communication and promotion, such as local markets to promote innovation, co-creating spaces, and hackathons, are more desirable.

Figure 9 - Communication and promotion facilities barriers to GI



6.5 Governmental Institution

The role of government in facilitating innovation is vital (Aubert, 2015). In assessing the governmental institution context, we compared the political environment, which consists of political stability and government effectiveness, and regulatory environment that includes regulatory quality and the rule of law across countries. Theoretically, a stable government and robust regulatory system should provide an ideal ecosystem for citizens to express their ideas, innovate, and obtain funding domestically and internationally.

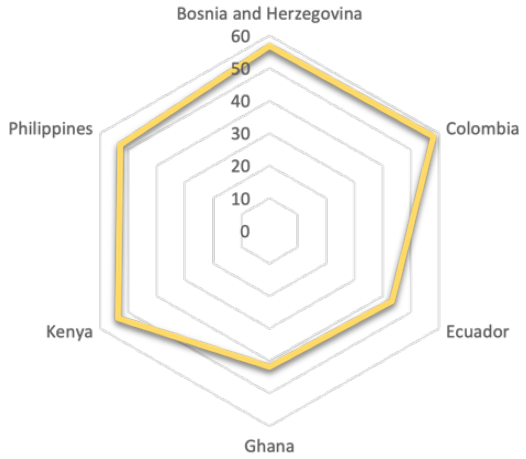
All the countries in our research show a volatile political environment compared to the more stable developed countries that usually score an average of 80. The regulatory environment might need significant transformation, especially for Ghana and Ecuador.

Table 4 - Governmental institution parameters in six countries

Parameters	Philippines	Bosnia and Herzegovina	Kenya	Ghana	Colombia	Ecuador
Political environment	55.6	45.6	47	52.9	53	48
Regulatory environment	50.1	68	60.3	30.7	63	38.6

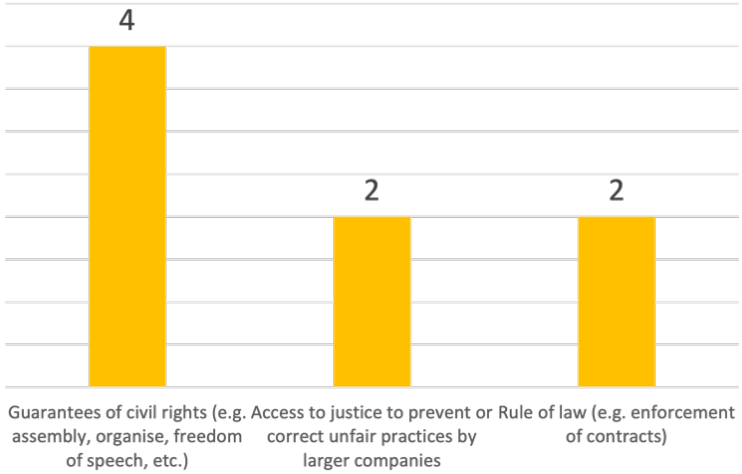
Bosnia and Herzegovina, formerly part of the Soviet Union and now recognised as a potential candidate member country of the EU, is privileged with a robust regulatory environment. This opportunity could be geared toward an innovation-friendly ecosystem.

Figure 11 - Governmental institutions context across countries



Only 3% of our respondents perceive governmental institutions as a barrier. These respondents feel that the guarantee of civil rights, like freedom of speech, is a barrier to innovation, which is interesting, as we identified a high threat of freedom of expression in Colombia and Iraq, through our interviews. Conversely, 22% of the respondents perceived the governmental institution as an enabler. Some favourable aspects of government that support GI include the establishment of dedicated policy for innovators and entrepreneurs, the ease of establishing companies, and other inclusive policies supported by the effective rule of law.

Figure 10 - Governmental institutions barriers to grassroots innovation



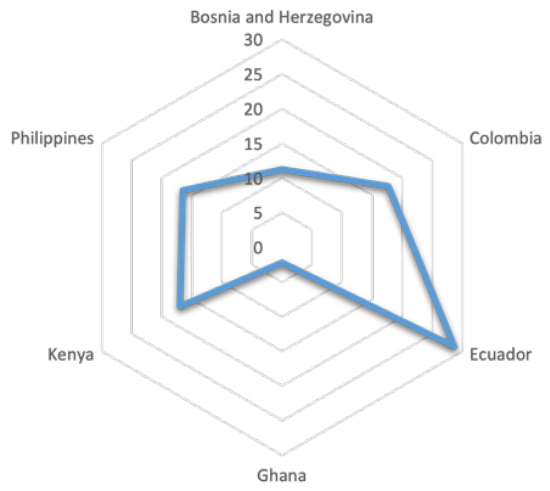
6.6 Intellectual Property Right

The literature is well populated with the issuance of IPR as a determinant of how innovation is evolving in a particular country. However, the law itself cannot yield any result unless there are policies in place to protect the IP right and enforce any violation. In countries where innovations are not motivated by altruistic motive, IP laws will have low effectiveness.

Table 5 - IPR parameters in six countries

Parameters	Philippines	Bosnia and Herzegovina	Kenya	Ghana	Colombia	Ecuador
Trademarks by origin	32.4	20.8	32.6	4.3	34.8	57.1
Patents by origin	0.6	1.8	1.4	0.1	0.6	0.2

Figure 12 - Intellectual property rights context across countries



To compare the implementation of IPR, we use two parameters: trademarks and patents issued at national or regional offices per billion PPP$ GDP. Trademarks are commonly used by innovators or owners of a product or service to distinguish their product from another product in the market, whilst 'patents by origin' refer to the value of a patent registered to an intellectual property body in a certain country per billion PPP$ GDP. Ecuador has the highest trademarks among the countries we examined, while Bosnia and Herzegovina has the highest number of registered patents. Ghana ranks last in these measurements by a significant margin, implying that the country might need to improve its IPR regulation and implementation.

Figure 13 - Intellectual property rights barrier to grassroots innovation

Contrary to some branches of innovation literature, we found that only 4% of total votes see the protection of IPR as a barrier to innovation at the grassroots level. Similarly, IPR are not viewed as enablers to GI. An explanation that we obtained from the interview is that many of the innovators face a trade-off between registering their innovation and entering the market as soon as possible. Therefore, many prefer not to lose momentum to enter the market and prefer not to file for trademarks or patents.

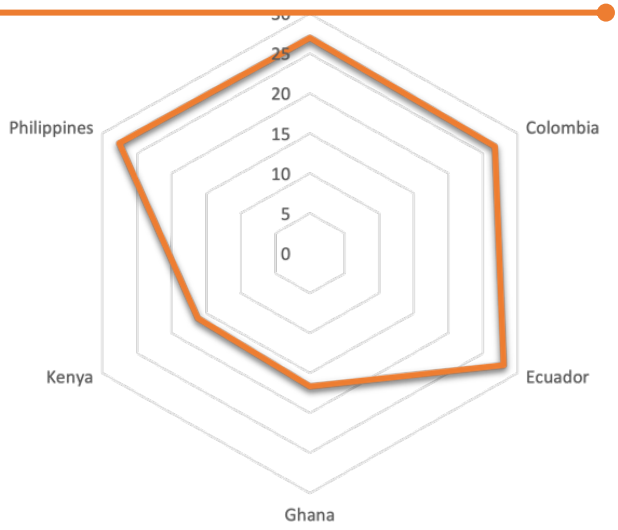
6.7 Education and Training

According to the World Bank data, the enrolment rate of primary education has reached an average of more than 70%, except in Africa. However, the enrolment percentage significantly decreases as the education level gets higher. Whilst tertiary education has been an engine for innovation and correlates with patent application (Chi & Qian, 2010), the World Bank data shows that only a handful of countries have a share of their population that complete higher education above 20%. The growth over time shows a slowly increasing trend for Sub-Saharan Africa and a more significant rise in Europe and East Asia, which explains the evidence of China in Chi & Qian (2010). North America experienced a fall of share in the year 2010-2014, contrary to what is experienced by Latin America and the Caribbean.

Table 6 - Education and training parameters in six countries

Parameters	Philippines	Bosnia and Herzegovina	Kenya	Ghana	Colombia	Ecuador
Expenditure on education	2.7	n/a	5.3	4	4.5	5
School life expectancy	13.1	n/a	10.3	11.5	14.4	15.2
Tertiary enrollment	35.5	n/a	11.5	15.7	55.3	44.9
Graduates in science and engineering	28.7	21.2	16.5	16.4	23.1	15.8
Knowledge-intensive employment	25.5	21.8	n/a	12.2	n/a	13.1
Firms offering formal training	59.8	37.9	37.4	40.1	63	73.7

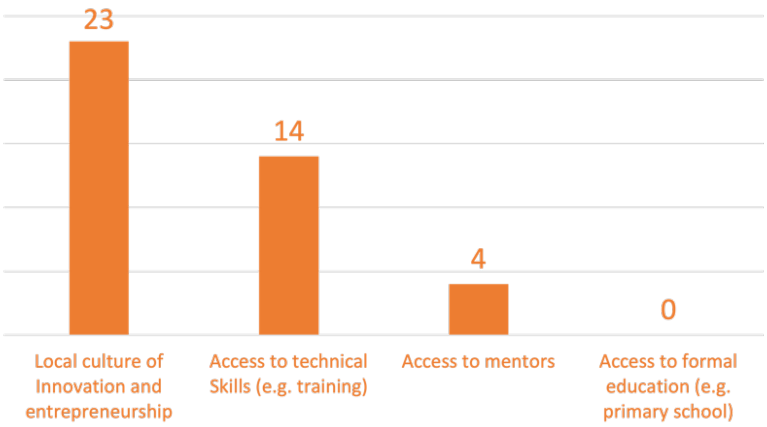
Figure 14 - Education and training context across countries



For the purposes of comparison, we use six parameters to present education and training conditions, as seen in Table 5. From this data, we can attest that Colombia and Ecuador have the highest expenditure on education per GDP and highest school life expectancy and tertiary education enrolment, compared to other countries. However, the Philippines produces the highest level of graduates in science and engineering. Both Ecuador and Colombia also have the largest percentage of firms that offer formal training, which is significant in increasing the technical skills of labour.

The survey result places education and training as a barrier to GI with 17% of the total votes. Our respondents also claim that the local culture of innovation and entrepreneurship could hinder the innovation itself. An explanation for this is from what we observed in the interviews is the lack of trust in local knowledge. Furthermore, limited technical skills impede the entrepreneur's ability to innovate. Therefore, it is essential to recognise the significance of entrepreneurship and technical skills training, apart from formal education, in building an innovation-friendly ecosystem. Interestingly, we found that access to formal education does not contribute as barriers to GI. This is likely due to the fact that the observed countries have a sound primary education system.

Figure 15 - Education and training barriers to grassroots innovation



On the other hand, education and training appear as enablers for GI. Less than 10% of the total votes feel that technical training and access to higher education contribute

positively to the growth of innovation. This finding supports many prior studies that state the importance of higher education to stimulate innovation.

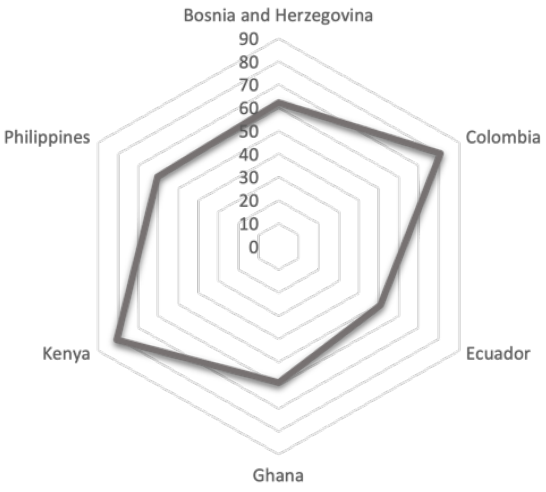
6.8 Financial Capacity and Institutions

The literature has confirmed that financial assistance, either through grants or tax incentives, is an essential resource for GI to emerge and grow (Mani, 1999). Therefore, a supporting ecosystem of financial capacity and institutions would be an advantage for innovators. To analyse the financial ecosystem in the countries we work with, we use five parameters: ease of getting credit, ease of protecting minority investors, the intensity of local competition, ease of starting a business, and ease of resolving insolvency.

Table 7 - Financial capacity and institutions parameters in six countries

Parameters	Philippi-nes	Bosnia and Herzegovina	Kenya	Ghana	Colombia	Ecuador
Ease of getting credit	40	65	95	60	90	45
Ease of protecting minority investors	60	56	92	60	80	44
The intensity of local competition	75	61.9	72	63.4	75	69.8
Ease of starting a business	71.3	60	82.7	85	87	69.1
Ease of resolving insolvency	55.1	68.2	62.4	25.4	71.4	25.5

Figure 16 - Financial capacity and institutions context across countries

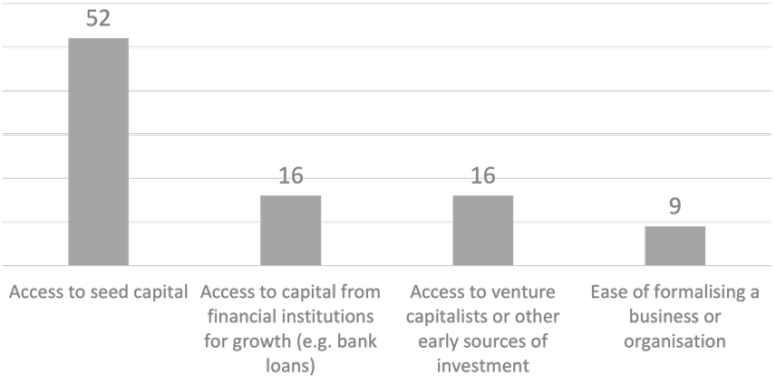


From the data we received, we found that, on average, Colombia and the Philippines have the most prominent financial capacity and institutions. However, we observe that the ease of getting credit and ease of protecting minority investors is the highest in Kenya before Colombia and Bosnia and Herzegovina. We found that Bosnia and Herzegovina has the lowest score of ease of starting a business. This is likely due to their recent transition from communism to a more capitalist economy.

Financial institutions are not limited to banks or other loan providers. A phenomena of massive mobile money accounts development in Africa is one example. Sub-Saharan African countries make up to half of the registered mobile money accounts worldwide,

reaching the number of US$400million according to the Mobile Money Metrics (2019). Mobile money is a system where individuals can deposit money to an account that links to a phone number and can be transferred to another phone user or converted back into cash. This innovation is proliferating in developing countries where bank branches and ICT are scarce. The use of mobile money in some countries in Africa has proven to reduce the number of households living in poverty (Jack and Suri, 2016). This technology is a limitless opportunity for innovators in developing countries to perform transactions, even in the most rural areas (ibid, 2011).

Figure 17 - Financial capacity and institutions barriers for grassroots innovation



According to our survey, financial capacity and institutions are considered to be the most challenging barriers but also the most critical enablers. More than a third of the total votes perceive financial capacity and institutions as a barrier, primarily due to access to seed capital. Since GI is usually initiated by either an individual or a small group in the community, seed capital would be the first resource used to develop the innovation. Meanwhile, access to capital from either financial institutions or venture capitalists are the latter concern. In addition, a small number of votes raise the ease of formalising business or organisation as a barrier.

Our respondents believe that financial capacity and institutions are the primary enabler of GI to emerge. The access to either grants or other financial support promotes innovation substantially. Furthermore, tax incentives and ease of paying taxes were also perceived to be enablers. This is supported by evidence in Ghana, where innovators were granted 5 tax-free years under several circumstances.

6.9 Caveats

There are several limitations in this research that are essential to acknowledge. First, the analysis of the enablers and barriers is a descriptive statistic. GI are difficult to measure,

prohibiting us from making more sophisticated analysis that includes regression. As a result, the findings could only identify the affecting factors without reflecting any correlation nor causal relationship. To accurately comprehend how these factors affect the GI, a further empirical study should be conducted.

Next, the research was conducted with UNDP Accelerators Labs' assistance. Most of our respondents and interviewees are connected to the network of UNDP AL. This similarity translates to a possibility of bias due to higher education background and similar motivation to be involved in this research. Future independent study that targets a more diverse random population could overcome this limitation.

Thirdly, there was very limited data on Iraq due to its unique political and economic situation for the last decade. Therefore, we could not incorporate Iraq in comparative analysis among countries. However, we would still include our findings on Iraq in the qualitative analysis section and provide a policy recommendation accordingly.

Finally, due to time and resource constraints, we could not circulate the survey for a longer period. Therefore, the number of responses we received might not be representable for the number of factors we aimed to assess. However, this research could be a foundation for future study that focuses on GI. Future research with more supporting resources with diverse and random respondents could strengthen the findings.

7 Qualitative Analysis

The information provided by the several interviewees helped us understand each of their different perceptions and priorities related to GI and how they are working towards encouraging GI. Following, we present an analytical overview of our findings

7.1 Context-specific

From our interviews, it seems that the most relevant factor about GI is that it is context-specific. What we mean by context-specific is that a combination of factors such as local culture, values, geography and history, influence the way in which GIs emerge as a response to context-specific challenges. Said in other words, grassroots entrepreneurs will bring to reality innovations responsive to the local challenges based on their perceptions of the world. These perceptions will not necessarily be aligned with western values and culture. For instance, in the Philippines, low-tech innovations responsive to the innovators' necessities gave life to creations such as a pumpable stove that increases the size of the flame while cooking or a portable corn sheller to aid small farmers to gain productivity. In Iraq, the mismatch between formal education and the market motivated a group of entrepreneurs to create a startup to fix the educational system for software programming. Therefore, it seems that GI cannot be fitted in the mainstream approach on innovation that assumes it is mainly technological, led by big corporations, developed in R&D departments and introduced in a top-down process.

7.2 Diversity

Another relevant characteristic of GI is its diversity. As GIs address local challenges, it is expected that they present a lot of diversity, which is consistent with the variety of countries we interviewed. Nevertheless, that diversity is further enlarged as it also incorporates a representation of the local culture and values. For instance, we learned about entrepreneurs in Kenya working on a light designed and used to prevent lion attacks or a device to warn communities of elephant attacks, solutions only suitable to contexts where the human-wildlife conflict exists. Meanwhile, in Ghana, we learned from a platform that helps individuals find medicines. In Ecuador, we learned about a grassroots company that helps households coordinate and prepare their recycling to be collected by the association of recyclers through a phone application. Furthermore, diversity is found not only between countries but also within them. For example, in Quito,

Ecuador, we learned from a collective movement of garment manufacturers that aimed to promote social cohesion and entrepreneurial values since that is what they identified as missing in their community.

7.3 Creativity

The diversity of GIs is fueled by the creativity from the grassroots innovators themselves, where creativity is encouraged as innovators explore different approaches to overcome the specific challenges they encounter. An example of this is the self-defined creative Philippines, where the country is composed of many islands. The differences among them boost creativity as it incorporates different sources of knowledge and perspectives, from indigenous traditional medicine to modern technological advancement. Furthermore, creativity equips grassroots innovators with tools to deal with local necessities using their available resources. For example, entrepreneurs from Iraq reported that during the war, hospitals needed to fix their machines.

Since the private sector to provide these services at that time was non-existent, some GIs provided the solutions to keep local hospitals running. The Kenyan team also described how Kenyans feel a need to innovate to improve their lives, where for example, some entrepreneurs were printing 3D medical supplies to cover the system's shortage. The Colombian team also shared with us this view, where people fix their problems to fulfil their necessities. The teams from Ecuador and Iraq also shared how institutional events such as Hackathons that assemble individuals from different backgrounds can help to encourage creativity and GI.

7.4 Governmental Institutions

All countries mentioned the importance of the government in encouraging GI, as it can solve collective action shortcomings and create opportunities to ease the process of creating and scaling solutions. All interviewees mentioned that there are not enough institutions to support GIs although some do exist. For instance, the Philippines has a law to promote GIs and a program named GI for Inclusive Development (GRIND) that targets GIs and provides them with training that helps them overcome initial challenges at the local level. Ecuador also has a program led by Conquito. Still, it is important to highlight

that the government has a relevant role in the whole innovation ecosystem, not only GIs in specific.

However, even when the government has an active role in promoting innovation, the interviewees mentioned that governments are biased towards technology-driven, top-down, corporate innovation. Thus, GIs that come from the bottom-up and incorporate many different approaches to innovation, which are not necessarily technological, are to a certain point, being neglected or left aside. For instance, in Kenya and Colombia, GIs are pervasive as people do not rely on the government to fix their problems. Yet, GIs do not view themselves as innovators as the innovation system does not include them. On the other hand, Iraq and Bosnia reported that as their governments are too big, they hinder private initiative and innovation by creating dependence and dwarfing the private sector. Yet, even in these scenarios, the role of the government in encouraging innovation seems relevant where policy plays an important role as long as the budget to promote change is available and the efforts are integrated. Furthermore, many countries highlighted the proximity to the community as an important feature of government programs.

7.5 Procurement

Additionally, as governments tend to procure in large amounts, GIs are systematically excluded from governmental contracts as they do not have the capacity to produce the volumes government's demand. Besides, procurement procedures also seem to be biased towards larger corporations. These procedures demand high levels of specialization, complex technical requirements, specific legal figures and significant financial guarantees. In other words, government's requirements are hard to fulfil and in the case of GIs, they are left behind even when they could have the capacity to offer the quality products and solutions the government needs. Governments could encourage GI by tailoring some of their procurement contracts towards GIs and by easing the financial requirements for GIs. On the other hand, technical requirements such as certifications add an additional layer of complexity as they require payments of significant fees that most GIs cannot afford in order to obtain the relevant documentation. Thus, this is a requirement that could be better evaluated for each procurement process.

7.6 Scaling

What appears to be a recurrent challenge that GIs face is scaling their ventures and coordinating with other relevant players in the ecosystem. Local infrastructures in place seem to be well prepared to ideate and incubate new ventures. For instance, entrepreneurs from Ecuador mentioned how they got supported by the local ecosystem to launch their venture, or one of the interviewed GIs in Iraq specifically focuses on aiding local entrepreneurs to ideate and incubate their ventures.

However, many ecosystems appear to be immature, missing players, highly centralized geographically and supported by fragmented silos of specialisation by different government levels. Particularly important is the financial infrastructure, which is commonly described as underdeveloped and highly centralized, making it harder for entrepreneurs to finance the growth of their activities. For example, in Iraq, interviewees reported that the financial system is not properly working. Many perceive banks as a vault, not properly trusting them, preventing the possibility of leveraging resources and becoming a barrier to GIs. In contexts where the financial system is more developed, such as Colombia, interviewees report that requirements for funding are complex and hard to fulfil by GIs.

Moreover, institutions such as angel investors are underdeveloped, making it hard for early-stage ventures to launch as they cannot find the financial resources. Overall, interviewees report that many relevant financial roles are missing, such as venture capital. Even when some start-ups emerge with the intent to fill these gaps, regulations can prevent the development of the financial ecosystem. For instance, in Ghana, where interviewees report that many fintech are emerging, the local regulations and procedures to approve their operations are not easy to fulfil. There is significant opportunity for the government to intervene in both integration and financial infrastructure development. The government can help better coordinate and strengthen the local ecosystem by facilitating local intercommunication, increasing integration by fostering networking spaces, and promoting local financial institutions and access to seed or other types of capital. Another challenge GIs mentioned is access to technical skills related to launching and growing in the early stages of product development. As GIs have limited resources,

the size of GI ventures also tend to be small. Moreover, they also mentioned the hardships they encounter in finding talent. As part of fostering the infrastructure to grow, policies could target entrepreneurial skills and other basic skills such as digital literacy to further boost innovation.

7.7 Education and training

Overall, GIs mentioned that their educational systems lack managerial and entrepreneurial training, which made them seek those skills outside the formal educational system. For instance, Ghana described that as formal education is not focused on building skills, the education does not translate into human capital. Educational systems among the interviewed are diverse, with some having good public education such as Bosnia and others lacking it. For instance, grassroots innovators from Iraq reported a relevant mismatch between the education system and the market, even when formal education has good content. Still, the teaching method is lagging in providing students with the skills they will need after graduation.

Furthermore, GIs emphasised challenges in finding people with the skills they are looking for to advance their ventures. GIs highlighted that financial literacy and English are additional skills that the formal education system is not delivering. Notwithstanding, some governments are making efforts to provide students with the skills required for entrepreneurship, such as the new Kenyan curriculum that introduces innovation from an early age.

The interviewees also questioned the ability of public servants to prepare an adequate curriculum since they are not ready for a tech-driven future, and defining the skills required is difficult. Iraq noted that their public servants might not have a proper understanding of entrepreneurship, specifically how to come with a feasible idea, implement and fund it. Furthermore, countries such as Ecuador and Colombia also reported that language can become a barrier as many indigenous communities speak different languages, and formal education do not fully incorporate adequate language skills in the curriculum. Additionally, countries like the Philippines reported that indigenous knowledge is not recognised such as traditional botanical medicine, handed down through generations. Finally, some countries such as Kenya reported that their

educational systems are experiencing brain drain of professors, which further deters them from improving their formal education delivery.

7.8 Information and communication technology

The different interviewees reported that ICTs play a significant role in fostering GI with Kenya, noting they have the largest mobile subscription in the region. The Internet eases connectivity and enables communication channels and knowledge that would be costly to acquire otherwise. Furthermore, during the COVID-19 pandemic, several GIs described how the internet facilitated their ventures and drove growth in certain cases. For example, a grassroots innovator from Ecuador who works with textile manufacturing described how during the pandemic, the demand for their products increased and how the internet eased the process of connecting and coordinating inside their network. Ghana also reported how the internet constitutes a driver of innovation as local innovation mainly comes from young people who are more connected, sometimes even leveraging remote areas.

Nevertheless, many countries described that the lack of internet connectivity in rural areas contributes to the difficulty of incorporating people from these regions into the grassroots movement, furthering the existing disparities between the capital cities and remote regions. For instance, Colombia described how the mountains create a “last mile gap” of internet connectivity, furthering the existing gap between the urban and rural access to technology.

Furthermore, even when ICTs are in place in the cities, low penetration rates and low quality, such as it was described by Iraq’s interviewees, make it hard to fully incorporate the internet as part of the GIs’ business model. Additionally, high costs of acquisition can also hinder GIs activities as it was described by the Philippines interviewees, or in Ghana, where the price reported for one gigabyte was one dollar. Therefore, ICTs can play a significant role in fostering GIs. If internet and connectivity technologies are not broadly available, they become a structural challenge that needs to be addressed by policy.

7.9 The role of international organisations and networks

International organisations (IOs) play a significant role in fostering GIs. For example, all the interviewed grassroots innovators mentioned the role of UNDP AL as a key player in

easing their entrepreneurial journey and as a partner in creating new connections throughout the ecosystem. Certainly, this information is biased as entrepreneurs were referred to us by the AL. Still, they also mentioned how other IOs with expertise in innovation and entrepreneurship were fundamental at the beginning of their journey by introducing them to other players or transferring knowledge, which suggests that the support of IOs is indeed important. In that sense, they all mentioned how networks they were exposed to played a significant role in empowering their innovation journey by providing them with broader opportunities, contacts, funding, talent and sources of knowledge.

Furthermore, they mentioned how networks help to build trust and connect with reliable individuals, a characteristic that plays a significant role in contexts that have been recently hit by war and conflict, such as Iraq and Colombia. Particularly, Iraq's GIs mentioned how security issues create distrust and fear, which becomes a barrier for entrepreneurs as they find it harder to negotiate, with political and economic instability making it riskier to invest and commit to long-term deals. Thus, insecurity or terrorism created high levels of uncertainty, leading to a pervasive lack of trust. Even when governments can play a significant role in building trust by strengthening the rule of law, these processes are likely to be slow.

Yet, networks or organisations such as UNDP AL can have powerful roles in recovering that trust by reconnecting individuals, notably as solidarity seems to be a systemic feature of GIs. Another feature of networks appears to be their capacity to adapt faster to circumstances by leveraging from shared resources. For example, a GIs innovator from Iraq shared how during the war GIs provided medical supplies and fixed hospital machines as these were the emergent necessities. Following these features of GIs networks, the focus should be on scaling the GIs movement and strengthening the network. Therefore, a network such as the UNDP AL adds significant value by identifying key players in the ecosystem. Additionally, UNDP AL plays a key role in bringing GIs together to target bottlenecks or local opportunities, e.g., the Open Innovation events in Ghana or Colombia, and serves as a proof of concept that the government can later scale.

An example of this is GRIND in the Philippines, which reported using the UNDP methodology to explore and map key players in their GI ecosystem.

7.10 Media

In fostering support towards GI, the media plays a significant role by giving visibility to many different approaches to innovation and creating awareness about the products, services, and people in the grassroots ecosystem. For instance, in Bosnia, a former communist country where innovation is relatively a foreign term, and young-talented individuals tend to emigrate as they perceive opportunities are insufficient (GEM, 2017), the media could play a significant role in promoting local role models and narrating inspiring stories of local entrepreneurs to raise awareness of how pervasive innovation is in the country and encourage new entrepreneurs to stay at their home country to work on their ventures.

An example of this is Ecuador, where one of our grassroots interviewees narrated how the media played a significant role in promoting their innovation and encouraging the recycling movement they were creating. Kenyan interviewees also mentioned how the media plays an important role in fostering GI. Likewise, the media also plays a central role in promoting new narratives of innovation and value. The role of the media is especially important in countries like Colombia, where grassroots innovators sometimes do not view themselves as innovators, and where locally made products are less valued. Consequently, the media can play a significant role by influencing the culture and mindset related to GI and highlighting the value of local products.

7.11 Intellectual property rights

IPR is a controversial topic. For some, it is an important challenge for grassroots innovators, as patents represent significant investments that GIs cannot afford and create barriers to promote more inclusive models of innovation. For others, IPR enable smaller competitors to protect their innovations against incumbent larger corporations and creates incentives for fostering more innovation. For instance, Colombia reported that entrepreneurs are afraid to share their ideas as they could be robbed, or Kenya reported seeing larger corporations copying ideas from smaller entrepreneurs. Still, in all but one

of the countries interviewed (Bosnia), even when the institutions to protect IPR are in place, the laws are not enforced.

Furthermore, when registration processes are bureaucratic and time-consuming, GIs face a trade-off between going to market or registering, making it even harder for them to protect their ideas. This trade-off was, for example, reported by entrepreneurs from Iraq and Ghana.

At the local level, knowledge around these types of rights is still not fully comprehended. The lack of awareness makes it costly for entrepreneurs to understand what they are patenting and how to do it, specifically with software technologies where even the regulators do not have clarity about how to patent this type of innovation. For example, an Ecuadorian grassroots innovator wanting to register their intellectual property was still struggling to find adequate advice, from the government and local lawyers, about how to register their phone application and whether it should patent the code, the process or something else. Yet, even when IPR are a relevant subject, it is in the implementation where GIs find the real challenge as they struggle to lay hands on the funding, human talent, infrastructure and other resources required to take their ideas to reality.

7.12 Corruption

Corruption and government bureaucracy represent a barrier for GIs. Power Dynamics are present at every stage of the entrepreneurial journey, from registering the organisation to competing against larger players with better connections to the government. Still, even when corruption appears to be a recurrent problem, GIs seem to adapt and learn to navigate it by "cheating or hacking" the system. For example, one GI from Iraq reported how the process to register was complicated and lengthy until he met someone that could help inside the institution in charge of the registration. However, a good policy could significantly reduce the barriers GIs encounter in formalising and implementing their ventures. On the other hand, it is important to highlight that innovation and entrepreneurship are also political, where there are winners and losers and competing narratives about what innovation is. As GIs remains an underexplored type of innovation and grassroots innovators themselves remain small players, advocating for legislation towards them remains important.

7.13 Responsiveness

UNDP ALs appear to be very responsive to the local necessities but filtered by their staff priorities. In that sense, we noticed that the AL's perceptions and local priorities about GIs seem to be very much influenced by the profile of the people who are leading the local team. For example, we noticed the focus of Ghana's ALs leans towards technology-driven innovation while the staff's background is also in technological development. On the other hand, in Ecuador, where the staff's background is more related to economics and Social Sciences, the priorities lean towards economic development and social inclusion.

7.14 COVID-19

Finally, all our interviewees mentioned the coronavirus pandemic has disrupted their work and their local ecosystems in many ways. COVID-19 has disrupted how education is delivered, what procedures are followed to register or deal with governmental or international organisations, how GIs interact with other players, making the internet a dominant part of their lives, if and when they have access to it. Nevertheless, we see significant value added by UNDP AL for aiding the local ecosystems by implementing different measures such as Open Innovation challenges to trigger and lead local GIs networks.

8 Policy Recommendation and Conclusion

8.1 Policy Recommendations

As previously mentioned in the report, GI, and the extent of success or failure of communities in being innovative at the grassroots level, heavily depend on what is known as "context". The problem of contextuality and intercultural diversity, make it complicated - if not impossible - to develop one fits-for-all set of recommendations. Our framework opens the window to a comprehensive analysis of the context. Based on our framework, we clustered the set of policies recommended in three levels: National Governments, Initiatives, and Local Authorities. The aim of this policy set is not to universalize the efforts for supporting GI, but to suggest a comprehensive list of policies for interested parties to select and prioritise their supportive activities from.

8.1.1 What governments can do:

- Institutionalising support for GI in the form of National Policy Initiatives and Government- Dependent Foundations
- Dedicating budget to the development of GI in the form of Grants and Funds
- Easing Business Registration Process by reviewing regulations and legal procedures
- Improving ICT Coverage especially in most deprived areas and provide co-creating space
- Enhancing education regarding entrepreneurial skills and technical training

8.1.2 What initiatives can do:

- Directing and distributing Grants and Funds to grassroots innovators.
- Shaping Partnerships with NGOs and International Organisations to reach out to further financial resources and receive advisory services
- Helping evidence-based and data driven decision making in the field by Data Gathering and Solution Mapping
- Helping evidence-based and data driven decision making in the field by Data Gathering and Solution Mapping
- Advocating for Governmental Support of GI
- Promoting the culture of innovation at the grassroots level by attracting Media Coverage and holding Events

8.1.3 What Local Authorities and GI Networks Can Do:

- Facilitating Access to Financial Resources by acting as guarantor for private loans and by receiving and distributing grants
- Designing and offering Professional Training Programmes
- Empowering communities for shaping Civil Society and Social Movements

8.2 Conclusion

This report aimed to explore what contextual characteristics and set of policies can promote grassroots innovation. Through our collaboration with the 7 UNDP ALs, our research suggests that policies concerning GIs have country-specific characteristics that need further synchronisation, and traditional innovation policies need to be adapted to nurture and encourage GIs. The need for creating conducive environments through appropriate policies is ever pressing, considering how the importance and contributions of GIs have been neglected for several years.

Our study has tried to provide a rich understanding of GIs through the mixed-methodology method. We recognised very quickly that a framework to understand GIs in a way that we could apply in our research was non-existent. Therefore, we have introduced a conceptual framework that we hope is a helpful tool that will explain the GI landscape in a specific context better when applied.

Through the interviews conducted with UNDP ALs that participated in our study, the report has attempted to provide a candid and comprehensive understanding of GIs' ground realities in the qualitative analysis section of this document. Additionally, we have also included a one-page brief SWOT analysis with tailored policy recommendations of each of the 7 countries we interviewed in the appendix. We derived our quantitative insights from the survey that we co-developed with UNDP AL and distributed it to the 7 countries that participated in the study. Due to the logistical and time constraints, we could not draw any causal inferences, and our analysis is limited to descriptive statistics, which nonetheless yielded some valuable insights.

Our survey results confirmed what we learned from the interviews in almost all framework domains except intellectual property rights (IPR). There was no consensus among those we interviewed on its significance. The survey results also suggest that

financial capacity and institutions, and communications and promotional facilities are the most significant impediments faced by GIs, followed by education and training, and technological advancement, consistent with what we learned from the interviews. Two notable parallels between the survey findings and the interview results include the role of information and communication technologies (ICTs) and relevant education and entrepreneurial skills training. For example, the discussions shed light on the critical role ICTs play in fostering GIs, specifically mobile subscriptions and access to the internet. Access to ICTs becomes even more critical in a pandemic situation. The GIs we interviewed also highlighted how overall, their respective educational systems lacked emphasis on managerial and entrepreneurial skills training, making them seek those skills outside the formal system.

Conversely, the survey results suggest that financial support, when received, is a key enabler to GIs. The findings confirmed what we learned from the interviews, like in Ghana, where tax incentives were instrumental in promoting GIs. Communication and promotion facilities follow suit. As mentioned in our qualitative analysis, UNDP AL's role in this ecosystem is important, particularly in building trust, sharing resources and emerging practices. Again, IPR does not seem to make much of a difference either way - be it in terms of motivating a GI to innovate or promoting innovation to grow.

Throughout this study, we have consistently maintained that the problem of contextuality and intercultural diversity makes it nearly impossible to develop a set of applicable recommendations that is replicable from one context to another. We did, however, propose a set of policies across National Governments, Initiatives, and Local Authorities that we believe can be beneficial to GIs, in addition to the tailored policy recommendations we provided as part of our country-specific SWOT analysis. We hope, through our research, we have adequately documented and demonstrated the critical role GIs play in our ecosystem. We certainly hope that in the future, GIs will be supported not just from a policy space but as a movement overall and that our research has to some extent, made a contribution in the right direction.

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10 Appendices

10.1 Appendix 1 – Country SWOT Analysis and Policy Recommendations

The Philippines

Context parameters score:

GDP per capita	US$3337.68	Population/area	368/km²
Technological advancement	23.90	Intellectual Property Rights	16.50
Communication and promotion facilities	45.1	Education and Training	27.55
Governmental institutions	52.85	Financial Capacity and Institutions	60.28

Creative in nature, the Philippines adopted the spirit of GI in many areas of the community. UNDP AL established a journey of solution mapping that they called SalikLabay as an adventure of finding bottom-up innovations in every single corner. Like many other developing countries, the Philippines face difficulties in providing ICT to its rural areas. However, the government's initiatives and support through different acts and projects is a distinctive point.

Strengths and Opportunities

- People in the Philippines are highly creative. They develop GI for two reasons. First, to fulfil their personal needs or the society needs using a hack of daily equipment and tools, such as creating flowerpot from used towels or using banana peel as an insulator. Second, they might use their innovation as a business model from which they earn their living. For instance, since the internet is expensive for lower income people, some people invented 1 peso internet with a PC desk and a timer in the middle of a busy traditional market. Identifying these innovations and providing the support through training and funding, would increase the inclusivity of innovation in the Philippines.
- Government involvement in reaching out to grassroots innovators across the country is an exceptional strategy. The training that the government provides for local innovators through GI for Inclusive Development (GRIND) allows innovators to learn more on scaling up their innovations. As the program is developing to a national scale, the opportunity to explore more GI is wide open.
- The government has a commitment to develop an ecosystem that supports innovation in which funding can be granted to innovators. This could be a perfect opportunity for Philippines society to invent and scale up their innovation.
- Through a decentralised approach, the government develops R&D centres in regions of the country cooperated with higher education institutions. If the centres are given the resource to map GI in the area, the innovation development could be even more inclusive.

Weaknesses and Threats

- Education in the Philippines, measured from the government expenditure and tertiary education enrolment, is still below the world median. Further attention should be given not only to R&D projects or higher education, but also primary and secondary education.
- Due to its geographical condition, ICT development in the Philippines might have not reached the entire population equally. For lower-income households, access to the internet

might still be expensive. If the equality for ICT access as one of the drivers of innovation is hardly fulfilled, inclusivity for innovation would be difficult to achieve.

- Even though the government has established pro-innovation projects across ministries, most of them are still focused on developing ICT-based innovation like start-ups. More attention to the inclusive part of innovation, such as the GI, could actually benefit the society as the Philippines are creative and develop creative goods and services better than half the countries in the world.

Governmental Policies and Initiatives:

- The government's Grassroots Innovation for Inclusive Development (GRIND) program is a significant step in the right direction. However, this program should be expanded to the national scale and built upon. The creation of community innovation centres, particularly in areas lacking access to higher education or more advanced entrepreneurial skills-training, could be a beneficial addition to the program. More importantly, the cataloguing and continued analysis of grassroots innovations would serve to introduce quantitative evidence that can inform future innovation-based policies. As the Filipino government has already demonstrated interest in grassroots innovation, the creation of a team to catalogue and analyse innovations appears to be feasible.
- Access to ICT in the Philippines is suboptimal and unequal. As of 2020 internet penetration stood at around 67% (Kemp, 2020). This number is growing, but the unequal dispersal of internet connectivity remains. This is particularly an issue as children are continually developing ICT skills at a younger age, leaving children in unconnected regions even more disadvantaged. In addition to expanding ICT infrastructure, the government should work to incorporate ICT into public schools. While it is difficult to provide internet to schools in areas where the infrastructure does not exist, introducing students to computers (even without internet access) can help them gain familiarity with technology that increasingly is increasingly utilized in nearly every type of job. Students can be taught typing skills, technology literacy, and potentially computer programming skills. This way, when internet access is expanded to these areas, the local population will be more able to take best advantage of it.

UNDP Accelerator Labs Initiatives:

- The Accelerator Lab team can play an important role in guiding the Filipino government towards supporting grassroots innovators rather than solely focusing on start-ups or entrepreneurial ventures that may be more tech-oriented and less inclusive. While the GRIND program is in its early days, it is important to demonstrate the value present in grassroots innovation. This can be accomplished through in person interviews/meetings with grassroots innovators, innovation challenges and analysis of innovation impacts. Detailing success stories and providing voices to inspirational innovators can help government workers understand the significance of grassroots innovation.

Ecuador

Context parameters score:

GDP per capita	US$5097.07	Population/area	71/km²
Technological advancement	18.30	Intellectual Property Rights	28.65
Communication and promotion facilities	35.65	Education and Training	27.95
Governmental institutions	43.30	Financial Capacity and Institutions	5.68

Having so many GIs in different areas, such as social, financial, and educational, Ecuador is still trying to overcome its greatest barrier, equality of access to important resources. The development of ICT reaches only the more centralised part of the country (Quito) and the provision of funding is biased towards big actors in the economy. With such potential, more participatory policy towards these small innovators should be put in place. Although some programs have been implemented, such as ConQuito, they remain insufficient to support the overall grassroot innovation movement emerging in the country.

Strengths and Opportunities

- The Ecuadorian innovation ecosystem seems to be developing slowly but consistently, primarily driven by a significant share of internationally trained young entrepreneurs who benefited from the government's past investment into scholarships. This poses a relevant opportunity for further accelerating the local ecosystem as there are plenty organisations providing training and support to local innovators to incubate their ideas and launch them.
- The market mechanisms seem to be well established, allowing for competition that can contribute to the already dynamic innovation ecosystem that is being built. Market sophistication also eases the process of market disruption by new entrants gaining market share for novel well-executed ideas that can become success cases to further encourage innovation.
- Local governments, such as Quito's government, are contributing in training and funding early stage GIs. International organisations are also playing a relevant role in further encouraging the development of GIs by promoting altogether events and spaces for networking.
- Ecuador is rich in the diversity of its resources, landscape and regions, which combined with the novelty of ideas emerging, aiming towards tackling local necessities that are left unattended, can offer a great opportunity for public-private partnerships. This is likely to further contribute to transforming Ecuador's strong social capital into economic and social development.

Weaknesses and Threats

- The innovation ecosystem appears to be highly centralised. This centralisation is also reflected in the finance sector, the national infrastructure and ICTs, which are likely to further increase the disparities between the urban and rural regions and the GIs emerging from these areas. Besides being highly centralised, the financial infrastructure is also underdeveloped, as it does not fulfil
- the financial necessities from GIs in early stages of growth. Furthermore, banking inclusion remains a challenge to surpass.

- Institutions and bureaucracy play a key role in encouraging or discouraging GIs. Where for example, registration and procurement procedures seem to deter innovation while local institutions like ConQuito promote it. Besides, corruption and political instability also play a relevant role in raising barriers for GIs. Furthermore, the overall innovation policy seems to be biased towards technology driven innovation
- The scaling infrastructure remains underdeveloped and unable to provide growing GIs ventures with the resources required for accelerated growth after the incubation and launch stage.
- Intellectual property rights remain a poorly understood subject, where GIs require further support.

Governmental Policies and Initiatives:

- While internet access has been improving in recent years, only around 66% of Ecuador's population had access to the internet in 2019 (Freedom House, 2020). Although the government has been making efforts to expand access to the internet, there remains a significant digital divide along socioeconomic and geographical lines. It is vital that the government work to not only expand internet access to more geographically challenged areas, but also subsidise the cost of this internet access. Costs are prohibitively high, and while government subsidies may be costly, expanding internet access opens up the door to a growing digital economy, more connectivity, and innovation.
- Available data on the Ecuadorian government's education spending shows that primary education expenditure has decreased from 2010 to 2015 (World Bank, 2020). During this same time period tertiary education increased drastically, reaching levels nearly twice that of primary spending (World Bank, 2020). Ecuador has made significant strides in increasing access to tertiary education, but it is important that the government emphasize the quality of primary education in addition to skills training. When tertiary enrolments increase, those who are unable to attend university risk being left behind, and ensuring that the base level of education is of high quality is important for these individuals, particularly if they have innovative aspirations.
- Promoting communication and cooperation amongst grassroots innovators is an important step in fostering a burgeoning grassroots innovation ecosystem. This can be accomplished through the creation of common meeting areas, particularly in economically disadvantaged rural or suburban areas. Encouraging innovators to share ideas and cooperate can positively influence their connection to the community and their innovation's development.

UNDP AL Initiatives:

- The UNDP Accelerator Lab team should work to expand their human library initiative. Expanding this project to more remote and vulnerable communities can help to provide much needed context and motivation for other grassroots.
- If possible, involving government officials in these efforts could help to raise awareness about the important role that grassroots innovation plays in the lives of many Ecuadorian citizens.

Colombia

Context parameters score:

GDP per capita	US$7842.92	Population/area	46/km^2
Technological advancement	23.90	Intellectual Property Rights	17.70
Communication and promotion facilities	43.70	Education and Training	26.72
Governmental institutions	58.00	Financial Capacity and Institutions	80.68

As a country of almost 50 million people with the Andes mountains lying in the middle, Colombia is very rich in oil and minerals. However, its natural conditions could be an obstacle to inclusive development. The inequality of access to quality education and communication networks is evident between urban and rural areas. The community, however, is very resourceful. A culture of sharing should be developed in the effort to build more trust towards local products.

Strengths and Opportunities

- Colombians are resourceful. They may not put labels on GIs because they perceived innovating as being resourceful for either themselves or the community. If such resourcefulness can be identified and documented, it might give the motivation for other local communities to develop similar innovations.
- As an upper-middle income country, Colombia is considered strong in the aspect of institutions and infrastructure thus providing a conducive environment for market and business development. This is an opportunity for Colombia to engage in more private-sector innovations. If the corporate social responsibility of the private sectors are encouraged, along with the raising of social impact institutions, it should increase welfare and inclusivity of the society.
- Colombia possesses a young demographic that are exposed to access to the Internet and social media. This group of population carries potential that has not been fully explored.
- The government has many innovation-focused policies yet carried out across different ministries. Therefore, there are multiple opportunities for training, funding, and developing available. However, the access to this might not be equal for urban and rural society.
- There has been a rising number of intellectual property rights and patents in Colombia for the past decade. The positive trend is perceived as a good sign for the growth of innovation.

Weaknesses and Threats

- Due to its extreme geographical conditions, many indigenous communities are living in rural parts of the country. Further challenged by political situation instability, it is difficult to provide public goods and services to the whole population equally. Colombia should establish a long term plan for equal and inclusive development, especially in the area that matters the most, education.
- The cultural aspect that hinders Colombia to innovate is the lack of trust. Society has low confidence towards local innovations and brands, thus fostering foreign products development more. Moreover, the trust towards the government is among the weakest in Latin America.

- There is a tendency of extreme capitalism in Colombia. Safety of leaders in social and environmental movements are threatened. This is a threat for people to freely express their ideas.
- Government initiatives, despite their large numbers, are carried out by different stakeholders with a similar focus. As a result, there is no clear distinction between roles and targeted outcomes. If the government could synchronize the plan and design of innovation policies, the policies could be better targeted and more inclusive across urban and rural areas and across innovation types.

Governmental Policies and Initiatives:

- Although the Colombian government is making efforts to support innovators, such as the work being conducted by the Ministry of Science, Technology and Innovation, much of these efforts are carried out in a top-down manner. The government may benefit grassroots innovators most by initiating education programs focusing on entrepreneurial skills that teach small-scale innovators how to start and expand their enterprises. Currently, the Ministry of Science, Technology and innovation is more focused on providing funding for masters and PhD studies, which would be unlikely to benefit grassroots innovators and may be an inefficient use of funds.
- According to the World Bank (2018) the Colombian government spends more money on secondary education than they on primary education, both on a per student basis and as a percentage of GDP per capita. This is concerning considering school enrolment is significantly higher during primary school, particularly for rural Colombians. In the mid 2010s less than half of all upper-secondary students stayed in school until 11th grade (WENR, 2020). The Colombian government could benefit from strengthening the quality of primary education, particularly in rural areas, in order to bridge the apparent education gap. Skills training programs in early secondary school may also benefit would-be innovators.
- Finding funding is a particularly important issue for grassroots innovators in Colombia. Again, this problem is exacerbated in rural areas. In this circumstance it may be prudent for the government to promote innovation competitions in rural areas. Although these competitions are not beneficial in all scenarios, as they are exclusionary, they can serve to excite local communities and acknowledge government interest in supporting rural citizens. These competitions are a relatively cost-efficient method of funding small projects and jump-starting innovation sharing and networking.

UNDP Accelerator Labs Initiatives:

- The UNDP Accelerator Labs can play a key role in steering the Ministry of Science, Technology and Innovation towards assisting smaller-scale innovators. Providing tangible examples of grassroots innovations, particularly in rural areas may help to place a spotlight on these underserviced innovators.
- Another potential area of influence is in building communication networks that connect different rural communities. It is important to promote intra-community and inter-community network building for grassroots innovators. Organizing competitions or group meetings may help facilitate more openness and cooperation amongst former strangers.

Iraq

Context parameters score:

GDP per capita	US$5955.1	Population/area	83/km²
Technological advancement	n/a	Intellectual Property Rights	n/a
Communication and promotion facilities	n/a	Education and Training	n/a
Governmental institutions	n/a	Financial Capacity and Institutions	n/a

An upper-middle income, Middle Eastern nation, Iraq benefits 5th largest oil reserves in the world. Iraq is an oil-centred economy, moving towards diversification only lately. Since the early 80s, Iraq has been involved almost continuously in military conflicts, at the cost of it's security, sovereignty and billions of dollars for military and security forces' equipment and training. The uncertainty caused by insecurity and conflict involvement, is the main barrier to investment, and harms Iraq's innovation ecosystem through limited financial resources.

Strengths and Opportunities

- International organisations in Iraq are very active in supporting GIs. The Iraqi government is open to international organisations and provides them with their needed free space to actively support and promote GI. International organisations such as UNDP Accelerator Labs and Oxfam can play a central role in supporting GIs in Iraq that could be done only in a few countries.
- ICT communication and mobile networks are widely accessible for Iraqis. With most areas covered by 3G and 4G upgrasion initiated recently. Grassroots innovators have introduced internet-based services and products. With wider coverage of 4G and cable internet, Iraqi innovators can benefit a wider demand base for their innovative internet-based products and services.

Weaknesses and Threats

- Since the US invasion in 2003, Iraq has constantly faced major security threats which led the Iraqi government through massive military and security expenditure. Although naturally wealthy with large oil resources, Iraq's extensive security costs prevent it from financing and investing in innovation.
- Iraqi government concentrates on security provision and economic stabilisation, and the public sector's efforts in supporting and encouraging GI are very limited. An initiative established by the government in cooperation with international organisations and local innovation hubs can effectively advocate for GI inside the government and beyond, and direct and empower government's efforts for supporting GI.
- Financial institutions in Iraq are not active in supporting startups and newly emerged businesses. This causes lack of access to financial resources for grassroots innovators. Most individual innovators lack necessary financial credit for receiving loans. Accelerator labs and international organisations can act as intermediaries through which bank loans are distributed.

Governmental Policies and Initiatives:

- One problem facing the grassroots innovators is the administrative barrier to receiving financial support from the government. The government has allocated some funds for financing SMEs, but they placed significant restrictions on this financial support, inhibiting small-scale innovators from having realistic access. The government may stand to benefit from streamlining support avenues. They can do so by requiring less input on the behalf of the applicant and more due diligence on the part of the government workers. While this is more costly, it ensures that financial support is more feasible for grassroots innovators who may really need it.
- Grassroots innovators also find it difficult to receive funding from private financial institutions. This is a difficult problem, but can be addressed by offering capped tax incentives to financial institutions that offer low-interest loans to grassroots innovators. However, it should be mentioned that the practice of offering these loans is risky. It is important to cap the tax incentives offered to financial institutions, so they are encouraged to research ventures before they provide them with financial support and do not over-leverage themselves.
- In Iraq, issues pertaining to grassroots innovation are often overshadowed by those of national defense and safety. In order to better encourage activity that is in line with government priorities, the government could create innovation support systems for innovations geared towards (non-violent) solutions that improve public safety and defense. The government could set up communal centers of innovation to encourage cooperation on these projects.

UNDP Accelerator Labs Initiatives:

- As is the case in many other countries, the Accelerator Lab plays an important role in shaping the perspective that the government views grassroots innovation. Continuing to catalog and promote new innovations is vital to the growth of the innovation movement. While it is unlikely that the government will deviate from their current policy priorities in the very near future, it is important to advance the innovation infrastructure so that there is a developed network by the time the government is willing to shift their focus.
- Reaching out to institutions of higher education may also be prudent. These schools may be more willing to provide R&D support or skills training for grassroots innovators.

Kenya

Context parameters score:

GDP per capita	US$3382.6	Population/area	94/km²
Technological advancement	13.65	Intellectual Property Rights	19.27
Communication and promotion facilities	39.10	Education and Training	16.20
Governmental institutions	53.65	Financial Capacity and Institutions	80.82

A major nation in Sub-Saharan Africa, Kenya has one of the most advanced education systems in the region, and proper ICT infrastructures, as well. However, its unstable economy and constantly high unemployment rate has left the large capacities that come after advanced education and ICT infrastructures, unemployed. The inherent culture of entrepreneurship in Kenya enables nationwide GI movements to happen, and to encourage self-employment as an alternative to formal-sector employment.

Strengths and Opportunities

- Kenyans receive education through one of the most modernised education systems in Africa. Thanks to the extensive amount of international aid offered to Kenya every year and World Bank's consultancy services, the Kenyan government has designed and implemented a modernised primary education system in which innovation is a central value. This creates a valuable capacity for innovation at grassroots level in Kenya.
- Compared to other necessary types of infrastructure, ICT infrastructures in Kenya show higher quality and better coverage. Businesses and innovations based on ICT are booming in Kenya. By expanding mobile networks and cable internet infrastructures, Kenya can further develop capacity for GI.
- The government supports innovation and has introduced initiatives in cooperation with accelerator labs and non-governmental organisations. However, these initiatives have not been as effective in building grounds for GI as expected. By running initiatives, the government should pursue a broader goal of capacity building rather than concentrating on instant support of current innovations.

Weaknesses and Threats

- Financial institutions in Kenya, though sophisticated and effective, tend to support foreign businesses rather than Kenyan innovators. The rate of unemployment and informal economy in Kenya is high. Therefore, grassroots innovators most probably do not possess full-time positions with secured salaries, and their financial credit is not enough for banks and financial institutions to offer loans to them. More effective, ground-building initiatives can help innovators by acting as guarantors for grassroots innovators, or they can directly offer loans to innovators if their budget allows them to do so.
- Lack of enforcement for IPR have been a challenge for Kenyan innovators. There are cases of ideas used by big firms without the innovators' permissions. The problem of IPR has two sides in Kenya, existence of IP regulations and enforcement of them. The first stage is still pending to be done by the government. They are taking steps towards it, but further effort by the government is needed to be put behind it.

Governmental Policies and Initiatives:

- The Kenyan government should consider utilizing R&D grants to grassroots innovators, rather than utilizing tax incentives. According to the Kenyan Institute of Economic Affairs (2016), over 80% of the Kenyan working population was employed in the informal sector in 2015. Additionally, around 5.85 million of Kenya's estimated 7.41 million micro, small and medium enterprises are unlicensed (Kenya Association of Manufacturers). This would imply that the vast majority of ventures would not stand to benefit from tax incentives but may be helped by the issuance of grants geared towards small-scale innovators who may positively impact their communities. To best implement these grants, the government should work to catalogue grassroots innovations. Additionally, the government should stray from imposing unnecessary new taxes on small businesses, as these might serve to prevent new innovators from entering the currently sparse formal economy.
- Instilling a clear and relatively stagnant regulatory environment will encourage innovators to enter the formal economy and may enable more foreign direct investment in new start-ups or innovations.
- Education is not a major issue in Kenya, as primary school completion rates were around 84% in 2017, with nearly 82% of primary school students going on to attend secondary school (UNICEF, 2018). Education spending by level is well balanced in its current state. However, spending on primary education has seen a decrease each year from 2013 to 2018, with additional funds being put towards secondary, tertiary/university, and technical schooling (UNICEF, 2018). This is to be expected as secondary and tertiary enrolment rates increase, but priority should be placed on ensuring primary schooling quality does not decline.
- Intellectual property rights are a challenge in Kenya. Recent instances of corporations allegedly stealing IP from small-scale innovators has created a sense of apprehension towards publicizing innovations. It is important that the government creates a streamlined IP registration process and considers subsidising processing costs for small businesses. Holding larger corporations responsible for IPR infractions is also necessary to ensure greater public trust in IP protections.
- ICT infrastructure in Kenya has seen significant improvements during recent years. Access to and use of mobile phones is high in Kenya, particularly when compared with other African countries (Jumia, 2019). According to Internet World Stats (2021), internet penetration (internet users as a proportion of total population) in Kenya is currently at 85.2%, compared to 43% in Africa as a whole. However, there is significant disparity in internet access for rural Kenyans. Broadband access and speeds are both significantly lower for rural Kenyans (World Bank, 2019). The government must invest in expanding rural ICT infrastructure to improve internet access and enable greater communication between rural and urban innovators.

UNDP Accelerator Labs Initiatives:

- UNDP Accelerator Labs should assist the government in the cataloguing of grassroots innovations and serve as a point of contact between innovators and government officials. This will help to paint a picture of the grassroots innovation scope in Kenya and will enable the government to provide better financial support to these innovators.
- The Kenyan government has had difficulties in spreading awareness of new initiatives geared towards innovators and start-ups. UNDP Accelerator Labs can and should leverage their network to publicize and keep track of government programs or initiatives that may be useful to local innovators. Creating an online message board or email list could be useful in this regard.

Ghana

Context parameters score:

GDP per capita	US$1884.28	Population/area	137/km²
Technological advancement	14.10	Intellectual Property Rights	2.20
Communication and promotion facilities	38.55	Education and Training	16.65
Governmental institutions	41.80	Financial Capacity and Institutions	58.76

Ghana is home to a thriving innovation scene. The country is equipped with research institutions, hubs and initiatives to support entrepreneurs and women. The country is also riding the ICT revolution wave – however, inadequate infrastructure, access to capital, and bureaucracy continue to pose challenges for GIs.

Strengths and Opportunities

- Ghana and the broader Sub-Saharan region is experiencing a new-ICT revolution driven by increasing access to mobile devices. More opportunities to create timely monitoring systems that support the detection of emerging issues in the field have emerged and have enabled extension organisations or value chain actors to respond to issues promptly.
- To facilitate the development of e-commerce and the digital economy, the government has recognised the importance of setting up a National ID. In 2003, the National Identification Authority (NIA) was established to facilitate the implementation of a national identification system in the country, and as of 2017, the new national ID card (Ghana card) has been launched. The creation of the Ghana card gives citizens the right to access public services. It promotes better access to online transactions, financial and other services, and innovative applications to improve service delivery in the priority areas of health, education, judicial, and parliamentary services.
- The government of Ghana has demonstrated commitment towards building infrastructure and the digital divide gap. Through its agency, Ghana Investment Fund for Electronic Communications (GIFEC), the government has initiated a Rural Telephony Project to ensure that underserved communities have access to communication needs. This project aimed to reduce the cost of deployment of infrastructures borne by operators by providing tower infrastructure on which operators can collocate within these areas.
- More recently, Ghana has leveraged frontier technologies to improve people's lives and protect the planet. The range and use of technologies have been extensive, particularly during the COVID-19 pandemic: AI and big data for screening patients, monitoring the outbreaks, tracking and tracing cases of the disease, and using drones for delivering medical supplies to remote communities.

Weaknesses and Threats

- High prices constrain individuals' internet use: more than half of households limit their internet use because of the cost. Moreover, even before they connect, many people still struggle to buy a device because they cannot afford one.
- There is a general shortage of skills to use frontier technologies. The use of such platforms requires literacy and numeracy skills and an aptitude for learning by doing. The government needs to consider how people can acquire the necessary skills and competencies to adopt frontier technologies into existing production bases. Inclusive and accessible education and on-the-job training programs are imperative as more services

move online, and such opportunities should involve women, noticing the critical contributions they can make.
- To support an inclusive innovation system, the government can respond to alternative technological change models by facilitating funding, linking these models to existing R&D institutions, and increasing their visibility through international networking.

Governmental Policies and Initiatives:

- Intellectual property (IP) laws in Ghana are not fully developed and not widely understood. Creating clear and comprehensible IP laws/regulations is important for small-scale innovators looking to enter the formal marketplace. There is a very large informal economy in Ghana, so IP registration will need to be simple and quick in order to incentivize innovators in the informal marketplace to transition their innovations to the formal marketplace. Simplifying and enforcing IP laws can help to encourage formal sector growth in this circumstance.
- As information and communication technology (ICT) becomes more widespread in Ghana, it is more important that Ghanian citizens possess the skills required to utilize these technologies to their full potential. Implementing technological skills-based primary education would certainly help in this regard. Financing the incorporation of ICT into the classroom may also prove beneficial.
- In conjunction with implementing ICT skills-based education, subsidising internet costs can be a valuable tool in ensuring greater access to and engagement with the internet. This will also enable individuals to utilize online methods of skill learning. Working to expand mobile phone access, particularly in rural regions, can also be influential in spreading new skills and connecting communities.
- Connecting communities with nearby institutions of higher education and research can also serve to perpetuate a greater sense of interest in ICT skills and studies. Initiatives such as these will also benefit research centers/universities, as they will gain new perspectives and expand their networks.

UNDP Accelerator Labs Initiatives:

- In addition to cataloging grassroots innovations, the Ghana Accelerator Lab can create and support regional hackathons or innovation challenges. These events would be particularly impactful in areas where ICT access is relatively new. This would encourage cooperative learning, innovative thinking, and team building.
- Getting the government involved in these events could enable the Accelerator Lab team to offer better prizes/incentives. For example, university scholarships, innovation funding, or government incubation.

Bosnia and Herzegovina

Context parameters score:

GDP per capita	US$6108.51	Population/area	64/km²
Technological advancement	20.53	Intellectual Property Rights	11.30
Communication and promotion facilities	32.50	Education and Training	26.97
Governmental institutions	56.80	Financial Capacity and Institutions	62.22

Bosnia has a different set of problems than the majority of the developing countries as they are an upper-middle-income country with high levels of education and public services not that different from the developed world. Nevertheless, they have many citizens leaving in search for opportunities abroad and innovation remains underdeveloped specially in terms of physical goods. As a country with a unique range of social issues and fragmentation, GI and its social movement nature offers them an opportunity to provide sustainable solutions targeting local problems and a unifying force for development.

Strengths and Opportunities

- Institutions and public services in Bosnia and Herzegovina (B&H) seem to be well developed, making it easier for residents to start any venture and grow it. In that sense, B&H holds an great potential for innovation and entrepreneurship to be unleashed.
- In comparison with other developing countries, education and ICTs operate over a higher quality and have more coverage, positioning B&H in a privileged status among the developed world where the residents of the country have the tools and the capacities to take their country to the next level. Furthermore, their proximity to the EU and being part of the Schengen area offers B&H an opportunity for scaling their ventures as they can easily offer goods and services to the European market.

Weaknesses and Threats

- The process of starting a business or formalising an existing one constitutes a challenge to surpass in the local ecosystem, as entrepreneurs might be discouraged from starting a new venture if the process is not easy enough or if it doesn't offer them significant advantages.
- The government infrastructure to support GI is still underdeveloped and fragmented. Overall, the country seems to lack a systemic approach to encourage GI and foster an ecosystem where these kinds of innovations can emerge and flourish.
- The media support for entrepreneurship and grassroots innovators remains insufficient to unleash its potential. In order to further encourage GI, the society should get to know the emerging projects so they endorse the work of local entrepreneurs. Overall, it seems that society remains fragmented and media can play a relevant role in fostering a more integrative, local and innovative narrative.
- The country faces a process of migration of high-skilled individuals to the EU. As this process continues, the national capacity of absorbing new knowledge is diminished, further reducing the national capacity to innovate. A focus on grassroots innovation could promote residents to stay and start local ventures that address local problems or even scale to address problems encountered in countries similar to B&H.

Governmental Policies and Initiatives:

- Like other former communist countries, Bosnia and Herzegovina faces the problem of privatizing formerly publicly owned companies. This process is not a simple one, but it is imperative that this is done, not only to shift economic responsibility and ownership into the hands of the citizens, but also as a means of encouraging more entrepreneurship and innovation. Privately held companies will be more diverse and offer differing business practices and new sources of R&D.
- Entrepreneurial spirit is something that is not necessarily ingrained in the mindset of citizens in Bosnia and Herzegovina. This is, again, mostly due to the country's communist history. It is necessary to promote entrepreneurial activities in order to engage a new wave of innovators. This can be done by instituting innovation-based educational programs and competitions in primary and secondary schools, funding innovation festivals, and highlighting success stories in government sponsored media forums. While it is not possible to require media outlets to report on matters pertaining to innovation, creating engaging events and stories can inspire these outlets to begin picking up stories relating to grassroots innovation.
- To combat the migration of high-skilled and educated citizens, the government can offer financial incentives to qualified university or secondary school graduates who display excellence in the academic field. Offering entrepreneurial grants for gifted students in secondary school or university can encourage these students to stay and work in their home country, rather than leave to pursue jobs elsewhere. Starting small, this program could take the form of a single incubator, bringing together bright minds from across the country. Alternatively, this initiative could simply provide grants that enable students to begin their own independent venture.

UNDP Accelerator Labs Initiatives:

- The Accelerator Labs team could play a significant role in building links between institutions of higher education and grassroots innovators/entrepreneurs. Universities may be interested in working with an international organization with a better grasp on the innovation landscape.
- Additionally, as is the case in nearly every Accelerator Lab, documenting innovations and highlighting success stories can help garner government and media attention.

10.2 Appendix 2 – Interview Questions

10.2.1 Interview Questions for the Academics

Marco Antonio Sardillo

1. What project do you work on in UNDP?
2. What actually is the role of UNDP Accelerator Labs? How do you define the relationship between UNDP AL with government and local innovators?
3. What would be the most important aspect of an innovation to grow and develop?
4. How is the interaction between stakeholders in the promotion of a particular innovation?
5. What gaps do you recognise in the setting of innovation promotion? What do you think would be the best way to analyse it?

Adrian Smith

1. How do you define "Grassroot Innovation"? In your opinion, what are the most distinctive differences between GI and other innovations?
2. How do you see the intersection between industrial innovation and GI? If there is any, how would you be able to measure it?
3. How would you approach your framework in GIs Movements (2017) that contains context, framings, spaces and strategies, and pathways?
4. Do you think there is a place of policy to promote initiatives and innovations apart from scaling up efforts?
5. What are the challenges you encountered when measuring the impact of grassroot innovation?

Eric Von Hippel

1. In your paper about adapting policy to user-centered innovation, you talk about how important it is to have conditions that are favorable to collaborative user-centered innovation. Do you think increasing access to the internet is a key project that the government can undertake to generate more innovation in developing countries?
2. In the same paper (Adapting Policy to user-centered innovation) you mention that you think strict IP laws hold back innovation. Do you think this might be the case in developing countries? Oftentimes more concrete IP laws are cited as being more beneficial towards innovation.
3. How could the government identify and measure GI?
4. From an innovation policy perspective, what are the main things we should try to identify as necessary conditions in the local context that promote or stop grass-root innovation

5. Is there anything the government could make sure that these free innovations from consumers could be promoted? How?
6. Do you think the network and intercorrelation between innovators has a significant impact in fostering innovation?

10.2.2 Interview Questions for the UNDP Accelerator Labs

1. Can you share us about your background and your work with UNDP Accelerator Labs?
2. What is your evaluation of the GI environment in your country?
3. Please give examples of GI processes that you may have come across, including spontaneous, induced by external agencies, or emerging from co-creation processes.
4. How is the local situation regarding (Technology/Communication/Governmental Institutions/IPR/Financial Capacity/Education)? (Further details in follow-up questions) - ICT, IPR, Financial Sources/Funding?
5. What do you think are the greatest barriers to GI in your country/community?
6. What mechanisms exist at the national/federal, regional/state and local/district level to promote innovations from the informal sector?
7. You have been clear regarding the barriers to GI, but what helps to enable it?
8. Do you think education encourages GIs? Why?
9. What do you think is exceptional in the Accelerator Labs you are working in?
10. What is it in your country that makes you proud to promote GI?

10.3 Appendix 3 – Survey Questions

This survey was designed by students from London School of Economics and United Nations Development Program Accelerator Labs and should take you less than ten minutes.

The survey aims to collect information and the perspective of people working in GI. Its results aim to feed public policy recommendations and to promote and support grassroots led innovation in developing countries.

Please help us by answering the following questions to the best of your ability.

Thank you for participating.

Which of this better defines your relationship with GI?

- I am a UNDP member supporting grassroots innovators
- I am a grassroots innovator
- I am non UNDP member supporting grassroot innovators

Question for grassroots innovator are:

1. In what country is your grassroot venture mainly based?
2. What is your age group?
    - 18-29
    - 30-45
    - 45-64
    - Over 64
3. Which of these best represents your highest level of education?
    - Unfinished high-school
    - High school or equivalent
    - Technical or occupational certificate
    - University graduate
    - Master graduate or higher
    - Other
4. What is your gender?
    - Male
    - Female
    - Other/Prefer not to say
5. Which of these best represents your full time occupation?
    - Accountant
    - Entrepreneur
    - Social worker
    - Farmer
    - Construction/Engineer
    - Academic/Researcher
    - Electrician/Mechanic/Technician
    - Economist
    - Lawyer
    - Social sciences' professional

- Other

6. Which of these options best reflects what motivated you to start your GI/solution? Please choose one option
    - To improve my personal or my family's financial conditions
    - To solve a problem my community was facing
    - To solve a problem me or family were facing
    - To improve my community's financial conditions
    - Other
7. At the current state of your venture, what would be the most relevant type of support you need? (Please choose up to 2 options)
    - To find new partnerships
    - To improve profitability
    - To find and retain talent
    - To patent the intellectual property I've developed
    - To improve the structure of the organisation
    - To grow and scale my solution
    - To find access to financing
    - Other
8. In 100 words, how would you describe your solution/venture? (Please describe what was the original problem and how did you solve it)

9. The 17 Sustainable Development Goals provide a roadmap for prosperity for humans and the planet. Which of these 17 goals listed below, best reflect the focus of your solution/venture? (Please choose up to 3 options)
    - End Poverty (Goal 1)
    - Improve food production and end hunger (Goal 2)
    - Improving Health and Well-being (Goal 3)
    - Improve the quality of Education (Goal 4)
    - Achieve Gender Equality (Goal 5)
    - Provide Access and quality to Clean Water and Sanitation (Goal 6)
    - Affordable and Clean Energy (Goal 7)
    - Decent Work and Economic Growth (Goal 8)
    - Build infrastructure, promote inclusive Industries and foster Innovation (Goal 9)
    - Reduce Inequality (Goal 10)
    - Create sustainable Cities and Communities (Goal 11)
    - Encourage responsible Consumption and Production (Goal 12)
    - Take Climate Action (Goal 13)
    - Protecting oceans and rivers (Goal 14)
    - Protect Fauna and Flora (Goal 15)
    - Peace, Justice and Stronger Institutions (Goal 16)
    - Foster Partnerships for Achieving the Sustainable Development Goals (Goal 17)
10. Thinking of your own venture in your local context, what would you say are the 5 most important challenges that you have encountered? (Please choose 5 options)
    - Access to legislation for the protection of intellectual property rights

- Access and Level of advancement of local technology (e.g.local software or manufacturing technology)
- Access to mentors
- Guarantees of civil rights (e.g. assembly, organise, freedom of speech, etc.)
- Access to research and development
- Social segregation
- Access to venture capitalists or other early sources of investment
- Access to technical Skills (e.g. training)
- Access to internet and connectivity (e.g. 4G or other telecommunications technology)
- Access to seed capital
- Access to capital from financial institutions for growth (e.g. bank loans)
- Access to international technology
- Access to larger markets
- Access to larger networks of collaboration
- Ease of formalising a business or organisation
- Access to the city and ports (e.g. infrastructure for the delivery of products or services)
- Access to justice to prevent or correct unfair practices by larger companies
- Local culture of Innovation and entrepreneurship
- Access to qualified staff and talent
- Rule of law (e.g. enforcement of contracts)
- Access to formal education (e.g. primary school)
- Other

11. Based on your own experience, what would you say are the 5 most important initiatives or policies you think your local/national government should focus on to promote long-term GI in your locality? (Please choose 5 options)
    - Access to higher education (e.g. scholarships to undergraduate or master degrees)
    - Technical training (e.g. entrepreneurship training programs, coding programs, etc)
    - Rule of Law (e.g. enforcing contracts)
    - Tax incentives (e.g. tax exemptions)
    - National Physical Infrastructure (i.e. roads and ports)
    - Procurement policies (e.g. buying by the government to grassroot innovators)
    - Clusters of innovation (e.g. centres for entrepreneurs, hackathons, etc)
    - Grants and financial support for innovators (e.g. seed capital)
    - Intellectual Property Rights /Patents (e.g. anti-piracy laws)
    - Local institutions to promote innovation (e.g. municipal initiatives, startup incubators,etc.)
    - Financial resources for research and development (e.g. grants and prizes)
    - Data gathering and measuring (e.g. reliable information of the demographics of the market)
    - Communication Infrastructure (i.e. internet connections, 4G)
    - Ease of establishing a company or organisation (e.g. legal incorporation)

- Ease of paying taxes (e.g. online forms and payment)
- Special legal regimes for innovators and entrepreneurs (e.g. legal figures, visa, etc.)
- Inclusion of under-represented groups (e.g. quotas)
- Other

12. Please share with us an example of a policy or initiative that has successfully promoted GI in your country.
13. Would you like to receive a copy of the results from this research? If yes, please provide your e-mail address.

Do you know other people who you think could contribute filling this survey? If so, please feel free to share the survey link with them. Thanks for your support!

Question for UNDP members and non-UNDP members that support GI:

1. In what countries are you supporting GI. (Please choose max 3 countries)
2. What is your age group?
    - 18-29
    - 30-45
    - 45-64
    - Over 64
3. What is your gender?
    - Male
    - Female
    - Other/Prefer not to say
4. In your experience as a supporter of grassroots innovator, what do you think mostly drives grassroots innovators to start their ventures? Please rank the drivers from 1 to 5
    - To solve a problem for themselves
    - To improve their community's financial conditions
    - To help their community develop
    - To improve their personal/family financial conditions
    - Other
5. Thinking of the GIs you support, please choose one example that stands out and describe it in 100 words. (Please describe what was the original problem and how did they solve it)
6. Thinking of the ventures you have supported, what would you say are the 5 most important challenges that grass-root innovators encounter in your local context? (Please choose 5 options)
    - Access to justice to prevent or correct unfair practices by larger companies
    - Access to qualified staff and talent
    - Access to larger markets
    - Access to international technology
    - Social segregation

- Access to research and development
- Ease of formalising a business or organisation
- Access to seed capital
- Access to legislation for the protection of intellectual property rights
- Access to internet and connectivity (e.g. 4G or other telecommunications technology)
- Access to venture capitalists or other early sources of investment
- Access and Level of advancement of local technology (e.g.local software or manufacturing technology)
- Access to the city and ports (e.g. infrastructure for the delivery of products or services)
- Guarantees of civil rights (e.g. assembly, organise, freedom of speech, etc.)
- Access to mentors
- Access to formal education (e.g. primary school)
- Access to capital from financial institutions for growth (e.g. bank loans)
- Local culture of Innovation and entrepreneurship
- Access to technical Skills (e.g. training)
- Access to larger networks of collaboration
- Rule of law (e.g. enforcement of contracts)
- Other

7. As a supporter of grass-root innovators, you have probably observed some challenges in the ecosystem that innovators themselves have encountered. Based on that, what are the most important initiatives you think your local government should focus on to promote long-term GI in the countries you are working? (Please choose up to 5 options)
    - Inclusion of under-represented groups (e.g. quotas)
    - Access to higher education (e.g. scholarships to undergraduate or master degrees)
    - Special legal regimes for innovators and entrepreneurs (e.g. legal figures, visa, etc.)
    - Ease of paying taxes (e.g. online forms and payment)
    - Local institutions to promote innovation (e.g. municipal initiatives, startup incubators,etc.)
    - Data gathering and measuring (e.g. reliable information of the demographics of the market)
    - Tax incentives (e.g. tax exemptions)
    - Clusters of innovation (e.g. centres for entrepreneurs, hackathons, etc)
    - Rule of Law (e.g. enforcing contracts)
    - Communication Infrastructure (i.e. internet connections, 4G)

- Technical training (e.g. entrepreneurship training programs, coding programs, etc)
- Grants and financial support for innovators (e.g. seed capital)
- Ease of establishing a company or organisation (e.g. legal incorporation)
- Intellectual Property Rights /Patents (e.g. anti-piracy laws)
- Financial resources for research and development (e.g. grants and prizes)
- National Physical Infrastructure (i.e. roads and ports)
- Procurement policies (e.g. buying by the government to grassroot innovators)
- Other

8. Please share with us an example of a policy or initiative that has successfully promoted GI in your country.

9. Would you like to receive a copy of the results from this research? If yes, please provide your e-mail address.

Do you know other people who you think could contribute filling this survey? If so, please feel free to share the survey link with them. Thanks for your support!

10.4 Appendix 4 – Definition and Measurement

This is the definition and the measurement that are used in the Quantitative Analysis part of this research.

Factor	Parameters	Description	Source
Technological Advancement	General infrastructure	1. Electricity production, includes all sources of energy such as oil, gas, coal, geothermal, solar, wind, and so on. 2. Logistic performance, that represents the efficiency of the logistic in the country and the supporting infrastructures 3. Gross capital formation that represents total gross fixed capital formation and changes in inventories and acquisition based on the System of National Accounts	International Energy Agency (IEA) World Energy Balances on-line data service 2019, World Bank and Tuku School of Economics Logistics Performance Index 2018, IMF World Economic Outlook Database 2019, computed by WIPO (2020)
	Ecological sustainability	1. GDP per unit of energy use that represents the PPP of GDP per kilogram oil equivalent of energy use 2. Environmental performance that represents how close a country to establishing environmental policy targets 3. ISO 14001 environment certificates that represents the number of certificates issude per billion PPP$ GDP in 2018	International Energy Agency (IEA) World Energy Balances on-line data service 2019, Environmental Performance Index by Yale and Columbia University 2020, International Organization for Standardization, The ISO Survey 2018, computed by WIPO (2020)
	Knowledge and technology output	A score formulated by WIPO (2020) that includes three parameters that represent the process of knowledge creation, knowledge impact, and knowledge diffusion	Various sources, computed by WIPO (2020)
	R&D	1. Researchers FTE, which represents full-time equivalent researchers per million population 2. GERD (Gross Expenditure on R&D) 3. Average expenditure on R&D on the top three global companies 4. QS university ranking score of the top 3 universities per country	UNESCO Institute for Statistics, UIS online database; Eurostat, Eurostat data base, 2020; OECD, Main Science and Technology Indicators MSTI database, 2020 (2009–19); QS World University Ranking 2019/2020, computed by WIPO (2020)
Communication and Promotion Facilities	ICT score	1. ICT access that includes telephone subscription, mobile subscriptions, and international internet bandwidth, percentage of household with computer and internet access 2. ICT use that includes the percentage of individual using the internet, fixed internet subscriptions and active mobile subscriptions 3. Government online service that represents the use of ICTs by governments in delivering public services at the national level 4. Online e-participation that represents government use of online services in providing information to citizen through digital platform	World Telecommunication/ ICT Indicators Database 2019, United Nations Public Administration Network e-Government Survey 2018, computed by WIPO (2020)
	Innovation linkages	1. University/industry research collaboration, represented by survey result 2. State of cluster development, represented by survey result 3. GERD financed by foreign financing as a percentage of GDP	World Economic Forum 2019, UNESCO Institute for Statistics, UIS online database 2019, computed by WIPO (2020)
Government Institution	Political environment	1. Political and operational stability, which represents the likelihood and severity of	IHS Markit, Country Risk Scores, aggregated for end

		political, security and legal risks impacting business. 2. Government effectiveness, which represents the perceptions of the quality of public service.	Q1, Q2, Q3, and Q4 of 2019 and World Bank Worldwide Governance Indicators 2019, computed by WIPO (2020)
	Regulatory environment	1. Regulatory quality, which represents the ability of government to design and implement sound policies to promote private-sector development 2. Rule of law, which represents perceptions of the extent to which agents have confidence in and abide by the rules of society 3. Cost of redundancy dismissal, which represents the cost of advance notice requirements due when terminating a worker, expressed in weeks of salary	World Bank Governance Indicators 2019 and World Bank Doing Business 2020, computed by WIPO (2020)
Intellectual Property Rights	Trademarks by origin	Number of resident trademark applications issued by national or regional office per billion PPP$ GDP	Intellectual Property Statistics, IMF World Economic Outlook Database, computed by WIPO (2020)
	Patents by origin	International patent application filed through WIPO administered Patent Cooperation Treaty per billion PPP$ GDP 2019	Intellectual Property Statistics, IMF World Economic Outlook Database, computed by WIPO (2020)
Education and Training	Expenditure on education	Government expenditure on education in any level as percentage of GDP	UNESCO Institute for Statistics, UIS online database, and Eurostat (2009-2018)
	School life expectancy	Total number of years of schooling that a child could expect to receive	UNESCO Institute for Statistics, UIS online (2009-2019)
	Tertiary enrolment	The ratio of total tertiary enrolment to the population of the age group	UNESCO Institute for Statistics, UIS online (2009-2019)
	Graduates in science and engineering	The share of all tertiary-level graduates in science, technology, economy, mathematic subject of all tertiary-level graduates	UNESCO Institute for Statistics, UIS online (2009-2019)
	Knowledge-intensive employment	The sum of people that are managers, professionals, and technicians / associate professionals among the people employed	International Labour Organisation ILOSTAT 2010-19, computed by WIPO (2020)
	Firms offering formal training	The percentage of firms that offer formal training programs for their permanent full-time employees	World Bank, Enterprise Surveys 2009-19, computed by WIPO (2020)
Financial Capacity and Institutions	Ease of getting credit	The score that represents whether certain features that facilitate lending exist and whether the information exists through credit reporting service providers	World Bank Doing Business 2020, computed by WIPO (2020)
	Ease of protecting minority investors	The score that represents the protection of shareholders against directors' misuse of corporate assets for personal gain	World Bank Doing Business 2020, computed by WIPO (2020)
	Intensity of local competition	Survey result that represents the intensity of competition in the local market	World Economic Forum 2019, computed by WIPO (2020)
	Ease of starting a business	The rank that represents all the official procedures required for an entrepreneur to start up and formally operate a commercial business	World Bank Doing Business 2020, computed by WIPO (2020)
	Ease of resolving insolvency	The score that represents the recovery rate and the strength of insolvency framework index	World Bank Doing Business 2020, computed by WIPO (2020)

10.5 Appendix 5 – Framework Construction Insights from Academics

For the purpose of establishing our framework, we interviewed several academics in the area of innovation. These interviews helped us to understand the practical view of innovation before extracting the information to form the framework. In summary, the academics gave us the idea of innovation network and the perspective to see innovation from system-level.

10.5.1 Marco Antonio Sardillo

Marco works with UNDP and the Philippines government in developing the Next Generation Cities project. One of the projects involves helping the government provide cash transfers to people in cities with no access to bank accounts. Before running any big systemic transformation or innovation, UNDP and the team would run little experiments. Innovation can be measured in many possible ways, such as analysing the number of patents filed or the amount of investment in research & development activities. However, before measuring innovation, it is essential to have a certain definition of innovation to focus on.

10.5.2 Adrian Smith

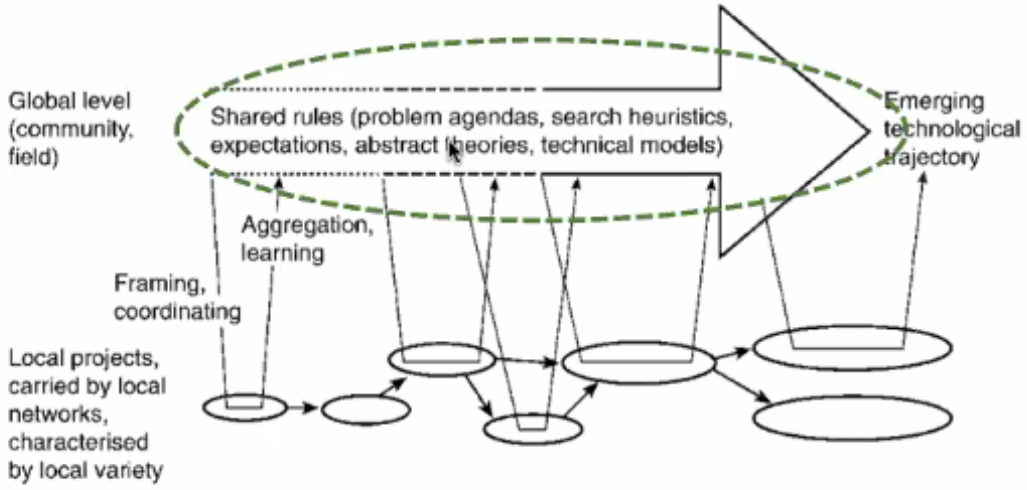
The background of Grassroots Innovation Movement (2017) was the attempt to analyse the local environmental and social development initiatives in different societies. People that are involved in those initiatives, however, were refused to be considered as innovators due to the way innovation is construed. Innovation in a narrow term is closely related to capitalism, Silicon Valley, and technological-based ideas. Thus, it is vital to look broader when studying about innovation.

Grassroots innovation pursues different pathways compared to industrial innovation. It is marginalised by the focus of industrial innovation where the capital and resources are accumulated. If one is trying to find an intersection between the two, it would be difficult to find any overlap unless one is looking at how industrial innovation or technological innovation is incorporated to carve out people's livelihood.

In his book, he analyses grassroots innovation through a simple framework consisting of context, framings, spaces and strategies, and pathways. The framework is in-depth enough to explain the background and process in each initiative yet broad enough to look for similarities among them. It is not an easy task to establish a framework that bridges industrial and grassroots innovation due to its different drivers, models, and determinants. Especially, in the case of grassroots innovation, the goal is not always scaling up.

There are different stakeholders that play a role in promoting grassroots innovation. Government, for instance, can play a role not only by scaling the innovation up but also

by providing education and training for the labour markets. Another important role is the intermediation. As illustrated in the figure below, intermediary organisation is in the global level. Intermediary bodies can identify and learn the diverse initiatives through framing and coordinating the grassroots innovation. Furthermore, intermediary bodies can relocate the resources and scale up or scale wide the initiatives which eventually would drive a sustainable activity. What Adrian suggested as the most important role of the intermediary body is that it codifies and documents the innovations and knowledge of the people involved in successes and failures. Such knowledge can then be learnt by other local innovations across the network.



Lastly, built on the fact that innovation does not always gain success, it is important to attentively learn the motivation and aspiration of the people who are involved in grassroots innovation projects and at some point, dropping the preconceived notions of success and learn to think about new metrics to measure the achievement.

10.5.3 Eric von Hippel

Innovation can be studied at individual level as well as system level. Taking industrial revolution as an example, it was the phenomena where thousands of little adaptations and innovations work together. It is a similar phenomena with innovation in developing countries. Developing countries are unlikely to produce the next biggest innovation but it has a hefty number of small innovations.

In the light of determinants of innovation, Eric argued that creating facilities for people to gather and innovate together, physically or digitally, would significantly contribute to promoting innovation. In addition to it, he argues that technology has an important role due to helping innovation to spread out. Training is also something that could accelerate the process of innovation. In contrast to the literature of innovation, Eric does not think

intellectual property rights (IPR) affect the emergence of innovation. Innovators would innovate regardless if an IPR is implemented.

If one wants to understand what promotes innovation, one should not only look into developing countries but also developed or advanced countries. There are lessons that could be learned and later offered to developing countries and analysed if it works. Another way to understand the innovation is to look into one country and see what works and what does not work. Therefore, it is feasible to compare it with similar context.

Looking deeper into user-innovation, an idea developed by Eric von Hippel in many of his published works, he argued that users know what they need and therefore innovate, regardless of the existence of a market. If the innovation is a good innovation, others pick it up. It signals the company or the market to provide such good or service. Until they are sure that there is a market there, manufacturers would only observe. Producers usually steal the innovator's idea. However, many producers recently have learnt to work with users and incentivise their ideas.

For the purpose of identifying any innovative projects, the government could surf on the Internet and see what the citizens do to solve a particular problem. Good innovation stands out by having the largest frequency of searches. As time goes by, artificial intelligence technology is getting cheaper and more accessible. This should help the government to identify the initiatives.

In regard to the barriers to innovation, Eric von Hippel argued that companies that are not open to user-innovation would be the first. Communities, therefore, should create their own companies. Any effort to reduce the cost of starting a company should foster innovation. At times, companies might not be needed anymore. The innovation further can be accessed through a digitally stored information platform.

10.6 Appendix 6 – Targeted Innovation Policy Based on Context

This section will analyse Kazakhstan, China, Brazil and Rwanda's approach to innovation policy. We provide this information is to highlight the government's role in innovation systems and explain why these countries have historically pursued linear innovation policy paths.

10.6.1 Kazakhstan

The demise of the former Soviet bloc led to a severe contraction in output and economic instability in Kazakhstan. However, over the last two decades, Kazakhstan's economic performance expanded rapidly, and today it is one of Central Asia's fastest-growing countries. Kazakhstan's economic growth is based mainly on oil and gas revenues, which accounts for 35% of its GDP and 75% of its exports (Nordea Trade Portal, 2021). The innovation sector, however, has struggled to keep pace. According to the OECD (2017), the Kazakhstani level of innovative activity stands at 3.9%. It is lower than former Soviet countries, like Belarus (19.6%) and Russia (9.9%), and significantly lower than OECD countries, like Germany (70%), Canada (65%) and Belgium (60%). A key issue is the weak domestic demand for innovation, reflected in Kazakhstan's structural characteristics and extractive industries' dominance. Kazakhstan's science and technology (S&T) industry is also scattered, dominated by research institutes that are mainly inherited from the past and funded primarily by the state. Several Kazakh strategy and policy documents highlight the importance of university-industry partnerships (UIPs) to promote innovative activity. Yet, UIPs remain inherently weak and limited to employers' involvement in teaching, the provision of internships for students, and technical consultancies (Jonbekova et al., 2020). Facilitating market entry for entrepreneurs and simplifying extensive legislation and regulation are prerequisites for innovation to thrive in an economy. Indeed, Kazakhstan has achieved some progress in improving the regulatory environment for private business, reflected through several improved international ratings. Additionally, several innovation initiatives like the Fostering Productive Innovation Project (FPIP) - a joint effort by the Kazakh Ministry of Education and Science and the World Bank - seek to unleash the country's innovation potential continuously. Overall, in Kazakhstan, while there has been significant improvement in creating a friendlier business environment, particularly on the regulatory and tax front and the quality of infrastructure provision, there is greater room for improvement in creating conditions for thriving entrepreneurial activity.

10.6.2 China

China's investment in and development of its S&T sectors has received worldwide attention. Since the 1970s, the Chinese government has issued several S&T policies to build an innovation-focused nation. Broadly, they include reforms to the S&T system, increased investment in research and development (R&D), the establishment of high-tech parks to boost venture capital investment, and improved intellectual property rights (IPRs)

(Liu et al., 2011). More recently, the Chinese government allocated more than US$ 77.82 billion in science and technology in 2011, with nearly a 20% annual growth rate since 2005, reflecting its continued commitment to enabling innovation (Fu, 2015). Separately, the state also introduced industrial policies that support the development of high-tech sectors to strengthen industrial competitiveness, encourage more investment in innovation, and promote high-tech trade (Schaaper, 2009).

Overall, the Chinese government has played an important role in the national innovation system, developing and implementing a comprehensive set of institutions and incentives. It has created an open market environment and innovation atmosphere that encourages external knowledge sourcing and acquisition and the commercialisation of scientific research discoveries and inventions. Innovation-related financial, tax, industry, trade, and S&T policies serve as effective linkages that connect all the relevant players at various national innovation system levels. China's key challenges, however, lie in a robust intellectual property rights regime to protect and facilitate knowledge sharing. There is also greater scope for the government to design and implement appropriate structural policies, including competition and regulations, public infrastructure, S&T base and talent education policies.

10.6.3 Brazil

Brazil's innovation ecosystem historically has had a strong public sector influence. R&D and the provision of technology traditionally lie in the hands of public institutions. This practice stems from the idea that the government is responsible for providing the business sector with (modern) technologies and dates back to import substitution industrialization (ISI) during the military dictatorship between 1964-1985 and continues to this day. For many years, the state viewed technology and science policy as separate from each other. The provision of technology for domestic enterprises is a priority and reflected in several national development strategies. However, policymakers rarely address the promotion of entrepreneurial innovation. It was not until the early 2000s when Brazil emphasized strong industrial policies, focusing on innovation and systemic processes. The government stimulated domestic companies' increased competition by opening markets to trade, pushing for economic reform, and encouraging privatization. It has also promoted innovation throughout the economy by legislating (US–style) innovation laws that protect property rights. Sectoral funds to financing tools for research, development and innovation projects have also emerged. Additionally, Brazil also established two government agencies - the Brazilian Agency for Industrial Development (ABDI) and the Center for Management and Strategic Studies (CGEE), which stand testimony to the country's commitment towards promoting innovation policies. However, public institutions' inefficiencies and a complex bureaucracy that complicate coordinating initiatives for building an innovation-based economy suggest that there are significant

path dependencies from the military dictatorship's actions that continue to affect some of the main features of Brazil's national innovation strategy.

10.6.4 Rwanda

Rwanda has achieved significant economic, infrastructural and social development in recent years (UNCTAD, 2017). The government, in several policies and strategies, acknowledges that the country's socio-economic development is vulnerable and that building a national scientific, technological, and innovative capacity to sustain the achievements made thus far is critical to advancing the country's socio-economic development. Rwanda's national development vision, known as Vison 2020, is testimony to the state's commitment to innovation. It highlights that becoming a knowledge-based economy is a key development priority. Efforts made by the government to liberalise the telecom sector and develop ICT infrastructure, including the build-up of a fibre-optic network over the entire territory, have been instrumental in fostering innovative activity. In 2012, the government also established the National Commission of Science and Technology (NCST) to advise on policies, legislation and regulation in science, technology, research and innovation, and monitor the implementation of such policies and legislation. The Smart Rwanda Master Plan 2020 (SRMP), launched in 2015, also articulated the overarching goal of increasing the private sector's involvement, narrowing the digital divide, improving e-government, and engaging the youth in a digital society. Despite these various efforts, implementation is inadequate. R&D, while mainly done through public organizations, lack the systems in place for facilitating the commercialization of research output. The low level of R&D activity in firms has been challenging to document and empirically assess. Moreover, funds for innovation and research is largely dependent on the government budget, and inadequate intellectual property awareness, human resource capacity, and finance access continue to be impediments to Rwanda's overarching innovation agenda.

10.7 Appendix 7 – Term of Reference

UNDP Accelerator Labs
Advancing innovation policy in developing countries: Pathways to scale for the UNDP Accelerator Labs Network
Capstone Terms of Reference (ToR) 2020/21

1. Project objective/s

The objective of this project is to establish a greater understanding of the types of policies that governments of developing countries can use to promote innovation nationally. The project will identify trends in recent-historical efforts to promote innovation and apply these learnings to current policy environments. This is a highly practical Capstone that will challenge students to translate a survey of a broad set of policy-relevant data and theoretical literature into real-time policy recommendations. The results will be used by the UNDP Accelerator Lab Network – a network of 90 social innovation labs. The work is embedded in the United Nations Development Programme and covers 114 countries.

2. Context/debate: why is this issue important?

Emergent disruptive influences such as climate shocks, soaring inequality, and disease pandemics challenge the international development community's ability to deliver on its work of keeping people safe, healthy, and out of poverty. In the context of compound global crises, increasing complexity, and an accelerated pace of change, UNDP sees innovation as critical for developing and delivering solutions to the world's most pressing challenges.

While innovation has been a priority of the international development community for several years, we see a unique window of opportunity now as many governments have realized that citizen-driven solutions are playing an important role in the fight against COVID-19.

From UNDP's perspective, social innovation is a way to promote open governance, citizen participation and greater inclusiveness. UNDP has invested hundreds of millions of dollars to promote innovation through initiatives such as the Accelerator Labs and Innovation Facility and we see government adoption of innovation policy as a key ingredient to create the right incentives for bottom-up innovation as part of sustainable development.

UNDP's innovation work thus far has focused on partnering with governments to demonstrate practical prototypes to model the power of real time data, new approaches such as foresight and behavioural science, and other innovation methods. While UNDP often works on development policy as related to decentralization, rule of law and access to justice and social protection, we need a broader evidence base to advise on innovation policy in our partner countries.

About UNDP & the Accelerator Labs Network

UNDP works in 170 countries and territories, helping to achieve the eradication of poverty and the reduction of inequalities and exclusion while protecting the planet. We help countries to develop

policies, leadership skills, partnering abilities, institutional capabilities and build resilience in order to sustain development results.

UNDP set up 60 Accelerator Labs last year to chart the course for a radically different way to scale positive change in the world. The labs tackle the gap between how we tackle global challenges and an accelerated pace of change. The Labs identify, test, and pilot innovative solutions as part of a portfolio of complex challenges and form a global network that rapidly translates insights into action at scale. After a successful first year, the network is expanding to 90 Labs in 114 countries (beginning September 2020).

This is a large-scale investment in a global public sector organization. UNDP invested $100M in the Accelerator Labs as a bet on doing development differently, doubling down on social innovation as a way to make breakthroughs on global challenges. As the Labs are integrated in the majority of UNDP Country Offices around the world, this investment is also intended to mainstream innovation into development work.

The UNDP Accelerator Labs focuses on three areas of innovation:

1) Grassroots innovation: building on the knowledge and ingenuity of women and men living in poverty and facing the effects of climate change
2) Collective Intelligence: Tapping into the power of people, data and machines to get smarter together
3) Portfolios of experiments: To intervene in complex systems, multiple safe-fail interventions are needed.

3. Research Question

The central research question is: What polices can governments adopt to promote innovation nationally? Inquiry should focus on both policy instruments and surrounding governance models (or policy environments).

4. Key activities to answer the question

Following an introductory literature review, refinement of the research question, and definition of key variables (e.g. innovation, ecosystem), researchers may structure this project in 2 stages.

(1) Historical review of innovation policy

This research will take the form of case studies of the types of policies that have promoted innovation in low-and middle-income countries in the last 15 years. In cases where there exist time series data that demonstrates impact, examples can also be drawn from OECD countries.

Researchers may consider the following sub-questions:

- What policy measures/inputs promote innovation?
- What changes can governments make to governance models to promote innovation?
- What challenges do governments encounter in pursuing policies to promote innovation?
- What are the central drivers (economic, political, social, domestic, international) of government's decision to pursue innovation-promotion policies?
- What was the outcome of government efforts to promote innovation?

Research will be conducted through primary documents (government policy documents, legislation, budgets, etc.) and secondary literatures. Analysis should identify and compare lessons learned across the cases.

(2) Analysis of current policy environment of countries where UNDP Accelerator Labs operates

This analysis will concentrate on the real-time locations where UNDP Accelerator Labs currently operates. Researchers will select between 6 and 12 countries for investigation.

This analysis should include:

- Scoping of policy environment relevant to innovation
- Analysis of opportunities for and obstacles to the introduction or strengthening of policies that encourage innovation
- A 1-page brief with policy recommendations for each country. These will be part of the final 15,000-word report
- As part of the final report, the analysis should provide a toolkit, or a set of practical, context-specific options that UNDP can use to advise governments on local innovation ecosystems

The two stages do not need to be connected (i.e. referred to the same set of countries) but, to evaluate the contribution made by Accelerator Labs, it could be useful to make the connection for at least some countries in the selected sample.

5. Scope

Parameters for this study are as follows:

- Research and analysis will concentrate on the types of policies governments adopt with the goal of promoting innovation nationally
- Stage 1: Historical case studies should be drawn from the last 15 years from low- and middle-income countries; in cases where there time series data that demonstrates impact, examples can also be drawn from OECD countries.
- Stage 2: Case studies of UNDP Accelerator Lab countries: in consultation with UNDP, choose 12 from list of 114 countries, including at least 5 from Africa and one from each other UNDP region.

Researchers may consider the following variables and questions when investigating policies relevant to innovation:

- Structural institutions such as
    - Regulatory frameworks
    - Tax policy
    - Procurement rules
    - Intellectual Property laws
    - Data Privacy Frameworks
    - AI strategies
    - Innovation zones
- Associated government practices related to
    - Spending (R&D, education, and/or other areas)

    - Financial regulations and incentives, such as promotion of venture capital or investment in SMEs or start-ups
    - Enterprise and property ownership
    - Entrepreneurship
    - Ethics of technology
- What forms of innovation policy work best in developing economies, particularly those that have a high degree of informality in the economy?
- How is the effectiveness of innovation policy assessed? What proxies are used?
- Is there evidence of innovation policy that reduces income and other inequalities? What policy designs work best?
- What are the instruments governments can use (financial, procurement, IP, etc.) that would fit into the existing regulatory/policy framework to acknowledge and encourage citizen-driven innovation?
    - How can governments promote "inclusive innovation" in the context of national policymaking?
    - What is the significance of "citizen innovation"? How can governments promote, or at least not discourage, this type of innovation, regardless of whether it results in commercial scaling?
    - How does a government support bottom-up innovation?
    - What actions should governments specifically *not* do?

6. Sources

This project will entail the use of government data (legislation, policy documents, budgets, announcements), statistics/macroeconomic indicators, and secondary academic literature (journal articles, books, policy briefs, working papers, etc.).

Data on patents, taxation, rates of lead user innovation will be explored to understand the impact of innovation policy.

7. Availability of data

UNDP offices in country will support data access where needed. Researchers should consider the availability of data during case selection.

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