



政策研究大学院大学
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政策研究大学院大学 科学技術イノベーション政策研究センター ワーキングペーパー (SciREX-WP)
National Graduate Institute for Policy Studies, Science for RE-Designing Science,
Technology and Innovation Policy Center (SciREX Center) Working Paper

[SciREX-WP-2020-#05]

**Features of ecosystems to advance disruptive
inclusive innovation for the Sustainable
Development Goals: Five global case studies**

2020/11

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SciREX Center
WORKING PAPER

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Abstract

The transformation of sociotechnical systems is considered necessary to achieve the Sustainable Development Goals. However, this transformation process is inhibited by institutional inertia of the public sector, vested interests of the private sector, routine habits of individuals, and increased complexity of globalized activities. While policies to stimulate the transition exist, these policies and pathways are still insufficient. Meanwhile, there are many individual private initiatives taking place to advance the societal agenda. Although these are still isolated actions of new actors, they have the potential to become broader movements. This study takes an inductive approach to examining factors that enhance the generation of new value networks with inclusive outcomes reflecting a model of “disruptive inclusive innovation.” Five cases are examined that involve venture capital, an incubator, venture companies, and a social impact fund. The study notes that a common feature underlying the ability of these organizations to generate high impact is the creation of tailored ecosystems. These activities are self-generated without much government support. Therefore, examining these as “signals” provide hints regarding how policy can be formulated to better complement and link relatively isolated cases of success so that private initiatives can be scaled-up and well-integrated with transformative policy efforts.

KEYWORDS

Disruptive innovation, Inclusive innovation, Ecosystems, SDGs, Emerging business

JEL CODE

O35 Social innovation, **O38** Government policy; **M13** New firms and startups,

Features of ecosystems to advance disruptive inclusive innovation for the Sustainable Development Goals: Five global case studies

Michiko Iizuka and Gerald Hane, GRIPS

1. Introduction

In 2015, United Nations member states adopted the 2030 Agenda for Sustainable Development, which outlined Sustainable Development Goals (SDGs). Under these targets, nations aim to create new pathways toward sustainable development while leaving no one behind. Science, technology, and innovation (STI) are expected to play critical roles in this process (TWI2050, 2020; Schot and Steinmuller, 2018). Currently, countries that subscribe to the SDGs are drawing roadmaps regarding STI for SDGs (UN-IATT, 2019). New approaches are essential because existing studies indicate that current policy instruments are either absent or insufficient for achieving the magnitude of transformation needed in the expected timeframe.

This study is based on the hypothesis that disruptive and inclusive innovation (DII) can play a conducive role in the transformative process to achieve the SDGs and that creating new innovation ecosystems are instrumental for paving new pathways. DII is innovation that disrupts current innovation ecosystems and creates value networks—through disruptive innovation (Christensen, 1997; Markides, 2006)—while satisfying unmet societal needs—through inclusive and social innovation (Chattaway et al., 2014; Chesbrough and Di Minin, 2014; Heeks et al., 2014). Although both elements of DII (disruptive and inclusive) have different goals, there are important overlaps in how they achieve their goals. SDGs define bold social goals that call for more disruptive solutions and stimulate the innovation process. This paper aims to examine cases that act as ‘signals’ to identify the factors that can promote the higher impact from innovation needed in order to reach the SDGs. The cases selected focus on activities that have societal impact and face new, blue ocean customers. This overlap is key to understanding how socioeconomic transformation toward SDGs can take place.

Leveraging innovation for this transformation is particularly challenging in emerging economies where the assets needed for successful innovation are not fully present. The construction of supporting ecosystems provides a path to strategically overcome missing factors of the context of their operation, initiating operation to fulfil the needs of citizens in not only delivering goods and services needed but also with new mechanism

to make them available and accessible for the mass in non-business conducive conditions. Aided by the construction of ecosystems, companies can initiate transformation by disrupting the status quo, creating new markets, and responding to unmet needs. This study attempts to shed light this process of transformation, the process of building new innovation ecosystems to pave the pathway toward SDGs (Schot and Steinmuller, 2018).

Ecosystems can facilitate value creation and value capture, both of which accelerate the path to the SDGs. Against the backdrop of a rise in platform-based businesses using digital technology, there has been increasing attention to the role of innovation ecosystems to ensure competitiveness. These case studies analyze how a new ecosystem secures a new market by creating a dominant platform. Building complementarity to a platform (e.g., linking competitive supplier networks to dependent users) ensures the sustainability of a business. The ways in which businesses have extended value networks through complementarities is different from value creation, as it is more focused on capturing value (Teece, 2018). This study pays attention to this complementarity and the importance of ecosystem development of DII business cases in order to observe how value capture via ecosystems generate greater social benefits. Value capture through ecosystem building can be a stepping stones in drawing disruptive pathways towards SDGs from the bottom up.

Section 2 of this paper reviews the literature to formulate the conceptual framework of DII. Section 3 explains the conceptual framework, research questions, and methodology. Section 4 introduces cases of disruptive businesses that link the concepts with practical examples. Section 5 compares these cases to answer the following research questions. How can new ecosystems advance DII and stimulate the transformation toward SDGs? How are collaboration and ecosystems built to gain resilience to challenge the social agenda? Finally, Section 5 offers conclusions and sets out the limitations and future research challenges.

2. Review of related concepts

2.1 Sociotechnical transitions and its challenges for SDGs

The transformation of existing sociotechnical systems (the way in which society and economic activities are organized) is considered inevitable for achieving the SDGs (TWI2050, 2018, 2019, 2020; Schot and Steinmeuller, 2018; UNCTAD, 2014). While recognized as essential, initiating transformation is difficult owing to path dependency

constituted of institutional inertia by incumbent actors with vested interests and consumers and users with habits and routines. These inhibiting factors, at distinctive levels, result in maintaining the system in its status quo. In addition, the globalization of economic and social activities that has occurred in past decades has created intricate webs of activities, making transformation a complex process.

Several studies have pointed out that existing policies are insufficient to initiate transformation. These studies have claimed that while some policies can positively encourage change (e.g., feed-in tariffs and carbon taxes), very few actively destroy the existing systems to facilitate transitions (Kern et al., 2017; Kivimaa and Kern, 2016; Rogge and Reichardt, 2016; Turnheim and Geels, 2012; Weber and Rohracher, 2012). This means that unless there are substantially advantageous (simple, low cost, superior, and universal) alternatives offered to individuals and society at large, transformation is difficult to take place (Franken, 2017). Indeed, existing policy instruments, such as subsidies for eco-products and public procurement for large infrastructure, aim at encouraging change from the demand side. However, these public initiatives have had limited results so far due to transformative failure that consists of failure to: identify the future trajectory (directionality), articulate demands (demand articulation), coordinate beyond conventional boundaries (policy coordination); and self-evaluate and correct (reflexivity) (Weber and Rohracher, 2012). This makes it imperative to collaborate closely with private (or non-public) actors to offer distinctively new innovative solutions—disruption—to change potential users' behavior with inclusive outcomes. In fact, there are increasing numbers of businesses and private initiatives that place societal purpose as one of their core objectives¹. Currently, these efforts are somewhat isolated. However, if aligned well they could become alternative forces in paving the road toward SDGs (Schot and Steinmueller, 2018).

Currently, STI for SDG roadmaps are being drafted in selected countries² as pilot cases (UN-IATT, 2019). Drawing roadmaps can be a challenging exercise because, by design, each government needs to determine, under the unifying global vision of the SDGs, where to initiate the journey (starting point: assessment of current status) to the goals (priorities, target); how to reach the goals (pathways: strategies); and how to translate

¹ For instance, Zebur Unite, numbers of prescriber for PRI (Principle of responsible investment), emergence of concept of shared values (Porter and Kreme 2011), valuing stakeholders than shareholders statement by Business Roundtable in 2019. <https://www.businessroundtable.org/business-roundtable-redefines-the-purpose-of-a-corporation-to-promote-an-economy-that-serves-all-americans>

²These countries are, Ethiopia, Ghana, India, Kenya, and Serbia with the EU and Japan.

goals to the implementable level (identification implementable actions and assigning tasks to relevant agents). This exercise creates a learning space for participating governments.

At the same time, globalization has already created a complex web of global value chains in the exchange of resources (natural, financial, and human capital) to facilitate economic and social activities. The configuration of pathways toward prosperity can be beyond the control of any single government. In addition, global prosperity is very much associated with inclusiveness obliging the Global North and the South to collaborate³ (Schot and Steinmeuller, 2018).

The efforts initiated under the UN-IATT to pave the way for successful roadmaps toward the SDGs are still incipient and have a long way to go to become a powerful practical policy tool to involve actual stakeholders in changing the course of the developmental trajectory. This, however, does not mean that change toward a new form of society is absent.

In fact, many “signals” of changes toward a sustainable society, independent of orchestration by the UN, are already being observed. For instance, the following aspects have emerged: 1) There are new business actors aiming to solve societal problems, such as social entrepreneurs, startups, and VC firms that employ emerging technologies and new business models to seek social returns in addition to economic ones. 2) Financial resources have emerged, focused on returns beyond pecuniary value, such as social investors, ESG (Environment, Social and Governance) funds, impact investment funds, and crowdfunding for social causes. 3) There are knowledge appropriation tools that allow more open access to knowledge and innovation for further use or sharing for public purposes, such as creative commons licenses, open and free source movement, and copy left⁴. 4) Rules and regulations have emerged to focus on societal impacts of innovation or economic activities that reach beyond country and disciplinary boundaries, such as international standards addressing environment and social and ethical issues, including environmental certification (eco) and social labelling, sustainable and ethical business codes of conduct, such as fair trade⁵. 5) New governance methods allow

³ For example, consider the migration of labor, students, FDI, global value chains of economic activities, and most recently, disruptions to the production of industrial goods from the spread of the Covid-19.

⁴ Copyleft, distinguished from copyright, is the practice of offering people the right to freely distribute copies and modified versions of a work with the stipulation that the same rights be preserved in derivative works created later.

⁵ Includes Corporate Social Responsibility (CSR), Principle of Responsible Investment (PRI, 2009), Triple Bottom line (1994), Creating Shared Value(CSV) (Porter and Kremer, 2011, 2016) among others.

experimentation to new innovative solutions so to diminish the time lag of users to benefit from the products and services, such as regulatory sandboxes and regulatory pacing (Marchant et al., 2011), agile governance (WEF, 2019), application of virtual reality simulations for policy and participatory or open governance (e.g., Port Alegre, Brazil and Quebec, Canada). 6) New business models have been created by the digital economy and sharing economy, such as peer-to-peer reciprocal services, customized and decentralized small lot production that can meet unmet needs, such as makerspaces, decentralized (off grid) power generation, various forms of financial inclusion using mobile phones (e.g., M-Pesa and Go-pay) with accompanying e-commerce services. Indeed, these developments have been made possible by emerging technologies that are said to have the potential to transform society, such as ICT, 3D printers, and artificial intelligence (Garret, 2015).

Currently, the “signal” is still a relatively isolated force but in a short space of time, these dots are being connected to manifest transformation from the bottom up in a variety of combinations. This is expected to occur more rapidly in the Global South than the Global North owing to the sheer necessity of overwriting the inhibiting factors, namely, regulation, institutional inertia, vested interests, and habits.

The question then becomes how such changes are achieved so that they can gradually transform systems to generate broader impacts. The key to the design is not just to focus on generating new knowledge, but also on generating positive externalities via collaboration with external actors (Prahalad and Mashelkar, 2010), and creating mechanisms to capture benefits (Teece, 2018). Here, innovation ecosystems and complementary assets play an instrumental role (Teece, 2018; Gawer and Cusumano, 2014).

Building sustainable mobility is an area in which an ecosystem approach will be essential. Creating new technologically superior products at low cost, for example, energy-efficient cars, at massive scale would only partially respond to the needs for sustainable and affordable means of transportation to all. Recent technology has enabled the creation of a new "system" that allows the co-existence of diverse means of transportation—for various geographical locations (for a rural vs. urban setting or a mountainous vs. coastal setting, etc.), users (young vs. older generation or mothers vs. children), purpose (long vs. short distance; leisure vs work), business models (subscriptions vs. peer to peer sharing or dynamic pricing)—and that use different technologies (self-driving or electric).

Each operates at its best in offering services to the differentiated needs of users while being a complementing module for the effective delivery of sustainable and affordable mobility services. This requires interoperability (universality of technology and legal systems) that encompass diverse and customized needs. Each mode in the transportation system also needs to be affordable, available, accessible, sustainable, and better than the existing choice of transportation. The success of a mobility system, therefore, is not technological “excellence” in one product but an ecosystem of complementary services running on interoperative systems catering to the diversity of unmet needs of the people.

Studies in sociotechnical system transitions offer rich insights for transformation to meet the SDGs. These studies have analyzed historical transitions (Geels and Penna, 2015; Geels and Schot, 2007), sector- or technology-specific transition processes, and those that address to societal problems (Geels, 2002; Schot and Steinmuller., 2018). In particular, a multi-level approach framework that nests niche, regime, and landscape levels offers useful policy implications for managing the transformation process (Geels, 2002). The STI for SDG roadmap includes both regime (national) and landscape (international) levels but currently pays little attention to what is happening to the niche (bottom-up, micro) level. This framework, therefore, could be effective for deeper understanding of activities at the niche, bottom-up level.

2.2 Disruptive innovation to transform value networks

Disruptive innovation forms a new market and value network that generates disruption and eventually replaces existing markets, firms, products, and alliances (Bower and Christensen, 1995; Markides, 2006). The disruption is generated as the outcome of innovation or subsequent generation of value chains and customers adapting to the new context (Bower and Christensen, 1995, Christensen et al., 2006).

This concept initially addressed the business and management sphere referring to business strategies in the moment of technological change. Specifically, it showed the danger of excessive reliance on known and presumed needs of current customers in competition, because this would undermine the ability to recognize new (unarticulated unmet) needs in the market at the firm level (Christensen, 1997). The concept, however, gradually evolved to cover a much broader connotation that addresses systemic change of markets (Christensen et al., 2018; Kilkki et al., 2018). For example, Christensen et al. (2006) highlighted the catalytic role of a disruptive innovator that: 1) scale ups and

replicates products and services; 2) meets needs that are either overserved (overly cumbersome, elaborate options) or underserved; 3) serves simpler and less costly options without being an inferior alternative; 4) generates resources through unconventional methods that are not taken by incumbent players (e.g., microfinancing, crowdfunding); and 5) adopts an unconventional business model, because it is customarily considered as unattractive or unprofitable (e.g., impact investment fund, online medical care, and education) (Christensen et al., 2006). Christensen et al. (2006) provide examples of new approaches vis a vis conventional choice: online classes (e.g. Massive Open Online Courses: MOOC) and community colleges versus traditional universities; microlending and crowdfunding (e.g. Kickstarter⁶) versus banks; basic health service providers (e.g. Minuteclinics⁷ and The Healthstore foundation⁸) in Kenya versus traditional hospitals. These examples offer unconventional alternatives to mainstream products and services, and are closely associated with systemic change. These also illustrate that disruptive innovation offers solutions for larger populations with unmet needs, potentially generating greater impacts (Christensen et al., 2006: 6; Christensen and Raynor, 2003).

More recently, Christensen et al. (2019) focus on the role of disruptive innovation in generating prosperity at national level. Christensen et al. (2019) emphasize its function in “market creation,” which subsequently generates: 1) sustainable jobs from creating new value networks; 2) profits from creating broader impacts; and 3) culture change of an entire society by creating new access and opportunities. The authors claim that disruptive innovation can contribute to prosperity via innovation that seeks to overcome the absence of: 1) skills to make use of what is being offered; 2) wealth (resources) or access to buy and use; and 3) time to consume or obtain access (e.g., time for waiting to see a doctor and delivery time). Above features indicate that a successful business model of disruptive innovation would naturally create an inclusive market by providing simple, easy-to-use, low-cost, and accessible products/services to current “non-

⁶ Kickstarter is a global crowdfunding platform focused on creativity. It has received more than US\$ 4.6 billion in pledges to fund 445,000 creativity projects in 2019. <https://www.kickstarter.com/>

⁷ The clinic only staffed by nurse practitioners and [physician assistants](#) to offer basic services including vaccinations, testing and treatment for sexual transmitted disease treatment, contraception services, smoking cessation, and TB testing. <https://cvshealth.com/about/our-offerings/cvs-minuteclinic>

⁸The HealthStore Foundation is a non-profit corporation founded in 1997. Its mission is to increase access to essential medication, basic healthcare, and prevention services for children and families in the developing world. It takes social franchise business format to establish the network of small clinics, called CFWshops. These shops “are to improve access to essential drugs, basic healthcare, and prevention services for children and families in the developing world using business models that maintain standards are geometrically scalable, and achieve economies of scale”. <http://www.cfwshops.org/>

consumers” with unmet needs. He illustrated how disruption can be made but was not as clear regarding how firms can overcome challenges accompanying the disruption.

2.3 Inclusive innovation to leave no one behind

Innovation⁹ is often associated with productivity and firm activities but it also enhances welfare and the quality of lives of individuals by solving societal problems. Since the 2000s, several types of innovation have been linked to welfare enhancement in particular, targeting the low-income strata of population. Innovation for the “base/bottom of the pyramid” (BOP) (London and Hart, 2004; Prahalad, 2005; Prahalad and Hart, 2002) has emerged, focusing on the market potential of the “bottom billion” with income of less than US\$ 2 per day. This initially included the poor as potential consumers whose needs are not being satisfied by the existing market while a later version treats the poor also as producers. Other concepts—such as grassroots innovation (Gupta et al., 2003; Fessoli et al., 2014)—consider the poor as a generator of innovation to improve quality of life by themselves and have tried to actively promote this more broadly through the use of intellectual property rights. Frugal innovation treats the poor as both users and producers of innovation, emphasizing that under constrained living conditions (absence of infrastructure, finances and resources, etc.), innovative configuration of existing knowledge is generated (Prahalad and Mashelkar, 2010; Radjou et al., 2012; Tiwari and Herstatt, 2012). The successive emergence of innovation concepts addressing welfare enhancement has proved the increasing importance of the problem-solving role of innovation in the present-day context.

Social innovation is another type of welfare-enhancing innovation. Unlike the types discussed above, social innovation does not specifically address low-income strata of society but focuses on the growing role of civil society in solving societal problems through innovation. It emphasizes the participation of stakeholders in innovation ultimately altering organizational methods and networks to effectively meet unmet needs, including the change in mindsets (Edwards-Schachater and Wallace, 2017; Nicholls and Murdock, 2012; Pol and Ville, 2009).

⁹ Similarly, the International Development Innovation Alliance, a collaborative platform of international aid agencies, defines innovation from a development perspective as “a new solution with the transformative ability to accelerate impact. Innovation can be fueled by science and technology, can entail improved ways of working with new and diverse partners, or can involve new social and business models or policy, creative financing mechanisms, or path-breaking improvements in delivering essential services and products. Innovation has been and will be pivotal for reaching sustained, scalable solutions to the world’s complex problems.” (<https://www.idiainnovation.org/>)

Von Hippel has highlighted the importance of user-led innovation (von Hippel, 1998) and subsequently, free innovation (von Hippel, 2018). User-led innovation emphasizes the role of users in generating innovation for their own unmet needs and sharing it among the peers. Under free innovation, von Hippel (2018) extends his argument of user-led innovation, claiming that the latter, as part of conventional innovation, can speed up the search for better options, leveraging the digital transformation underway.

Inclusive innovation is derived from the concept of “inclusive growth,” which involves “marginalized” and “low-income” stakeholders in the developmental process (George et al., 2012; Heeks et al., 2014). This is closely associated with social innovation, which focuses on the participation of stakeholders, or civil society, in meeting unmet needs via innovation. Technology (e.g., ICT, mobile phones, and renewable energy) in this context is portrayed as a means to support implementing innovation, serving as a platform for knowledge diffusion, learning, or exchange of products and services. Some studies employ the “open innovation” concept to social innovation as a mechanism to increase impact (Chesborough and Di Minin, 2014).

Similar approaches from the business literature also demonstrate the role of the business sector in confronting the social challenges. Creating shared value (CSV) extends the positive impact of Corporate Social Responsibility (CSR) as “business can serve new needs, gain efficiency, create differentiation or identity, and also expand markets” (Porter and Kramer, 2011). CSV considers that the competitiveness of a company can be enhanced while advancing the economic and social condition in the communities in which it operates, combining societal and economic progress (ibid:p6). These can be reached through three approaches: 1) reconceiving products and markets, 2) redefining productivity in the value chain and 3) enabling cluster development. This idea shares concepts reviewed earlier that identify addressing new customers, market niches, and collective mechanisms to support new alternatives. However, these approaches do not fully illustrate how to bridge the present state to CSV. Shared values of profit should inform societal issues in the locality in which the firm operates (Porter and Kramer, 2006, 2011).

Overall, Mashelker and Pandit’s (2019) “ASSURED”¹⁰ innovation crystalizes the key features of inclusive innovation. The seven elements of ASSURED innovation are as follows: 1) affordable, 2) scalable, 3) sustainable, 4) universal, 5) rapid, 6) excellent, and

¹⁰ ASSURED takes the first letters of above characteristics.

7) distinctive. These characteristics are critical for creating products and services that can solve societal problems and will be accessible to a large population. This is an excellent operational definition of inclusive innovation. Still remaining, however, is the question of the mechanisms to enable these innovations to reach the populations in need. This requires new ways of configuring stakeholders to create innovation ecosystems that will ultimately generate greater social impacts.

2.4 Innovation ecosystems and the potential to address core enabling factors

Innovation ecosystems are critical if innovation is to be deployed and have a transformative impact (Chesbrough and Di Minin, 2014; Christensen et al., 2019). Innovation ecosystems are increasingly considered to play a critical role in the strategies of firms and other actors to enhance competitiveness (Adner, 2016; Gawer and Cusumano, 2014; Jacobides et al., 2018). Emerging literature emphasizes that recent advances in digital technologies have enhanced modularity and platform capabilities, and as a result, innovation system complementarity can be generated in a shorter time span. For the network to successfully execute its mission of serving specific functions, good governance, shared values, and sustainable flow of financial resources are critical. Hence, key elements of a successful ecosystem appear more like a package (e.g., business model) of adaptive modules than a production chain for products and services. Here, the technologies are only half of the story, because disruptions require other complementary factors in a network to deploy and diffuse innovation to a mass of people. This requires the business model to ensure: flow of finance, develop human capacity, provide agile and adaptable physical and legal infrastructure to ensure access to the market for both producers and users (Marchant et al., 2011; Shapiro and Glicksman, 2002), partner with stakeholders that provide services and inputs (Gawer and Cusumano, 2014), and be a leading/strategic intermediary or coordinating entity (Adner and Kapoor, 2010; Gawer and Cusumano, 2008, 2014; Iansiti and Levien, 2004; Jacobides et al., 2018). These factors basically determine how networks are shaped, actors are aligned, flow of knowledge is open or closed, governance (rules of the law) is exercised, and values are shared (Gawer and Cusumano, 2014). Such value networks can be considered innovation ecosystems, which are defined as “the alignment structure of a multilateral set of particulars that need to interact in order for a focal value perspective to materialize” (Adner, 2016: 40). The studies done on ecosystems focus on how to create value and be competitive; however, they fail to mention the ways to ensure profitability (Teece, 2019). In other words, the ecosystem as a whole can become a

resilient mechanism in a time of crisis by leveraging mutually beneficial relationships among stakeholders involved.

Based on the above-mentioned literature, business success would benefit from ecosystems that consist of value creating networks aiming at both social and economic goals. Such a model would align financial flow, technology (as the means for implementation), capabilities (human, institutions), access to market and customers and business-conducive legal and physical infrastructure.

2.5 Types of technologies, complementarities, and innovation ecosystems

An innovation ecosystem places primary focus on the alignment of actors to generate value and impact from the network. This alignment of actors depends on the type of complementary assets that are involved. Here three types of technology are reviewed, emerging technology, enabling technology and general-purpose technology (GPT) to illustrate ecosystems surrounding the technologies. The general characteristics of different technologies are compared in the Table 1.

Emerging technology is often associated with the 4th industrial revolution and is considered the driving force for sociotechnical transitions. It is defined as “radically novel and relatively fast-growing technology characterized by a certain degree of coherence persisting over time and with the *potential* to exert a considerable impact on the socio-economic domains(s) which *is observed in terms of the composition of actors, institutions and pattern of interactions among those along with the associated knowledge production process*”¹¹ (Rotolo et al., 2015: 1828, emphasis added). This indicates that the impact of “emerging technology” lies in the future. In other words, its potential can be clarified only through implementation and the ecosystems surrounding it.

In contrast to the emerging technology, general purpose technology (GPT) exerts great impact on sociotechnical systems, as they: 1) are pervasive (widely used), 2) capable of ongoing technical improvement, and 3) enable complementary innovation in application sectors (Bresnahan and Trajtenberg, 1995). This means that GPT, being widely applied in various sectors, generates second- and third-order impacts by triggering follow-up innovations, engaging new accompanying systems, and generating cumulative impacts (Garret, 2015; Jovanovic and Rousseau, 2005). Hence, GPT is not just technology; it

¹¹ The following five key attributes for emerging technology have been identified (Rotolo et al., 2015): 1) radical novelty, 2) relatively fast growth, 3) coherence, 4) prominent impact, and 5) uncertainty and ambiguity.

can take the form of a product, a process, or an organization. Moreover, GPT has been developed over an extensive period of time as the result of collaboration between individuals with different skills and is considered to have significant impacts¹².

Enabling technology,¹³ underpins innovation across many products or services, across a variety of industries. Enabling technology shares the characteristics of GPT on two accounts: cumulative improvement of technology and complementary innovation in application. Enabling technology is often disruptive to the status quo, generating considerable economic benefit and social surplus. Again, like GPT, enabling technology has impacts that not restricted to product level but are likely to affect downstream users through networks and systems.

These technologies—GPT and enabling technology—are different from emerging technology: their impacts occur in real time and not are simply *potential* in the distant future. The critical issue is how these technologies are diffused, materialize complementarities, and culminate to generate impacts (Carlaw and Lipsey, 2002). The marked difference is the system that surrounds technology.

Table 1: Types of technology

	Emerging Technology	Enabling Technology	General Purpose Technology
Novelty	Radical technology	Drive radical change in use	Affect broad socio-economic areas
Impacts	Uncertain and ambiguous	Enhance user capability	change extant economic and social structure
Impact of technology	Coherence/Convergence	Applicability to diverse field	Creates many spillover effects
Observed change	Relatively fast growth in use	Rapid development of subsequent technology	Societal transformation
Complementarity	Explore methods of use	Complement for broader impacts	Complementary for transformative change and acceleration

Source : Based on Rotolo et al. (2015) and Teece (2018)

Teece (2018) referred to complementarity using enabling technology, and GPT. He argues that “technological complementarity occurs when the value of an innovation depends on altering the nature of one or more existing technologies and/or on creating new ones. It applies when the full benefit (or even any benefit) of the innovation cannot

¹² Examples of such GPT are printing, made-to-order materials, and steam engines.

¹³ The European Commission identifies the following as enabling technology: nanotechnology, industrial biotechnology, and advanced materials. These technologies are said to underpin product innovation across many industries and to be important for addressing societal challenges (https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies_en). Teece provides the examples of containerization of cargo shipping; 3G/4G, which has enabled the spread of Facebook; location sensitive mapping; and streaming media (Teece, 2018).

be achieved until some other, complementary technology has been created or re-engineered. The complements can be related vertically, horizontally, or laterally” (Teece, 2018: 1374).

In other words, complementarity influences the degree and magnitude of impacts. For technology to have broader impacts to disrupt, it requires complementary parts. Hence pervasive technology may exert greater transformational change. This requires complementing parts to be affordable, scalable, sustainable, universal, rapid, excellent, and distinctive (as seen in ASSURED innovation) because these characteristics enable a critical mass of potential users to adapt the technology and consequently amplify the impacts. For instance, the new generation of cellular networks requires high-performing universal microchips and handsets at cheaper cost and at massive scale to make the service available to potential users. Such a new network would bring on board a whole set of applied services and products, enabling the Internet of Things (IoT) (Garret, 2015). All the above requires the system to align the core functions.

Understanding the differences in technology types helps us to illustrate the importance of complementarity and ecosystems that transform the mere potential of emerging technologies into actual impacts through involving broader segments of non-users. Thus, although technology is an important factor to be considered in transformation, it is embedded in ecosystems that create value networks, and create effective complementarities in order to achieve DII toward SDGs.

3. Conceptual framework

3.1 Disruptive inclusive innovation

DII exists in the intersection between disruptive innovation and inclusive innovation. It brings about new value networks that differ from one or the other. By addressing a broad range of potential users at all economic levels, DII can accelerate the impact of innovations addressing societal challenges. First, DII embodies complementary concepts, each with a distinctive trajectory: one trajectory focuses on societal impact while the other focuses on the process of generating new value networks. DII occurs in the overlap in which disruptive innovation includes underserved customers and when inclusive innovation creates a new market and value networks. This is shown in Figure 1.

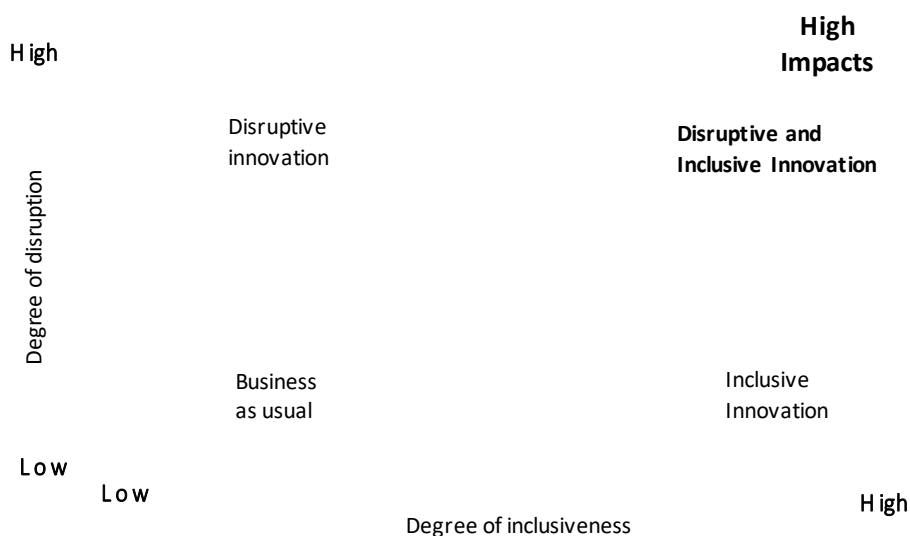


Figure 1 Disruptive inclusive innovation concept •

Source: authors

This study draws on cases of DII, which are expected to create systemic changes with greater inclusiveness by providing better access to product and services to large populations. Innovations incorporate technologies with business models so that the benefits become accessible to potential users who were not previously served by the market. An example of an innovation that is both disruptive and inclusive is Africa's M-Pesa. M-Pesa is a mobile phone-based money transfer system that allows those without bank accounts to leapfrog a traditional banking system by offering financial services via a mobile phone. This enables M-Pesa to reach a much larger population. This is a case of success through the development of an ecosystem that included key stakeholders. These stakeholders (Safari com, DIFD, Vodafone) established networks of cashing spots (Mas and Morawczynski, 2009) hence enabling a business that serves a mass of people that did not use financial services before. Supporting business success are 1) the involvement of diverse stakeholders external to the system including government support, ODA, and DFID; 2) prior information on needs for cheaper money transfer in the domestic market; and 3) the prevalence of mobile phone ownership that can be used as the infrastructure to lower the entry barrier to getting into a new activity. What this example illustrates is that with the inclusion of complementarities, the innovation can realize disruptive impacts.

3.2 Research questions and methodology

3.2.1 Research questions and implications

This study aims to understand how transformation toward SDGs can take place by analyzing existing activities with the features of DII through exploratory inquiry of successful cases. The underlying assumption is that promotion of DII will advance transformation toward inclusive sociotechnical systems from the bottom up, ultimately speeding up transformation to achieve the SDGs. For any firm, choosing a disruptive and inclusive path is a highly risky option. Hence the research pays particular attention to how collaboration and ecosystems are built to gain resilience to challenge social agendas. Key questions include the following.

1. How have innovators overcome uncertainty in initiating DII?
 Here, business models entail several factors mentioned in previously reviewed literature such as the flow of finance, access to market (customers), capable human resources.
2. How are collaboration and ecosystems built to gain resilience to challenge social agendas? How can a conducive environment be created? What are the missing elements (complementarities) needed to allow transformation from the bottom up?

The hypothesized relationship between collaboration and risk-taking to enable transformation is shown in Figure 2.

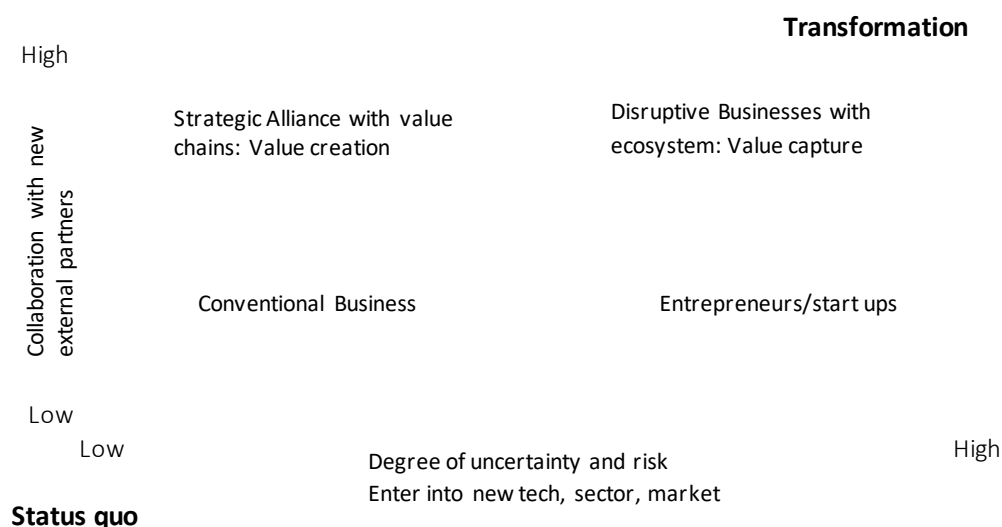


Figure 2 DII addressing transformation: how collaboration and risk taking relate to transformation

Source: authors

Enabling factors that we posit to be important for creating sound business models to challenge societal issues are: technology, finance, access to customers, capability (human resources), networks, and regulations and physical infrastructure.

By answering the abovementioned questions, we expect to contribute to 1) a better understanding of how innovators can successfully achieve DII, and 2) what policies or policy changes can enhance the benefits of these innovations and advance the transformations toward achieving the SDGs.

3.2.2 Methodology

This is an exploratory study to find out how emerging firms that address societal challenges run successful businesses. These cases not only address the societal agenda but also propose disruptive models with inclusive outcomes. Given these characteristics, it is sufficient to follow the case study approach, which enables us to illustrate the inner works of certain processes that take place in an exploratory manner (Eisenhardt, 1989; Yin, 2014).

The information to understand each case is obtained from both primary and secondary sources. The primary sources are interviews with CEOs as well as information obtained by the authors' participation in seminars and events. The secondary sources include books written by the CEOs, magazine articles on the CEOs and firms, newspaper articles, and website information on firms and their recent activities.

The cases are selected based on the following criteria: 1) it must be a new type business ("disruptive") (Christensen et al., 2006); 2) it must generate inclusive outcomes (Chataway et al., 2014; Heeks et al., 2014); and 3) it should concern technology and innovation (but not be limited to high technology).

4. Case studies

4.1 General overview

This study analyzed five cases that employ technologies and business models in unconventional ways and generate scalable social impacts. The businesses included are summarized in Table 3. The purpose of the case study comparison is not to focus on their differences but to observe their common enabling factors

Table 3 Case overviews¹⁴

Name	East Ventures	Samurai Incubate	Aavishkaar Capital	Nippon BioFuel/ ADM	Makuake
Activity	Venture capital	Incubation/Venture capital	Impact investment	Startup	Crowdfunding
HQ	Indonesia Singapore Japan	Japan	India	Japan/Mozambique	Japan
Year estab	2008	2009	2001	2000*/ 2012	2013
Activity take place in	Indonesia	Japan, Israel, East Africa, South Africa	India, South Asia, Southeast Asia, East and West Africa	Mozambique	Japan

Source: author. * The company was established in 2000 but operation in Mozambique from 2012 as ADM.

4.2 Assessment of each case based on enabling factors¹⁴

The general trends that emerge clearly as common features of all cases are as follows. First, building networks of actors in an ecosystem is important for business growth and for creating social impacts. It is evident that ecosystem creation is critical in means to overcome shortcomings of given physical infrastructure and legal institutions in emerging economies, where the operation takes place. While these constrains, in some cases, can work positively as stimulating conditions to nurture disruption. Second, adding on to the above, the examples demonstrate that ecosystem creation is important not only for creating value but also for capturing value and reducing risks, enabling space for experimentation. Third, focusing on social needs, unarticulated demand of the mass population, defines the purpose and targeted impact of a business. By focusing on the core needs of a large population, entities are addressing large markets. Fourth, the necessary ecosystem generates complementary businesses and activities, enhances follow on impacts. Lastly, these examples demonstrate the importance of a space that allows flexible experimentation in maneuvering innovations to different markets via expanding activities.

4.3. Case Summaries

4.3.1. East Ventures¹⁵

East Ventures is an Indonesian and Japanese VC firm established in 2009 whose origin goes back to Mixi, a Japanese ICT startup. East Ventures has three unicorns in its portfolio, two Indonesian, Tokopedia and Traveoka, and one Japanese, Merucari. It also

¹⁴ Information comes mainly from interviews listed in the appendix.

¹⁵ Unless otherwise stated, information used in this section comes from company website.

<https://east.vc/>

owned part of Grab as the result of a stock sale of their mobile based payment company Kudo to Grab in 2017 for US\$ 100 million. The VC firm raised US\$ 75 million in 2019 for its sixth fund. This firm notes that its mission is to “support the country’s growth with empowering local small-to-medium businesses and building the local ecosystem.”¹⁶ By September 2019, it had funded 300 founders, accelerated more than 160 startups, attracted US\$ 4 billion in follow-on funding from other investors, and claimed that its invested companies had contributed more than 1.5% of Indonesian GDP and empowered 8.5 million micro and small enterprises. This one VC has had a large impact on the economy.

As a forerunner of venture capital in Indonesia, East Ventures has access to a broad range of venture companies seeking investment. But when launching, they noticed that the ecosystem to foster venture growth was largely lacking. Companies had limited access to technology and trained personnel, poor connections to suppliers and customers, and little access to start-up or follow-on financing. In order to foster the business development of its invested companies, East Ventures created *keiretsu* portfolio strategy. That is, the VC selected companies that did not compete in the same space and then actively worked to create mutually beneficial alliances among these companies to fill ecosystem gaps. East Ventures also recruited other international venture investors to strengthen follow-on financing.

For example, East Ventures used this strategy to build a kiosk company, Warung Pintar. This effort started with an initial desire to assist an elderly lady who operated a very simple, traditional kiosk directly in front of the East Ventures office building. The company realized that if it worked with her to add services, particularly digital-based services, she could have a much more prosperous business and a more attractive store. If successful, it could also be replicated broadly as there were countless street vendors nationally. Working with its portfolio firms, East Ventures added numerous digital services, including digital payment, wifi, displays, security cameras, charging stations, and accounting and logistics support.

With the model established with this one vender, East Ventures went on to develop a service package that could be replicated with many other kiosks. They developed a packaged service option in which vendors could receive a prefab kiosk with all needed

¹⁶ East Ventures, “East Ventures Closed Oversubscribed Sixth Fund at \$75 Million,” August 22, 2019, East Ventures. <https://east.vc/east-ventures/east-ventures-sixth-fund-75-million/>

equipment for US\$ 5,000, with various services provided through East Venture’s portfolio companies. East Ventures effectively strengthened the competitiveness of the kiosk business and at the same time secured new customers for its portfolio companies, (Interview with Mr. Etoh, 2019; Russel, 2018, 2019). By mid-2019, Warung Pintar managed over 2,000 kiosks. This project continues to expand and is engaging other investors including Indonesian conglomerate Lippo, Digital Garage in Japan, Vertex in the US, and Yahoo co-founder Jerry Yang.



**Figure 3 Collaborative investment within Keiretsu:
example of Warung Pintar, smart kiosk**

Source: Russel, 2018

When the COVID-19 pandemic emerged, East Ventures responded by using its venture network and ecosystem development skills to launch the country’s first private initiative to develop test kits. The initiative, called Indonesia Pasti Bisa, “Indonesia Surely Can”, targets the development and production of 100,000 COVID-19 test kits. East Ventures’ newest portfolio company Nusantics, a deep tech start-up with advanced genomic expertise, leads the test kit development in cooperation with the government’s science and technology agency, the Technology Assessment and Application Agency (BPPT). BPPT led the government’s Technological Research and Innovation Task Force for COVID-19.

To support the ecosystem, East Ventures led the development of a 10 billion IDR (approximately US\$620,000) crowd funding site. Their fintech portfolio venture, KoinWorks manages the funding and provides accountability. Indonesian media company, IDN Media advertises the site and ensures transparency by publishing and timestamping donations.¹⁷ The campaign was successful in less than two weeks with contributions from 2,101 donors. By late-May 2020 the test kits were being produced and shipped across Indonesia with a production partner, state-owned pharmaceutical company Bio Farma.

4.3.2. Samurai Incubate

Samurai incubate was established in 2008 as an incubation program and soon thereafter established its own seed stage investment fund. It has been a successful forerunner as a combined incubator and VC in Japan, nurturing pre-seed stage ICT startups when this support was not well established in the private sector. Samurai Incubate expanded its activities to Israel in 2014 and subsequently to Africa in 2018. In both countries, it applied a similar model, incubating and making seed investments in local startups, including those launched by Japanese entrepreneurs operating in these countries. In Israel, Samurai Incubate is the first incubator-investor from Japan and it keeps its focus on high tech ventures. In Africa, Samurai Incubate started in 2018 and is already establishing its second fund in 2020. The focus countries include Kenya, Nigeria, South Africa, Uganda, Rwanda, and Ghana. The value of the first fund was US \$4.5 million and for the second, approximately US\$10 million. The investment per company is relatively small considering the early stage of startups. They prioritize projects that focus on solving societal problems with the innovative application of technology and business models.

As in the case of East Ventures in Indonesia, Samurai Incubate Africa found little existing ecosystem to support start-up businesses in Africa, so it also had to employ a concurrent ecosystem building strategy. Samurai Incubate grew up with the culture of an incubator and therefore targets hands on and very early engagement with companies to help their businesses. In this way, they can directly assist in an intensive manner with business plans, staffing decisions, building core and complementary assets, and finding customers. In the case of Africa, Samurai incubate found a strategic infrastructure value chain focus model to be more appropriate than pure incubation model.

¹⁷ Mulia, K., "East Ventures launches program to support R&D and production of 100,000 COVID-19 test kits in Indonesia," KrAsia, March 27, 2020.

Among the startups invested by Samurai Incubate Africa¹⁸, is MPost, a company that creates virtual addresses in the mobile sphere to deliver mail in Kenya. The majority of people do not have physical addresses for mail delivery in Kenya. Those who need the service usually rent postal boxes at the post office but these are sparsely located¹⁹ and in many cases, mail is either lost or delivered very late. MPost, by collaborating with the Postal Corporation of Kenya, Kenya Tellecom, and Safari.com, filled in the missing links of basic infrastructure to ensure the secure delivery of postal services.

MPost forms a part of the strategic infrastructure Samurai Incubate Africa is trying to establish with other investee companies. These companies are digital payment (Xento), mobile delivery services with motor bikes (Sendy), and e-commerce with distributed manufacturing (Fashpa). Samurai Incubate Africa is forming stepping stones covering manufacturing, payment to shipment for creating value chains for e-commerce. In other words, the company creates markets at the same time as fills in missing complementarities of services so that invested startups are sustainable. This collaborative network is a key to success in generating impact, especially in the context where there are scarce basic public services to meet the needs of potential users (Samurai Incubate, 2020; Leapfrog Africa, 2019).

Samurai Incubate is also addressing the demand side of venture innovation by partnering with Japanese corporation Daikin. Daikin is a leading manufacturer of air conditioners and in November 2019 they announced a Daikin-Samurai Africa Incubate Ideathon 2019 to introduce ventures to potential sales and partnership with Daikin. The purpose was to help start-up companies to expand their links to a downstream customer in the venture value chain.²⁰

4.3.3 The Aavishkaar Group²¹

The Aavishkaar Group is a pioneer social impact fund located in India. Aaviskaar, which means “invention” in Hindi, invests in social entrepreneurs with a vision to bridge the opportunity gap for the emerging 3 billion. It invests in projects that solve problems which are 1) worth solving; 2) affect everyone, not just privileged few; 3) take more than capital to solve; and 4) create solutions that offer a paradigm shift (Rai, presentation Nov. 2019).

¹⁸ Samurai Incubate Africa has been operating under the name, Leapfrog Africa from 2018 until 2019 and changed its company name to Samurai Incubate Africa.

¹⁹ For instance, there are only 622 post offices in the whole of Kenya whose land mass is 580367 km².

²⁰ <https://www.opportunitiesforafricans.com/daikin-samurai-incubate-africa-ideathon-2020/>

²¹ The information unless cited otherwise are from Aavishkaar websites and interview.

By supporting small steps in rural societies, the Aavishkaar Group has had a large-scale impact on the livelihood of millions.

The founder of Aavishkaar, Vineet Rai, began his journey with an idea and US\$100 to launch his first fund in 2001. He wanted to develop the entrepreneurial potential of rural India. Recognizing just providing finances was not enough, he borrowed US\$2,000 from his wife and in 2002 founded Intellectap, Intellectual Capital Advisory Services to provide know-how. His vision was to provide leadership in rural and underserved regions of India that would encourage aspiring entrepreneurs to launch businesses and to demonstrate to investors that profits and positive social change could be generated in the process. He identified the need for high quality “intellectual capital” to build an enabling ecosystem that would nurture young rural enterprises.

Rai also recognized that he had to employ a different model than the Silicon Valley model. He knew that even highly successful Indian rural businesses were not likely to generate the kind of accelerated, up-side growth found in Silicon Valley. Thus, whereas Silicon Valley investors targeted a few big “winners” and could tolerate an 80 to 90 percent disappointment rate, Aavishkaar would need more consistent success, with disappointment rates in the 30 to 40 percent range. He would achieve this by focusing on needs rather than wants, where success was driven mostly by execution rather than technology. Due diligence gave priority to business models that emphasized scalable social impact. Some of the successful investments include NAPRA waste treatment plant and Agrostar, a telephone-based distribution center for agricultural produce and supplies. Both closely deal with the local challenges. Once the prototype is made, the business models are extended to other cities in India²²

Aavishkaar would also engage in close interaction with all of his invested firms, with the help of partners in their networks. The COO, Pradeep Kumar, noted: “The most important factor is to keep the entrepreneur at the center of the universe. Putting together structures that work for them, rather than what would be best from a purely investment perspective, is the center of everything we do.”²³ Aavishkaar staff would typically spend days with companies in their often rural and isolated locations, working with the entire

²² For instance, NAPRA is now expanding to 25 cities in India. (information obtained from www.youtube.com/watch?v=eqQ_uXlMUuY)

²³ Brett, D., et.al., “Aavishkaar India Micro Venture Capital Fund,” The Impact Investor,” November 2013. https://www.pacificcommunityventures.org/wp-content/uploads/sites/6/2016/03/casestudy_aavishkaar_v6.pdf

team to provide strategic and business guidance. Pradeep noted that “we need to be hands-on, or else our model will not work.”²⁴

In this process, Aavishkaar realized that a key challenge for businesses that they established was in gaining further access to capital in order to grow. In addition to providing funding guidance, Aavishkaar evolved to create other financial organizations that would be able to finance companies. Aavishkaar evolved its own financial ecosystem to support the birth and growth of bottom-of-the-pyramid social impact ventures.

The original fund, Aavishkaar Capital is now a part of the larger The Aavishkaar Group²⁵, which consists of 3 others independent groups companies—Arohan, Ashvi, and Intelcap. Each offers different functions that are complementary in serving the company vision. Arohan engages in micro finance and gives credit lending services to microbusiness with loans ranging US\$ 100 to US\$ 1500. Ashvi invests in small to medium companies in India with entrepreneurial intentions, investment range from US\$3000 to US\$1.5 million. Aavishkaar Capital places investments ranging from US\$500,000 to US\$10 million. Intelcap deals with consultation and business advice. Each firm within the group is independent with siloed information walls, but all report to the same CEO, Vineet Rai, the founder of the Group.

At the end of its investment period in 2013, Aavishkaar India Micro Venture Capital Fund (AIMVCF) made several exits which, combined with the fair market value of the remaining portfolio, represented a gross IRR of over 20 percent and roughly 13 percent net IRR for its investors, in line with the fund’s target financial performance. By 2019, Aavishkaar Capital had over US\$1 billion under management, invested in 67 early-stage businesses with 36 of them successfully operated (collected investments) while generating 5500 jobs and US\$105 million profits. (Nikkei, 2019). The company estimates that it has helped to create 150,000 jobs and improved the lives of 70 million people.²⁶ Aavishkaar Capital now operates outside of India, in such South Asian countries as Sri Lanka and Bangladesh, and is starting investments in East and West Africa from 2020. However, challenges remain. As Aavishkaar receives its funds for investment from overseas investors, there are times when it cannot invest due to foreign

²⁴Above comments by Pradeep coincide with Vineet Rai (interview, 2019)

²⁵ The formation of Aavishkaar group had a structural change since Nov. 2019-March 2020. Interview, Sept, 10, 2020.

²⁶ Intelcap web page. <http://www.intelcap.com/group/> Accessed, July, 2020

capital restrictions. gain regulatory clearance. Regulatory reform is thus needed to support the maximal impact of the Aavishkaar impact investing approach.



Figure 4 Aavishkaar group ecosystems to capture value

Source: based on Aavishkaar group website and interview, Sept, 2020.

4.3.4 NBF/ADM

Nippon Bio-Fuel (NBF) is a startup established in 2000 with headquarters in Japan. Its experience reflects the example of a company that did not have needed ecosystem complementarities in its market, so it created its own micro-ecosystem through experimentation and scaling up. In 2012, NBF started a business based as a jetropha biodiesel-based energy provider to deliver electricity in rural Mozambique. NBF then established another company in Mozambique called ADM (Agro-Negócio para o Desenvolvimento) to serve the African market. After launching the business of providing electricity with jetropha, it started to distribute solar panels and other services via managing local kiosks in rural Mozambique. Later, in 2015 it introduced a near field communication (NFC) card as the payment systems for at their kiosks, entering into fintech activities and electronic-based information systems. Now it aims to develop digital platform to support agricultural cooperatives in Africa.

NBF/ADM is a startup firm that is highly adaptable to the environment to develop the complementary assets that it needs for success. NBF originally started off with the idea of generating electricity from biofuel of jetropha in areas with no electricity, but it had to overcome two problems: low efficiency of jetropha based bioenergy and use of bio

residues. To make this effort feasible, NBF joined efforts with other private firms and obtained research funds in 2008 to create proof of concepts of research from the Research Institute of Innovative Technology for the Earth, a semi-governmental research institution. After 2 years of development, they successfully found the methods of extraction which tripled productivity²⁷.

In 2011, NBF collaborated with three universities and received 6 years of funding to experiment with their proof of concept (POC) in Mozambique from a scheme financed by the Japan International Cooperation Agency and the Japan Science and Technology Agency called SATREP. In 2012, ADM was established and began working on combining the POC with a business model. At this time, NBF also found that solar panels for energy in these villages were economically feasible, and obtained funding from the New Energy and Industrial Technology Development Organization (NEDO), a governmental innovation funding organization, to experimentally implement an electrification project in Mozambique using biofuels and solar. This operation was successful but experienced difficulty in collecting all the payments in cash from users via kiosks where they buy jetropho from local farmers, and sell agricultural products and electricity services.

To improve collection of payments, ADM created its own e-money, working with Japanese electronic equipment manufacturer NEC and the Japan International Cooperation Agency (JICA). This payment system was based on near-field communications (NFC), a technology that was becoming more widespread in developed economies.²⁸ Introduction of e-money in the rural area of Mozambique went smoothly as it was just replacing the cash used in their business. The introduction not only solved the problem of payment collection but brought about positive externalities. The farmers started saving money on e-cards. This enabled both ADM and farmers to trace a leverage the money flow, allowing ADM to give out microcredit as farmers started to invest in improving their livelihood. In another words, financial inclusion became possible.

ADM conducted further pilot projects to replace cash with e-money for the Food and Agriculture Organization(FAO), the World Food Programs(WFP), and the World Bank

²⁷ Obtained patents for both efficiency of oil extraction and production of fertilizer (press releases, NBF, 20xx)

²⁸ Typically NFC is used in public transportation card in various countries in Europe, for instance.

between 2015-2018²⁹ This led to a project with the WFP to create a digital agriculture cooperatives platform via mobile phones in Mozambique.

Having succeeded in these projects, ADM jointly established a POC to extend this model into the Agriculture Innovation Platform with the Ministry of Agriculture, Forestry and Fishery of the Japanese government and participating private firms under the Africa Business Council's working group on agriculture (African Business council WG for Africa's Agriculture, 2019). ADM would use the experience in Mozambique in installing the platform to provide the E-Agri platform (see Figure 5). The blueprint of this platform was presented at the Tokyo International Conference on African Development (TICAD) in Yokohama, Japan, 2019 as the part of Yokohama Declaration in front of African government delegates and preparation for implementation is underway. The E-Agri Platform tries to create a digital market to match needs of both the demand and supply sides.

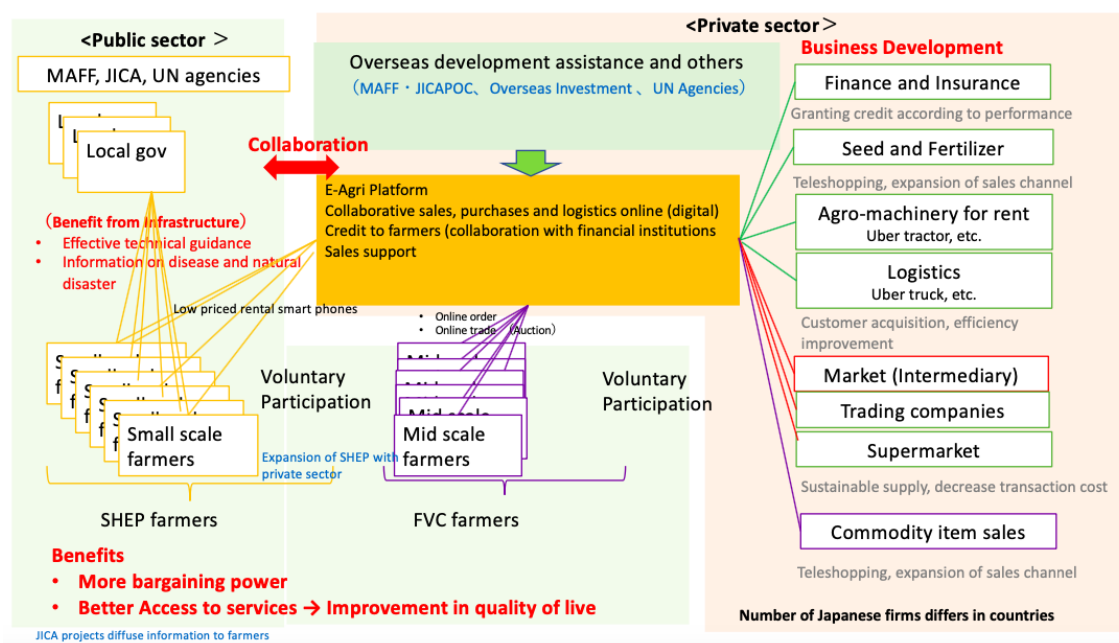


Figure 5 Agriculture innovation platform (plan)

Source: Africa business council (2019)

4.3.5 Makuake

²⁹ These consisted of replacing paper vouchers with electronic forms, replacing cash to the e-money. The e-money was also used for emergency aid.

Makuake³⁰ is an early crowdfunding firm and is the largest in the genre of project or product-based crowdfunding³¹. Established in Japan in 2013, Makuake helps emerging businesses and projects to raise funding through their crowdfunding platform. Makuake's unique approach is that it does not only provide a platform for raising money, but it offers two other platforms: 1) testing of POCs with active user feedback, and 2) fostering connections among supporting stakeholders for startups, including through active intermediation. This multi-sided platform approach is a powerful tool for entrepreneurs. Since the outset, Makuake encouraged the interaction between innovators and their customers so that the innovator can use the Makuake platform to improve the product at an early stage based on precious customer feedback. In addition, Makuake provides innovators the ability to form communities with other innovators and those with complementary skills. This enables the formation of teams that are both virtual and physical. The three faces of the Makuake platform – sales, market feedback, and team building - offer a new model to accelerate emerging innovations that link innovators with investors and markets. In its fiscal year 2019, the company had US\$54 million in sales and in December achieved an initial public offering on the Tokyo MOTHERS stock market.

Until 2015, equity purchases through crowdfunding were not allowed in Japan. Although this law has changed, Japanese consumers are not drawn to Makuake for equity opportunities but rather for an exchange with an innovator. Approximately 90% of cases involve peer to peer exchange rather than equity investment.

Makuake has a high-touch strategy for customer support. One reason is because the products and services offered on their platform are typically new. Therefore, ensuring the reliability of the system is essential to maintain consumer confidence and protect against scams. In curation, approximately 50% are accepted, 20% have to brush up, 30% are rejected.³² Makuake has about 200 projects running at any one time and about half are able to achieve their fundraising goal. Approximately 30% of investors are also users of Makuake. Thus, they are part of the ecosystem that brings ongoing support to innovators. The other 70% of users are from the outside, therefore targeted promotion leveraging media is essential. In Makuake's case, their majority shareholder, Cybergent,

³⁰ Makuake recently became public via IPO (Mothers)³⁰. Mothers is one of Tokyo Stock Exchange's section where shares of start up companies are listed and traded. Mothers was established in November 1999 in Tokyo Stock Exchange in Japan in December 2019. It generated JPY 5.4 billion (approx. US\$ 54 million) in sales in September 2019, growing 2.5 times in 2 years ³⁰

³¹ There are different types of crowdfunding genre depending on function.

³² <https://www.disruptingjapan.com/crowdfunding-in-japan-is-not-about-startups-ryotaro-nakayama/>

is a major digital advertiser, offering a capability in Makuake's ecosystem that proved essential to its success.

This platform enables companies to easily launch test marketing of their products and to make improvements before scale up. By showing demand in the market, the companies are then in a stronger position to go on to receive financing from banks and professional investors. By the nature of crowd financing, the products are typically accessible to the general public and most innovators are pursuing small scale solutions to what could be large scale opportunities. The reactions from crowdfunders are valuable, particularly for regional banks to evaluate the investment proposals from small and medium enterprises. Innovators in large corporations also find this to be a highly valuable way to validate their products. Market validation through Makuake supports large company innovators who must often follow conservative, gated decision-making processes.

An interesting feature of the business is that it can accumulate a broad spectrum of business partners from its pool of clients to improve the curating process for the next client. For instance, over the years of collaboration with regional banks in evaluating projects, Makuake can leverage information accumulated in the banks to address their client needs (e.g. providing access to good small lot manufacturers). In this way, Makuake is able to serve as a unique business intermediary. With the decentralization of production and diversifying consumers' needs, Makuake has positioned itself in the advantageous intersection where players that are regional and global, large and small, meet through extended networks.

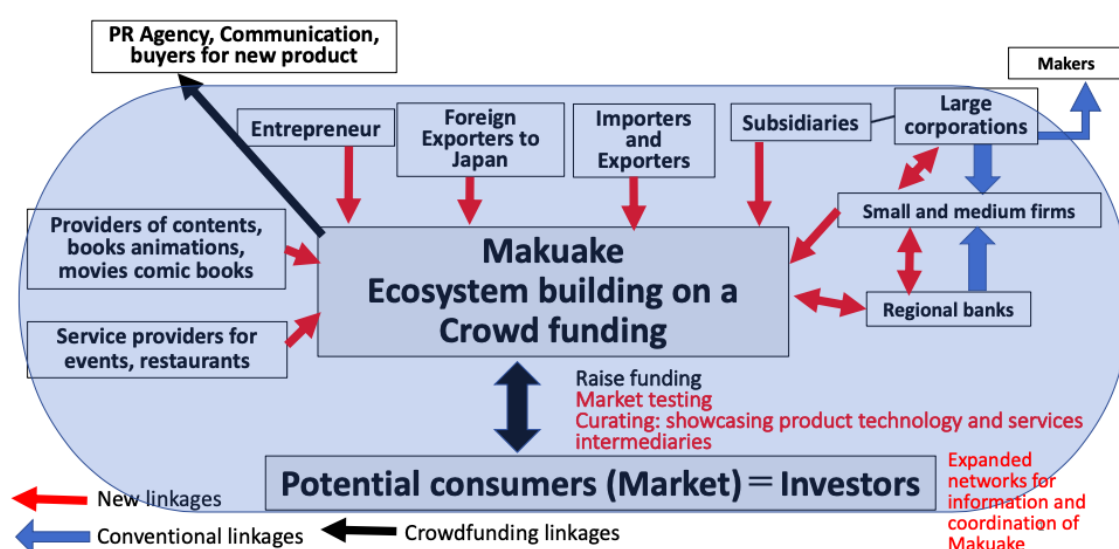


Figure 6 Makuake's extended networks

Source: authors, based on interview and Nakayama (2017)

4.4. Ecosystem and cross-cutting factors

By selection, all the cases introduced in the previous section share the following common characteristics: 1) represents a new type of business; (disruptive); 2) generates inclusive outcome/impacts; and 3) involves technology and innovation (not limited to high tech). The purpose of this research is to uncover the key factors enabling success and to identify common threads. One such common factor is the creation of ecosystems tailored to their business models and the environment for innovation. The findings obtained are intended to contribute to the design of public policies that would support achievement of the SDGs, leveraging private and public collaboration.

Developing the appropriate ecosystem design is a valuable lever in gaining societal impact from the innovation and sustaining business. The ecosystems of cases reviewed here include the venture keiretsu ecosystem of East Ventures, the value chain of the seed venture ecosystem of Samurai Incubate, the internal impact financial ecosystem of The Avishkaar Group, the adaptive micro-ecosystem of Nippon Bio-Diesel, and the virtual multistakeholder ecosystem created by Makuake. Each type of ecosystem was tailored to bring in complementary assets that were critical to bringing successful change and impacts.

The purposeful keiretsu ecosystem design of East Ventures provides active business links between portfolio companies and is a valuable way to strengthen early business growth. Examining Warung Pintar, the smart kiosk business, it can be seen that the East Venture keiretsu provided an enhanced business model, additional technology, staff expertise, new market access, a network of business partners, and financing. Also, targeting kiosks created new market channels with broader social impact that helped the business of the keiretsu partners. East Ventures' ability to act as a group with social impact was well demonstrated in the early phase of Covid-19 pandemic in Indonesia. The East Ventures group managed to raise financing, generate testing kits, and deliver them to the people, working jointly with the government.

Samurai Incubate, with its genesis as a successful incubator and seed investor in Japan, typically engages at the earliest stage of seed company assistance and builds the

ecosystem through hands-on assistance from the incubator. At the earliest stages they engage in business plan development, technology planning, network development and defining customer recruitments. In the case of Africa, Samurai Incubate Africa found it a faster launch strategy to first assist emerging venture companies that needed help. Using the same hands-on approach to building the companies, Samurai Incubate Africa selected a series of startups to generate a chain of activities that were complementary modules in ecosystems. In the absence of an existing complementary businesses, this investment strategy created its own value chain of activity to support their synergic development. Here, digital technologies were leveraged for their synergies.

Aavishkaar created an Impact Financing Ecosystem that enables it to support its invested companies at different stages of company growth, and by adding complementary functions via its ecosystem. Leveraging the internet to facilitate the investment process, Aavishkaar could overcome adverse conditions and scale-up to enhance impact. Their work goes well beyond financing for a project, and includes enhancing the cashless infrastructure, managerial capacity building, and fostering better business environments for would-be entrepreneurs. As a consequence, Aavishkaar created its own end-to-end financial ecosystem to promote these businesses. They provide business advice and capital that helps companies to launch, and further support those companies to gain market expansion and grow. Aavishkaar's ecosystem has made it a leading impact investor in the world.

Nippon Bio-Fuel (NBF) built its own adaptive micro-ecosystem reflexively through meeting the challenges on the ground and pave new pathways to business opportunities. Seeing the irregularity of bookkeeping at kiosks, where the payments for their services are collected, NBF introduced its own cashless payment system with the help of partners, NEC and JICA. NBF soon discovered that their cash cards became important savings instruments for the local population. This has led to a new business opportunity in micro financing for financial inclusion. First, to validate that this idea, NBF used external project opportunities. NBF introduced a cashless payment system with the backing of the Food and Agriculture Organization and the World Food Program to establish the proof of concept. This had led to the experimental project on digital cooperatives in Mozambique financed by WFP. Based on these learnings, they developed an idea for a platform business that could be incorporated with additional ecosystem partners, the Ministry of Agriculture, Forestry and Fisheries of Japan and the African Business Council, to promote a central platform for connecting suppliers and customers under an E-Agri

Platform. (African Business council WG for Africa's Agriculture, 2019). Although more exploration and experimentation need to take place, through ecosystem building NBF/ADM is now engaging in a platform business that has broad impact. This case demonstrates a highly adaptive ecosystem involving various stakeholders to advance a new purpose.

Makuake is using its internet platform to offer a multi-sided, multi-stakeholder ecosystem for product acceleration. From its crowd funding financing base, their platform connects innovators to early adopters who will provide feedback on the offering and how it can be improved. By increasingly involving former clients as part of its ecosystem, it has expanded the role of market mediation in its platform. The platform connects a broad set of actors that can provide valuable services and products to the company's new clients. It is a test bed and place for iterative improvement. An interesting feature of Makuake is that its clients can become part of network for the curation of the evolution of a project. The platform also enables partnerships with individuals or companies that can bring complementary skills. In addition, Makuake's service is not limited to startups. Increasingly, large corporations have begun to use the potential of this space to market test prototypes and to validate markets for new technologies.

Building an innovation ecosystem is an important strategic choice for business development as a valuable way to generate growth and impact, and to ensure that an organization can achieve its social mission. Ecosystems can strengthen the value generated from networks, enlarge financial streams, and improve market access. Ecosystems also facilitate the innovation process itself by enabling testing and iteration with partners and clients, filling gaps, and expanding an innovation's appeal and utility. Ecosystems thus have the ability to enhance adaptability to mass customization, and cater to local diverse needs. Such ecosystems accompany various complementarities that are essential as companies seek to exercise technology with broader societal impact.

Table.4 Ecosystem factors tapped by cases

	East Ventures	Samurai Incubate Africa	Aavishkaar Capital	NBF/ADM	Makuake
Activity	Venture capital	Venture capital	Impact investment	Start up	Crowdfunding
Ecosystem Type	Keiretsu network of investee	Value chain of invested seed venture	Internal impact financial ecosystem	Adaptive micro ecosystem	Virtual multistakeholder ecosystem
Social Challenges (aims) mentioned	Support the country's growth via empowering local small to medium business and building the local ecosystem	Solving societal problems with the innovative application of technology and business models	Solving social challenges through creating broad impacts	Providing BOP communities with equal access to energy and a financial service	Providing market channels and market experimentation opportunities all types of producers/creators
Technology applied	Synergies among different services based on digital technologies	Digital technology, (Mobile and ICTs) synergies	Digital financial synergies	Renewable energy and digital money synergies	Multi-sided platform enabling crowdfunding, market feedback, and collaboration
Business Model	Keiretsu model	Value-chain model	Financial value-chain model	Adaptive and gap filling	Crowdfunding and community building
Finance	VC syndication	VC syndication	External funders/ Impact fund/ microfinance	Combining private investment, government aid, and grants	Crowd funding
Network established	Within group	Within group	Within group	Partnership with diverse actors	Partnership with diverse actors
Access to Customers	Leverage portfolio	Leverage portfolio	Investor, internal networks, and scale up of investee	Expanded through broadened ecosystem and platform	Multi-sided platform access
Human Resources	Leverage returnees	Leverage VC training	Leverage internal networks	Leverage local and provide trainings	Leverage platform network
Regulations or counter measures taken	Collective power for change	Regulatory sandbox in the new market	International presence for financial regulatory management	Regulatory sandbox in the new market	Financial regulation existed on equity investment; regulatory testing
Outcome of Ecosystem/ Sources of resilience	New network to experiment and expand to new businesses within Keiretsu	Value chains to mutually capture the synergies to enhance the business as a whole	Accommodate diverse scale of needs for their services	Expanding their business and diversifying into new fields	Expanding their business and social impacts, especially for SMEs in the regions

Source: based on Authors

Table 4 above reveals the ecosystem elements accessed by the different cases discussed here. Leveraging different ecosystem strategies, the investors and venture companies were able to enhance such cross-cutting enabling factors as technology, networks, finance, access to customers, human resources and regulations by leveraging the power of tailored ecosystems in order to deliver social impact.

4.5. Regulations

Finally, there is the role of managing regulations. Regulations can have a major impact on company organization and markets. Aavishkaar needed to deal with foreign investment regulation to enable with financing for impact fund. In Indonesia, similar domestic control regulations were initially applied to e-commerce companies, which forced the most promising early companies to locate their headquarters abroad. This is not limited to developing countries. Makuake also needed to deal with regulations limiting equity investment. In other commonly regulated sectors such as health, environment, energy, nutrition, safety, etc., adapting regulations to new innovations is often a challenge.

On the other hand, a more permissive regulatory environment can be the one of the reasons for seeking business launch elsewhere in order to explore and experiment with new products and services. It is possible to experiment with new technology and business models prior to implementation in other developed markets that can have more stringent rules (regulatory arbitration); making the new market a regulatory sandbox. Regulations affecting drone use, for example, differ between countries and some areas of Africa have become important innovation test beds for drone business models. Samurai Incubate Africa, for example, invests in digitally-based new businesses in emerging new business environment with few regulatory hurdles.³³ NBF/ADM was able to quickly acquire a microfinance license to operate in Mozambique even though the concept was new to the economy.

5. Discussion

The study demonstrated that successful cases have certain unique features with regard to combining factors to increase impact and capture the value from the networks created to mitigate risks associated with the business. Although all cases address social challenges, they are in different businesses: venture capital, incubation, impact investing, crowdfunding and startup. All cases demonstrated that building an ecosystem is a strategic choice not only for business development and gapping weaknesses but also for ensuring the organization's social missions and scale-up of their impacts. These ecosystems are intended to maximize the value generated from networks, enlarge financial streams, and improve market access via better adaptability to mass

³³ For example, Rwanda's government has sandbox for digital technology.

customization (catering to local diverse needs) that have emerged as a result of meeting unsatisfied needs for clients by enabling access to the full package of lacking services: finance, infrastructure, trusting partners, and technology. Such ecosystems enable broader society impact.

This study, based on cases, identified two streams of trends in the formation of ecosystems to enhance impacts: one is internal consolidation to create mechanisms for scaling up; another is to extend external collaborative networks to scale up or engage in new activities. For instance, East Ventures consolidates their investee firms to jointly experiment between new businesses to scale up and expand their activities while at the same time strengthen extant activity. Samurai Incubate Africa generates strategic choices for their investing firms to establish complementary value chains of activities. All of these increase impact by consolidating internal bases, filling gaps in local infrastructure and experimenting with synergistic investing to generate POCs prior to collective scale up. The Aavishkaar Group creates internal companies to broaden customer coverage and create an efficient system for problem solving projects and the scaling-up successful ones.

NBF/ADM and Makuake have slightly different strategies. NBF/ADM increasingly expands external networks to form a platform. Makuake, uses their virtual platform to engage new partners and participate in new activities through crowdfunding. NBF/ADM entered into their digital platform through e-money as well as digital cooperatives. Both firms pave their pathways with multiple and iterative experimentation with external collaborators. This provides space to simultaneous experimentation and expand to new activities.

The Figure 7 illustrates different ecosystem strategies by types of collaboration in a 2x2 matrix. This locates East Venture, The Aavishkaar Group, Samurai incubate Africa in the lower left quadrant as these collaborate internally to scale up their activities. Both Makuake and NBF locate in the upper right quadrant as these collaborate externally to expand their activity. The lower left quadrant includes venture capital investors acting in emerging countries while upper right quadrant includes platform based activities.

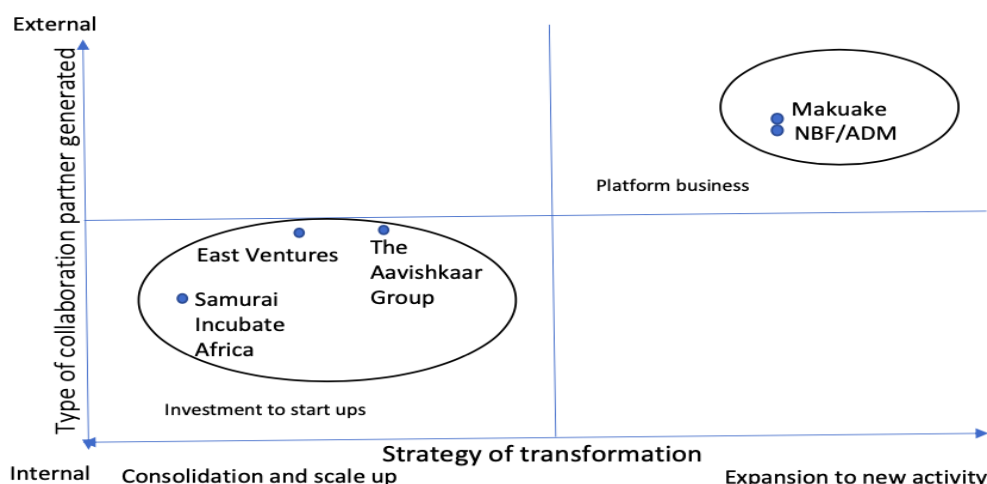


Figure 7: Types of ecosystems: Scaling up business model vs Expansion business model

Source: Authors

6. Conclusion

To achieve the SDGs, the transformation of sociotechnical systems is needed (TWI2030, 2020; Schot and Steinmeuller, 2018). Although efforts to create roadmaps toward the SDGs are in progress, it has become evident that there are still no clear and effective policy mechanisms to generate transformations. Thus, fresh perspectives are needed for innovations in policy, society, business, and knowledge generation aiming at unifying goals for 2030. In order to contribute to the discussion of options, this study reviewed several cases of emerging businesses that are working to advance toward the SDGs in leaps, and that are inclusive of all levels of an economy. We called these examples “Disruptive Inclusive Innovation (DII) cases”. The findings reflected key factors identified in the literature and were intended to help us to identify generic and pragmatic suggestions that would contribute to the roadmaps for STI to achieve the SDGs.

These case studies from the business domain demonstrated that the innovation ecosystems and complementary are important factors for competitiveness in providing better or critical products and services as well as generating impacts. This is consistent with the work of Adner and Kapoor (Adner, 2016; Adner and Kapoor, 2010). This is also critical for capturing the value generated, which is consistent with the observations of Teece (Teece, 2018). The case studies identified two approaches in ecosystem building: consolidating internal networks prior to scaling up their activities and multiplying external

partners to strengthen platforms prior to engaging in new activities. Both approaches are aimed to increase impacts, reduce risk and accommodate diverse needs so that no one is left behind. The choices of strategies are influenced by context and point to the importance of conducive environments to carry out and support successful innovation. Hence, ecosystems built around the new activity can generate disruption and provide new services and products to underserved. The very creation of the ecosystem by an emerging business provides signals of what is missing.

With this understanding, it is possible to identify potential areas for public policy to take active role to fill ecosystem gaps. First there is a need for policy that supports business with positive social goals at the early stage of business development, especially to accelerate the impact, these should comprise a system of synergistic incentives, assets and capabilities. This can be strengthened by targeting multi-stakeholder collaborative mechanisms. Second is the need for supporting innovative financing. Although impact funds and BOP accessible funds are increasing with the aid such new financing modes including crowd funding and microfinances, effective regulations still emerge as a challenge. Policies need to promote fund access rather than stay buried in outdated capital controls, while at the same time ensuring transparency of management. Third, policy should encourage opportunities to experiment with proof of concepts, prototypes, and market testing through the support of innovation and regulatory sandboxes, both physical and virtual. This experimentation of new technology and business models would also inform regulatory change for innovation. Finally, there should be support for capacity building not only for new technology and business models, but also for innovative (blended) financing, agile governance, and reflexive policy making in order to enhance the human base for innovative capability. These policy themes would support the transformation of systems yielding positive impacts.

The cases reviewed in this study illustrate private sectors' roles of pioneering high impact disruptive innovation. By advancing collaboration with these private actors, the public sector would play active role in ensuring science and technologies developed can fully serve the society. This paper is limited to few observations of progressive cases and further research is needed for designing effective policy instruments to promote disruptive and inclusive innovation.

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Information used for companies

Makuake

Web page <https://www.makuake.com/>

Samurai Incubate

Presentation Materials

Website <https://www.samurai-incubate.asia/>

East Ventures

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Appendix

List of interviews conducted

	Organization	Title	Name of Interviewee	Date of interview
	Makuake	CEO, Founder	Mr. Ryotaro Nakayama	April 8, 2019
	Samurai Incubate	CEO, Founder	Mr. Kentaro Sakakibara	April 11, 2019
	East Ventures	CEO, Founder	Mr. Batera Etoh	August 5, 2019
	Aavishkaar Capital	CEO, Founder	Mr. Veneet Rai	November 8, 2019
	Aavishkaar Capital	Advisor	Mr. Hashimoto, Yoshiki	September, 10, 2020
	NBF/ADM	CEO, Founder	Mr. Makoto Goda	February 27, 2020

Source: author



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