CHAPTER 4

LEVERAGING NEW TECHNOLOGIES FOR YOUTH SOCIAL ENTREPRENEURSHIP

INTRODUCTION

The global youth NEET rate has changed very little over the past 10-15 years. According to the most recent data available, almost 185 million young people — around 30 per cent of young women and 13 per cent of young men, accounting for 22.2 per cent of the total youth population — are not in employment, education or training. NEET youth, the vast majority of which live in developing countries, represent enormous untapped potential for economic development and, more specifically, for the achievement of the 2030 Agenda.

The evidence is clear: traditional job creation will not be enough to resolve the youth unemployment crisis. The private sector can play a critical role in helping to address this crisis, especially as most of the world youth population lives in developing countries, where SMEs account for the largest share of job creation. Young people who have the opportunity to create their own employment while also tackling challenges faced by their communities can realize their full potential and become agents of sustainable development.

CHAPTER

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The integration of new, emerging and frontier technologies in youth social entrepreneurship creates opportunities to disseminate and scale up technological solutions that will contribute to the global welfare, leverage the full potential of youth, and counter the decline in entrepreneurial dynamics associated with the ageing of the global population. The purpose of this chapter is to determine how best to achieve this. The chapter explores the enabling potential of technology within the entrepreneurship ecosystem, with particular attention given to one of its more recent additions — the impact start-up accelerator. The suitability of this intervention for supporting youth social entrepreneurship is analysed, and suggestions are offered for adaptation and fine-tuning in the areas of education, finance, technical support, networking and market-building.

There is enormous potential for both youth development and social good in the fusion of frontier technologies and social entrepreneurship. Young social entrepreneurs can use evolving technologies to address systemic social challenges — for example, facilitating access to educational and health services, supporting efforts to address complex problems arising from urbanization, or helping communities adapt to climate change — while also building critical ICT skills that will allow them to thrive in a digital world.

4.1 NEW TECHNOLOGIES AND INEQUALITIES

A number of new and emerging technologies have the potential to contribute significantly to efforts aimed at

Photo : ILO / Marcel Crozet

Technologies can help accelerate the implementation of the 2030 Agenda if harnessed for the benefit of humanity.

addressing societal needs and challenges in every country, regardless of development level.[17] Among these technologies are artificial intelligence (AI), advanced materials, cloud technology (including big data), autonomous vehicles (including drones), synthetic biology, virtual and augmented reality, robotics, blockchain, 3D printing and the Internet of Things (IoT) (see Combes and others, 2017, p. 5). These technologies may form the basis of innovations that can help accelerate the implementation of the 2030 Agenda if harnessed for the benefit of humanity.

Frontier technologies are driving structural transformations in societies and economies around the world through digitization and automation processes. As young people are generally among the earliest adopters of trending technologies, they are poised to take advantage of innovations in this area to drive the impact of social entrepreneurship. At the same time, they will be disproportionately affected by negative outcomes associated with technology products that are used primarily by young people.

Many young people are considered "digital natives" by virtue of their age and early experience with technology. However, this term does not apply to substantial numbers of youth in developing countries, especially in the global South, as these young people still lack digital access and digital literacy (Palfrey and Gasser, 2008). The increased focus on new technologies driven by the advent of the Fourth Industrial Revolution should not obscure the fundamental goal of providing universal Internet access — an essential step towards narrowing the digital divide (Sambuli and Magnoli, 2019). The digital divide disproportionately affects women and young people in developing countries. Of all those without Internet access, 2 billion are women, and 9 out of 10 youth who lack access live in Africa or in Asia and the Pacific (ITU, 2017). Access to mobile phones can also be crucial for the development of a digital economy, but infrastructure costs are high in remote areas, contributing to the rural-urban digital divide and exacerbating inequalities in both Internet and cellular phone use (Cruz-Jesus, Oliveira and Bacao, 2018). This gap is critical in the present context, as those without digital access or digital literacy are effectively prevented from participating in digital entrepreneurship, defined here as "the process of creating a new — or novel — Internet enabled/delivered business, product or service. This definition includes … start-ups — bringing a new digital product or service to market — but also the digital transformation of an existing business activity inside a firm or the public sector" (van Welsum, 2016, p. 1).

The rapid development and diffusion of emerging and frontier technologies have the potential to further exacerbate the digital divide and other inequalities. It is therefore even more crucial that policy action be taken to achieve universal and equitable digital access, as the risk of being left behind is growing ever greater (Sambuli and Magnoli, 2019). Providing Internet access generates new opportunities for young people; the development of more complex digital skills expands those opportunities. As a side note, Governments developing digital access policies should focus not only on expanding connectivity, but also on anticipating and addressing the potential negative effects of new technologies (including its disproportionate impact on lower-skill workers and the risks it poses to the privacy and mental well-being of young people).

The 2030 Agenda acknowledges that technology is crucial to the achievement of sustainable inclusive development. Target 9.c of Sustainable Development Goal 9 (Industry, Innovation and Infrastructure) urges

17 The key characteristic of the Fourth Industrial Revolution is digital connectivity. The world is more connected than ever before, and global technology flows (international technology transfers) have accelerated. Developed and developing countries all over the world are affected, and many (regardless of development level) are jumping on the digital bandwagon; for example, China has become a world leader in artificial intelligence, Kenya is leading the fintech revolution, and South Africa is home to the world's largest 3D printer.

Governments "to significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020". Unfortunately, progress has been slow; statistics for 2018 indicate that global Internet user penetration stands at 51 per cent, with rates of 45 per cent for developing countries and 20 per cent for least developed countries (ITU and UNESCO, 2019).

4.2 NEW TECHNOLOGIES AND THE SUSTAINABLE DEVELOPMENT GOALS

How can young social entrepreneurs leverage new technologies in the service of sustainable development? How can the disadvantages youth face as entrepreneurs be neutralized or overcome through technology-infused social entrepreneurship? One answer to both questions is that entrepreneurship ecosystems must provide the appropriate support, with full account taken of the needs, characteristics, constraints and ambitions of young social entrepreneurs.

Institutional models of entrepreneurship support have been characterized by growing diversity over the past couple of decades. One innovative support mechanism is the start-up accelerator, which became a worldwide phenomenon following the establishment of Y-Combinator (the world's first start-up accelerator) in 2005. Although the model has proven successful, much remains to be done to ensure that it is appropriately adapted to youth, social entrepreneurship, and the needs of those in the global South.

Start-up accelerators are explored within the broader context of this chapter, which relates to the need for entrepreneurship ecosystems to support youth social entrepreneurship in a manner that leverages technology and promotes or facilitates digital access for all. In this chapter the term "technology" refers to the "rules and ideas that direct the way goods and services are produced" (Kemeny, 2010, p. 1,544), so technological inventions are essentially new rules and ideas influencing what goods and services to produce and how to produce them. Technological inventions become technological innovations when these new rules and ideas find practical use through commercialization by entrepreneurs or existing businesses. Innovation is therefore the extraction of economic value from novel activities (ASTRA, 2007). The term "frontier technology" effectively ties these concepts together; it is defined by one software developer as "the next phase in the evolution of modern technology: ... the intersection where radical forward thinking and real-world implementation meet" (Gensuite, 2020).

The next section of this chapter deals with the new, emerging and frontier technologies of the Fourth Industrial Revolution.[18] These technologies have the potential to improve human welfare but can also pose risks and introduce new threats; this is true for countries at all levels of development. The more widespread adoption of digital technology and the expansion of digital literacy will contribute to increased youth mobilization and youth agency across the world. The answer to the question of how to support young social entrepreneurs

18 The terms "new technologies", "emerging technologies" and "frontier technologies" are often used interchangeably, even in the present *Report*, as there are no universal definitions that conclusively establish where these concepts converge or diverge. There are arguably differences that may or may not be significant in certain contexts; for example, emerging technologies are generally defined as those whose development or applications are still largely unrealized, while frontier technologies are usually regarded as those that have completed the research and development phase and are in the process of entering the market but may not yet have been broadly marketed or adopted by the mainstream.

in identifying, adopting, adapting and commercializing appropriate new technologies for local community development without further widening the digital divide lies in entrepreneurship ecosystem design.

4.3 OPPORTUNITIES FOR YOUNG SOCIAL ENTREPRENEURS

Rapidly evolving digital technologies are already having a huge impact on societies and economies. The tools they offer can produce wide-ranging outcomes depending on how they are used; in the present context, such tools can be used to support or undermine efforts to achieve the Sustainable Development Goals. Brynjolfsson and McAfee (2016) refer to the present period as the "second machine age", arguing that the hugely transformative impact of these technologies can only be compared with that of the "first machine age" (the Industrial Revolution). The Industrial Revolution, which marked the transition to new manufacturing processes in Europe and the United States during the period 1760-1840, was made possible by technologies such as the steam engine, textile milling tools (including the flying shuttle, Spinning Jenny and cotton gin), the electric telegraph, gas lighting, and locomotives and railways (see McFadden, 2018).

In this second machine age, new and emerging technologies both drive and reflect the fusion of physical and digital production and consumption. The convergence of advances in AI, IoT, advanced materials, digital platforms, robotics, big data analytics, the Interface of Things, and other such technologies has created a world of new possibilities, and innovators have already tapped into these technologies to develop solutions such as mass customization through 3D printing (additive manufacturing), production-as-a-service through digitization, and new operational frameworks such as the sharing-economy and on-demand-economy business models. Reductions in the costs of computing power, data storage and bandwidth are facilitating this convergence (Deloitte, Council on Competitiveness and Singularity University, 2018). The second machine age is sometimes referred to as the New Industrial Revolution (Marsh, 2012), the Fourth Industrial Revolution (Schwab, 2016), or Industry 4.0.[19] As observed by Klaus Schwab, this most recent industrial revolution is "disrupting almost every industry in every country, … [leading to] the transformation of entire systems of production, management and governance" (ibid.).

The newest industrial revolution is different from previous industrial revolutions in that the speed of change is exponential rather than linear (Deloitte, Council on Competitiveness and Singularity University, 2018). Exponential technologies "enable change at a rapidly accelerating, nonlinear pace facilitated by substantial progress (and cost reduction) in areas such as computing power, bandwidth, and data storage" (ibid., p. 5). The exponential growth in computing performance and the significant decline in computing costs are enabling the development of other technologies such as AI, additive manufacturing and bioengineering. The disruption of manufacturing and technology derives not from individual technologies but from the process of convergence, which has accelerated over the past 10-15 years (Friedman, 2016).

Disruptive innovations are those that revolutionize how products are made or services are offered. **Table 3** highlights the most important of the new technologies that are disrupting manufacturing and service provision. Typical of the impact of these technologies is making things better, cheaper and more accessible (ibid.). The many virtually free functions on most smartphones

19 The Second Industrial Revolution (around the turn of the twentieth century) was characterized by the application of science to mass production; the Third Industrial Revolution (in the mid-twentieth century) marked the beginning of digitization.

— such as GPS, text and image messaging, information access, video recording and playback, videoconferencing and massive processing power — constitute one familiar example. It has been estimated that owning all of this technology in 1985 would have cost an individual at least $32 million.[20] Because these technologies and their applications are making manufacturing easier and more accessible, there is greater scope for developing countries to become more involved in manufacturing — in a way that is more localized and thus more sustainable and that contributes to a reduction in long global value chains. It should be noted that situating manufacturing closer to destination markets through automation may have negative consequences for developing countries that benefit from traditional global value chains, given that the individual links in these chains generate investment and employment.

20 See *https://www.webpagefx.com/data/how-much-did-the-stuff-on-your-smartphone-cost-30-years-ago/*.

TABLE 3. MOST IMPORTANT NEW TECHNOLOGIES AND THEIR APPLICATIONS

TECHNOLOGY	DESCRIPTION AND ROLE	CURRENT AND POTENTIAL FUTURE APPLICATIONS
(Industrial) Internet of Things	A system of devices, networks, software platforms and applications that makes it possible for sensors on physical "smart" objects to generate data on the objects and their environment that "are then fed back to improve decision-making in the operational or production process" (ECLAC, 2018, p. 25).	Optimization of production, predictive maintenance, the "servicification" of manufacturing, tracking products, automated flows, servitization, and customized production. By 2017, around 8.4 billion objects were connected to the IoT (ECLAC, 2018, p. 25).
Digital platforms	"A technology-enabled business model that creates value by facilitating exchanges between two or more independent groups" (Accenture, 2016, p. 8). Digital platforms "are built on a shared and interoperable infrastructure, fuelled by data and characterized by multi-stakeholder interactions" (ECLAC, 2018, p. 61).	Online and digital trade, software-as-a-service, infrastructure-as-a-service, the on-demand economy, collaborative manufacturing and manufacturing design, customization, recruitment, and financing (ECLAC, 2018).
Biomanufac-turing	"A type of manufacturing or biotechnology that utilizes biological systems to produce commercially important biomaterials and biomolecules for use in medicines, food and beverage processing, and industrial applications" (Labroots, 2020).	Pharmaceuticals, renewable oils, clothing and textiles, synthetic flavourings for food and beverages, green bioplastics, and cellular agriculture (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 38).

continues

Table 3 continued

Advanced materials	"Chemicals and materials like lightweight, high-strength metals and high-performance alloys, advanced ceramics and composites, critical materials, bio-based polymers, and nanomaterials" (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 32).	Automotive and aviation manufacturing, sporting goods, wind turbine generators and batteries, building materials (such as coatings) and displays (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 32)
Robotics	"Machines or systems capable of accepting high-level mission-oriented commands … and performing complex tasks in a semi-structured environment with minimal human intervention" (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 34)	Product assembly, packaging, welding, fabrication, painting, mixing, loading, unloading, testing and inspection; use with drones for intelligence gathering, monitoring, inspection, and chemical detection (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 34)
Artificial intelligence	The theory and development of computer systems able to perform tasks that normally require human intelligence" (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 36).	Predictive maintenance, computer vision (for quality assurance), automated driving, and personalizing consumption (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 36).
3D printing	"An additive process of building objects, layer upon layer, from 3D model data" (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 28).	Automotive and aviation design, dental printing and medical implants (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 28).
Blockchain	Digital technology that allows data to be structured and distributed "without the need for a centralized authority", with the data recorded and transmitted to this technology "believed to be immutable, safe, secure, and tamper-proof" (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 40).	Product tracking and verification, performance reviews of suppliers, and fraud reduction (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 40).
Interface of Things	Includes virtual reality, augmented reality, mixed reality, and "wearables and gesture recognition technology that enables humans to communicate and interact with a machine" (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 50).	Virtual assembly manuals for factories, virtual design of factories and products, quality checks, instruction and training for manufacturing, and remote assistance (Deloitte, Council on Competitiveness and Singularity University, 2018, p. 50).

Sources: Excerpted or drawn from Naudé, Surdej and Cameron (2019), table 10.1; Naudé (2018); ECLAC (2018); Accenture (2016); Labroots (2020); and Deloitte, Council on Competitiveness and Singularity University (2018).

Some of the ways these new technologies are changing the face of production and consumption are through the reduced use and optimization of physical products and assets and through the development of non-material solutions. Manufacturers can keep less stock, products use fewer physical inputs and last longer, and the potential exists for resource sharing, regeneration and recovery (as reflected in the shared-economy and circular-economy business models) (Naudé, 2017). The technologies featured in **table 3** are likely to simplify manufacturing and dematerialize physical production. The dematerialization of manufacturing is facilitated by the expansion of digital manufacturing through the use of AI for purposes such as predictive maintenance and through the use of advanced materials such as nanomaterials and carbon fibre composites. New and emerging technologies can drive the creation of new businesses that can contribute to growth, employment and social change. **Table 4** illustrates how new technologies can facilitate — and in some cases accelerate — the achievement of the Sustainable Development Goals.

TABLE 4. EXAMPLES OF AREAS IN WHICH NEW TECHNOLOGIES CAN PROMOTE SUSTAINABLE DEVELOPMENT

NEW TECHNOLOGY	EXAMPLES	RELEVANT SUSTAINABLE DEVELOPMENT GOALS
Artificial intelligence	Smart farming (including crop monitoring and automatic crop disease detection); vertical agriculture (computerized factories for food production); automation and acceleration of threat detection and analysis; voice recognition for secure and targeted social protection.	Goals 1, 2 and 3
Robotics, including drones	Mining safety; security and peacekeeping; manufacturing competitiveness; unmanned aerial vehicles (drones) for remote sensing, advanced warning systems, livestock monitoring, aid and distribution, and emergency assistance.	Goals 1, 2, 3, 8 and 9
Biotechnology, smart materials, and 3D/4D printing	Molecular crop breeding for better drought, salinity and pest resistance; health care; infrastructure; building; design.	Goals 2, 3, 9 and 11
Information and communications technology, blockchain, and fintech	Insurance and social protection against climate-change-induced damages; blockchain for land registries, land improvement, obtaining finance and establishing identity (migration); weather and tsunami warnings; eHealth and other health applications; digital entrepreneurship; (distance) education; digital government; circular and sharing economies.	Goals 1, 2, 3, 4, 5, 10, 11, 12 and 16
Renewable energy	Solar energy; creating water out condensation.	Goals 6, 7 and 13

Sources: Applications focused on addressing climate change are excerpted or drawn from Naudé (n.d.); other content derived from internal United Nations input.

New technologies can make a substantial contribution to the achievement of the 2030 Agenda; however, if not harnessed properly, they can also pose threats to sustainable and inclusive development (Naudé, 2018). First and foremost is the threat automation poses to many routine jobs. The World Bank predicts that automation will likely have a greater impact on developing countries, where two thirds of the jobs fit this profile and are therefore at greater risk in the coming decades (World Bank, 2016b). Job losses will also impact richer countries; estimates indicate that 57 per cent of jobs in OECD countries involve tasks that could potentially be automated (van Welsum, 2016). Many countries, particularly those in developing regions, rely on low-wage labour to attract manufacturing firms so that they can build and maintain a competitive advantage (Frey and others, 2016). Both within and between countries, the distributional effects of automation are likely to be skewed towards those who have access to high levels of physical, economic and human capital, and these are the areas in which inequalities are likely to widen as new technologies — including but not limited to automation — are increasingly integrated into progressively more streamlined production processes.

Those whose jobs are at risk may wish to acquire new skills that make them more employable in the age of new technology; however, this may prove difficult in some settings. Even securing basic digital connectivity has been a challenge for individuals and businesses in different parts of the world. Between 2010 and 2014, 9 out of 10 businesses in high-income OECD countries had broadband Internet access; the corresponding ratios were 7 out of 10 in middle-income countries and 4 out of 10 in low-income countries (World Bank, 2016b). If simple access is this uneven, the availability and uptake of rapidly evolving and often complex new technologies are likely to reflect even greater disparities, which will further exacerbate inequalities. This matters because young people who wish to leverage new technologies for enterprise creation in developing countries will face additional barriers on a number of fronts, as they will lack not only the requisite individual skills and competencies but also an enabling environment.

Part of creating an enabling environment is ensuring that mechanisms are in place to prepare individuals to function optimally in the new age of advanced technology. Education needs to focus on practical, higher-order, experiential and lifelong learning. Youth need to learn twenty-first century skills and develop the appropriate competencies. A strong and comprehensive technology education needs to start early and keep up with developments in the digital world. Human capital formation is essential.

Another aspect of an enabling environment is a strong infrastructure. At this point, the frontier firms that are able to access, adopt and exploit new technologies make up a very small number worldwide, and there is a sizeable and growing gap between these enterprises and others operating in the market (OECD, 2017). Developing countries face a double burden in that they still have to develop the necessary infrastructure that will enable them to access frontier technologies. More than 1 billion people in developing countries lack access to electricity, and an additional 2.5 billion are under-electrified, with access limited to weak and unreliable connections (United Nations, 2018). Adequate investment in basic infrastructure is both essential and urgent, as this represents the foundation on which to build a strong technology infrastructure that will support the development and diffusion of new technologies and the flourishing of enterprises. As a side note, government policies aimed at supporting technology infrastructure development should also include safeguards and protections. Increased connectivity, and particularly the use of AI and IoT, have raised concerns about the protection and use of personal data and biometric information and the need for appropriate safeguards for children and youth.

Clearly, there are a number of conditions that must be met for developing countries to take full advantage of frontier technologies. Where basic needs remain unfulfilled, young people will find it difficult, if not impossible, to exploit these opportunities and engage in technology-driven social entrepreneurial activity. Solutions are outlined in several of the Sustainable Development Goals — in particular Goals 4, 5, 6, 7 and 9 — but Governments will need to clearly and unequivocally prioritize the formation of human capital and the development of the necessary physical and digital infrastructures in order to reap the massive potential benefits of frontier technologies. This prioritization must take place now because the window of opportunity for leapfrogging will not remain open for long.

CONCLUSION

NEET youth represent significant untapped potential for economic development, and this weighs heavily on poorer countries in particular. Fortunately, there is enormous potential for youth to utilize new and emerging technologies as social entrepreneurs to tackle systemic social challenges; some enterprising young people are already doing so (see **boxes 12 and 13**).

BOX 12.

ZIPLINE: DRONES SUPPORTING HEALTH SERVICES IN REMOTE LOCATIONS

Zipline is a social enterprise co-founded by Keller Rinaudo, Keenan Wyrobek and William Hetzler in 2014. Keller Renaudo, a young American robotics entrepreneur and a recipient of the prestigious Schwab Foundation for Social Entrepreneurship Award in 2017, serves as Chief Executive Officer.

Zipline transports urgent medical supplies, including blood and vaccines, to remote medical centres in Rwanda. After a Zipline health worker receives a medical supply order via text message or email, the requested package is prepared and loaded into a battery-powered Zip drone. The drone is then launched, quickly reaching a speed of 100 km/h, and is monitored using a tracking system until it arrives at its destination within a few minutes; deliveries are often made to very remote locations that would normally take hours to reach. The package is released from the drone with a small parachute and lands near a medical facility, where it is recovered by another health worker. The Zip drone then returns to its base.

Zipline partners with the Government of Rwanda to deliver medical products to more than 20 health centres in remote locations. Zipline's price per order varies according to weight, urgency and distance, but Zip drone delivery is always less expensive, faster, and less damaging to the environment than traditional transport options. Given that the vast majority of the population in Rwanda lives in rural communities, quick access to medical supplies can represent the difference between life and death. For example, in situations where there is a postpartum haemorrhage, access to blood for a transfusion in a matter of minutes can save a life.

"Called a 'visionary project' by the World Health Organization, 'the new face of the aerospace industry' in The New York Times, and one of Business Insider's Startups to Watch in 2017, Zipline uses cutting-edge technology to leapfrog the absence of pre-existing infrastructure all over the globe and deliver medical necessities to healthcare professionals and their patients in the most remote parts of the world" (Schwab Foundation for Social Entrepreneurship, 2017).

In 2019, Zipline expanded its operations to Ghana, India, the Philippines and the United States.

Sources: Zipline website (flyzipline.com); Schwab Foundation for Social Entrepreneurship (2017); Baker (2018); Stewart (2018).

BOX 13.

TYKN: JOURNEY OF A YOUNG TECH SOCIAL ENTREPRENEUR

According to the Office of the United Nations High Commissioner for Refugees (UNHCR), more than 1 billion people worldwide lack identity papers. Individuals without proper identification are at very high risk of being excluded from society, as access to work, housing, banking services, mobile phones, and other aspects of a sustainable livelihood is severely limited. Most of those lacking identification are already in vulnerable situations, as they are often asylum seekers, refugees and migrants. In many instances, it is impossible for asylum seekers and refugees to obtain identification, as their home countries are engaged in conflict or the documents have been lost or destroyed and cannot be replaced. Babies born in refugee camps usually lack identification papers, as parents often cannot complete the birth registration process due to national status, administrative complexities or other reasons.

Three years in a refugee camp in the Netherlands made Toufic Al-Rjula realize that his lack of identification papers made him "invisible". Toufic was born in Kuwait during the Gulf War, and his birth certificate was among those documents systematically destroyed during the conflict. The son of a Syrian father, Toufic had Syrian citizenship but grew up in Lebanon and then worked abroad in the bitcoin industry for a few years. When his work visa expired in 2012, he found himself unable to return to Lebanon or the Syrian Arab Republic. His only choice was to apply for refugee status with his Syrian citizenship. In his twenties, he ended up alone in the Ter Apel refugee camp in the Netherlands. There, he met thousands of other Syrian refugees who had lost not only their identification documents, but also their academic records, professional certificates, land titles, and other vital records. All of these other people were also invisible.

Toufic was inspired by these thousands of invisible people to partner with Khalid Maliki and Jimmy J.P. Snoek in the creation of a social enterprise called Tykn, a digital identity management system that aims to provide self-sovereign identity to refugees using blockchain technology. In Turkey, Tykn is collaborating with the Ministry of Foreign Affairs and UNDP to help employers issue work permits to Syrian Refugees. This process relies on a paper-based system and refugees need to prove their right to work. Tykn will empower them with a tamper-proof digital credential, verifiable forever through blockchain.

Blockchain refers to the "technology behind decentralised databases providing control over the evolution of data between entities through a peer-to-peer network, using consensus algorithms that ensure replication across the nodes of the network" (Tykn, 2020b). Tykn allows organizations to issue tamper-proof digital credentials which remain verifiable forever. Bringing privacy and trust to identity through DIDs, Verifiable Credentials & Blockchain technology. Users can prove their ID to access services from institutions while remaining in full control of what personal data is viewed, shared and stored. This reduces bureaucracy and allows refugees to obtain support faster.

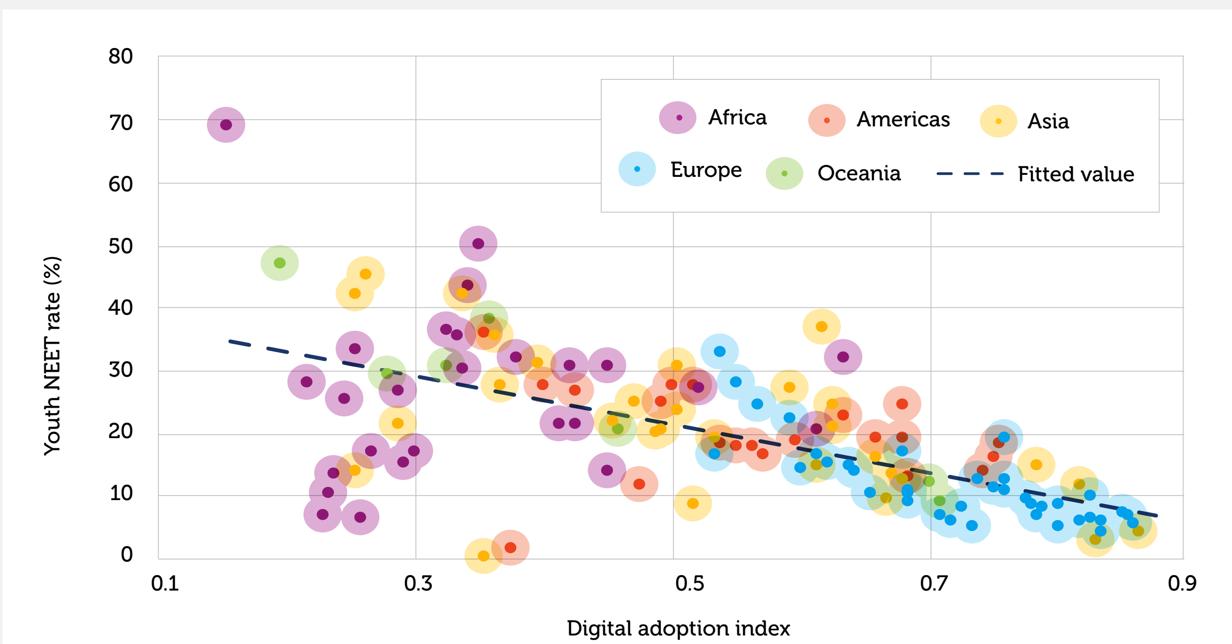
Tykn is now working with partners to explore how integrating blockchain technology into humanitarian operations could speed up the delivery of assistance.

Sources: Tykn (2020a); Tykn (2020b); Loritz (2019).

Countries with higher levels of digital technology adoption tend to have fewer NEET youth. **Figure 11** illustrates the positive correlation between the adoption of digital technology and the utilization of the talents of youth, as measured by the World Bank Digital Adoption Index based on a sample of 145 countries.[21] The relationship between the two variables is believed to be bidirectional; in other words, higher levels of digital technology adoption are likely to translate into greater engagement among youth in learning, education and employment, and greater youth engagement in these areas is likely to accelerate the adoption of digital technologies. A two-pronged approach may therefore be needed, with efforts to bridge the digital divide carried out in tandem with increased investment in science, technology, engineering and math (STEM) education for youth, with particular attention given to ICT education and skill development. Schools, universities, and other institutions providing

[21] The Digital Adoption Index (DAI) provides a relative measure of digital technology adoption at the country level across the domains of business, government and households. It evaluates data that reflect the use of digital technologies, focusing on variables such as business websites, secure servers, download speeds, 3G coverage, mobile-cellular access at home, Internet access at home, the cost of Internet access, e-customs and e-procurement activity, digital signatures, and e-filing for taxes (see World Bank, 2016a).

FIGURE 11. RELATIONSHIP BETWEEN THE ADOPTION OF DIGITAL TECHNOLOGY AND THE UTILIZATION OF THE TALENTS OF YOUTH (AGED 15-24) ACROSS THE WORLD



Sources: DESA, based on ILOSTAT database (non-modelled estimates); World Bank, Digital Adoption Index 2016.

support for the adoption of digital technologies are going to play an increasingly pivotal role in enabling entrepreneurship ecosystems.

One of the defining features of the present era is rapid innovation linked to new, emerging and frontier technologies. As noted previously, the technologies driving the Fourth Industrial Revolution present both opportunities and threats. Higher rates of digital technology adoption are generally associated with higher levels of youth engagement around the world, but taking full advantage of this positive dynamic requires that young people be appropriately supported in identifying, adopting, adapting and commercializing new technologies to contribute to social development. This is particularly urgent for youth residing in the global South, where there is the double imperative of providing basic infrastructure and accelerating technological development. All of this needs to be considered in entrepreneurship ecosystem design.

Innovation and its commercialization are rarely the work of a lone entrepreneur and do not take place in a vacuum; typically, this process involves the efforts of multiple agents that are often clustered in a particular geographic area and are embedded in a support system (Nelson and Winter, 2002). This dynamic is well recognized and has resulted in Governments coordinating relevant support; many have invested in national innovation systems[22] to facilitate the flow of information and technology among people, enterprises and institutions (see Lundvall, 1992) and are building entrepreneurship ecosystems to support start-ups (Mason and Brown, 2014). In these institutional support systems, the three key parties are usually the Government, commercial businesses and scientific institutions — the constituents of what Etzkowitz and Leydesdorff (2000) refer to as the "triple helix" of innovation. In the case of social entrepreneurship, the concept of a "quadruple helix" may be more relevant, as civil society is also involved (see Carayannis and Campbell, 2009). Each "strand" of the triple or quadruple helix has a role to play, though configurations vary widely, with the local context determining the relative focus of each agent (the Government, industry, scientific institutions and civil society) on different aspects of the ecosystem. No two entrepreneurship ecosystems are the same.

Connecting young social entrepreneurs with new and emerging technologies represents an opportunity to disseminate and scale up technological solutions that will contribute to the global welfare and leverage the enormous potential of youth worldwide. How can this be done most effectively? What is certain is that ensuring access to new-technology-focused education is essential to youth employment and entrepreneurship and to sustainable development more broadly. Given the rising importance of technology both in school and in the labour market, access to technology-relevant (especially new digital technology) skill development and education is crucial for harnessing the talent and potential of young people, including those who aspire to become social entrepreneurs and contribute to the achievement of the Sustainable Development Goals.

22 A national innovation system comprises of a set of organizations, systems and incentives that encourage the generation and adaption of technology (Nelson, 1993).

Photo: ILO / Osseiran Nadine