COUNTRY REVIEW: GEORGIA

ICT-Centric Innovation Ecosystem Snapshot and Recommendations For Accelerating Digital Transformation

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1. Introduction

Digital innovation profiles are an important element in the ITU series of snapshots of information and communication technology (ICT)-centric innovation ecosystems. Each profile assesses and summarizes the opportunities and challenges facing a country's ICT ecosystem. The at-a-glance format enables international comparisons and meaningful measurement of the capacity to accelerate digital transformation and of innovative ICT capability.

Digital innovation profiles offer a rapid and straightforward means of analysing and optimizing your ICT ecosystem. This analysis then helps navigate through a country's fast-moving ICT/ telecommunication landscape with a view to building a competitive, sustainable, ICT-enabled economy. Further collaboration with ITU can go on to target specific engagements, including the implementation of appropriate, co-developed, bankable projects that are of high value in the national context.

All digital innovation profiles are developed by experts specially trained to apply the ITU digital innovation framework. This framework features highly structured workshops and facilitated assessments, designed to build national capacity, enhance on-the-ground skills and powerfully accelerate digital transformation. The framework process equips ITU Members States with the tools to assess and monitor their own ICT innovation ecosystems.

The analysis and the positions expressed in this initial high-level assessment, reflect opinions and research of the national expert, working within the ITU digital innovation framework process and with guidance from the ITU-D Digital Innovation Ecosystems cluster.

2. Background

Key Indicators	
Population [2021]: 3,728,600	ITU Global ICT Dev. Index [2017]: Rank 74 / 176 Score: 5.79 / 10
Population Density [2021]: 65.2 km2	Global Innovation Index [2020]: Rank 63 / 131
GNI per capita [2020]: $4,071	Innovation Efficiency Ratio [GII 2020]: Score: 63
Region: Europe	Global Competitiveness Index [2019]: Rank 74 / 141
	Business dynamism (GCI) [2019]: 58/141 Innovation capability (GCI) [2019]: 91/141

Table 1: Key Indicators

With a population of 3.7 million, Georgia is a small lower-middle-income country located in the South Caucasus, at the intersection of Eastern Europe and Western Asia. In 2020, agriculture contributed around 7.37% to the GDP of Georgia, 21.63% came from the industry and 58.57% from the services sector (Statistica, 2021). Economic growth had been robust until 2019, averaging 5% per annum, and poverty declined rapidly to 19.5%, almost half its 2007 rate, driven by sound macroeconomic policies and improved governance (World Bank, 2020). Deep reforms in economic management and governance have earned Georgia a reputation of "star reformer," scoring 7th out of 190 countries for Ease of Doing Business. Today, the Georgia National Innovation Ecosystem (GENIE) Project (IBRD $23.5 million) is helping develop innovative start-ups, deepen financial and capital markets, improve corporate governance, and strengthen investment promotion.

A long-term challenge to economic growth is the constant zero rate of population growth and high emigration, which means the labor force continues to shrink (Geostat, 2021). The small labor market lacks appropriate technical skills, a consequence of Georgia's education system, which despite significant achievements in recent years, continues to face many challenges. Substantial youth (age 15-24) unemployment (30-40%) indicates the lack of employment opportunities in general and shows that Georgia lacks a suitably qualified talent pool (UNDP, 2021) In 2018 the OECD student assessment placed Georgia 70th among 79 countries. In the same year, public spending on education and training was 3.52% of GDP, while the European Union countries' average for 2017 was 4.72% (World Bank, 2018). In March 2019, the

government announced plans to designate about 6% of the country's GDP in investments in the educational system by 2022 (Agenda.GE, 2019). There is an educational framework for ICT studies; however, Georgia lacks an integrated Education information management system and robust data analytics to inform education policies.

The World Intellectual Property Organization ranks Georgia 63rd out of 131 in its Global Innovation Index (2020). Since 2010, Georgia has strengthened its support to ICTs through various public-private partnerships and digital-related initiatives such as zone tax exemption, foreign investments, and projects to improve the labor force (ITU, 2020). In 2017, the ICT development value was 5.79, and the ICT sector accounted for 3.8% of the total GDP (Geostat, 2018).

The telecommunications market is in general very open to competition. There are more than 270 licensed and operational Service Providers and Network Operators (ITU, 2020). The COMCOM launched in 2000 with the main aim to establish a transparent regulatory environment and promote competition in electronic communications and broadcasting. With a competitive sector primarily driven by private investments, the telecommunication sector remains among the fastest growing and in 2017, represented between 5-7% of the country's GDP (ITU, 2020).

ITU data shows in 2019, the number of fixed-broadband subscriptions per 100 inhabitants was 23.56 and that 75.8% of households had Internet access at home. Wireline broadband networks (using fiber-optic or cable networks) are limited in their reach outside of urban areas. The country's National Broadband Network Development Strategy for 2020-2025 (NBDS) targets for 2025 are the following: 4G covers 99% of Georgia; pilots for 5G services in three municipalities; All institutional entities have access to 1 Gbps connectivity; All households have access to networks for high-speed (100 Mbps+) broadband, aligned with plans for 5G development in the country. The strategy aims to create infrastructure and establish Georgia as a digital and information hub between Europe and Asia while also upgrading knowledge and skills, leading to employment growth (EU4Digital, 2020).

The introduction of artificial intelligence systems in the Georgian public sector is at an early stage of development. The most prevalent AI technologies in the civil service are chatbots, used by several government agencies to consult citizens. The Ministry of Internal Affairs uses AI in image processing (radar and video technologies for road traffic), and law enforcement agencies use automated facial recognition technology. The Georgian Prosecutor's Office uses some AI-based applications to support crime investigations (PMC, 2021). There are many successful examples of AI solutions in the private sector, especially in insurance and banking, including a neobank that exists only as a mobile app, without branches and physical presence. In 2020, Georgia reached 43.39/100 index score and was ranked 72nd out of 172 countries, according to the AI Readiness index.

The Georgian private sector is dominated by services which provide 44.5% of jobs. This sector is boosted by the hotel, restaurant, transport, and telecommunications industries. Whilst agriculture employs 41.3% of the working population it only accounts for 6.22% of GDP. The SME Development Strategy 2016-2020 has been adopted, improving legislation, institutional and regulatory frameworks, and the operational environment, widening access to finance,

developing entrepreneurial skills, broadening internationalization, and supporting innovation activities. SMEs still face challenges in terms of funding for innovation and attracting and retaining digital talent.

3. Current landscape
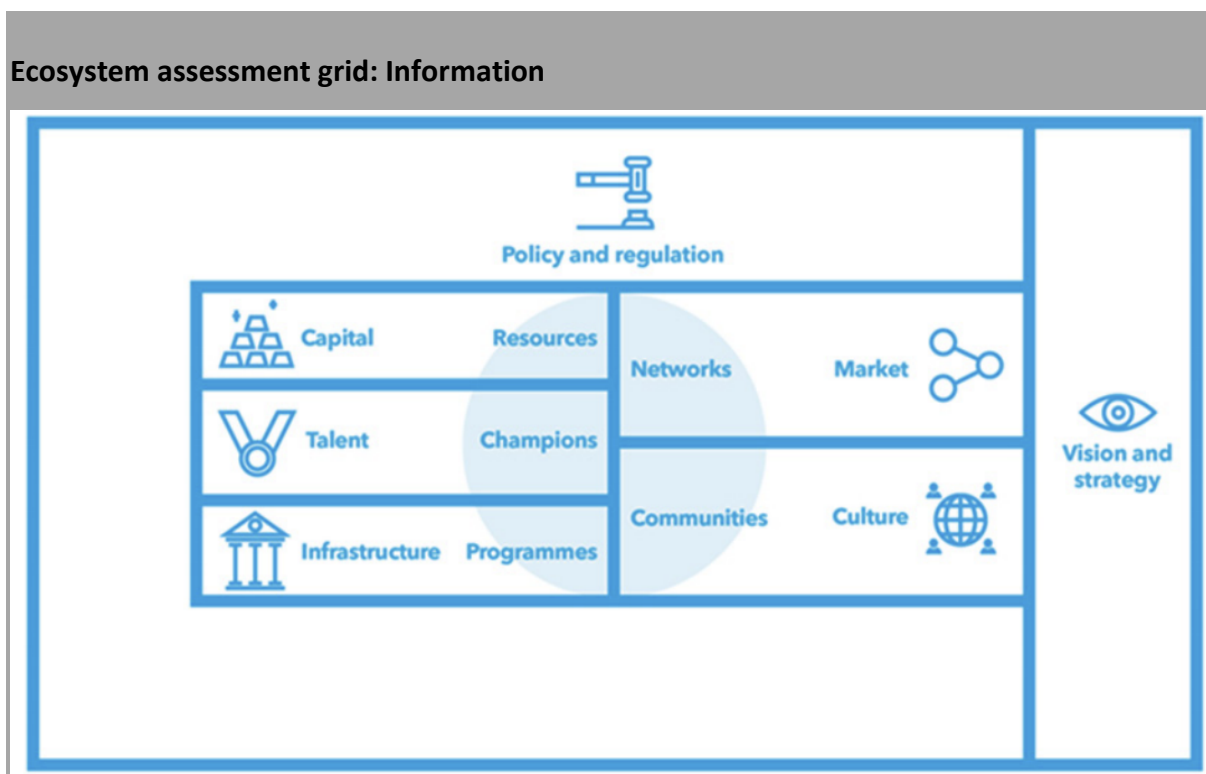
Ecosystem assessment grid: Information

Figure 1: Ecosystem assessment grid

To conduct a country-wide assessment, one needs to understand the environment in which innovators are going to have to operate. As noted above, the lack of an enabling environment is one of the main obstacles facing digital innovation. The ecosystem grid is a tool that will help you better understand Georgia's ecosystem and make your diagnosis to resolve this problem. It is based on the analysis of the main pillars of the environment which reflect the situation of the ecosystem.

This grid allows actors to analyze the events occurring within the ecosystem and to identify the problems and possible solutions. Let's take a closer look at the role of each pillar in the ecosystem.

Table 2: Ecosystem assessment grid: Information

3.1 Vision and strategy

- Strong and impactful strategy for innovation but with little awareness among actors of the ecosystem.
- Common consensus of existing issues among stakeholders but lacking big picture.
- Good engagement and connection between the public sector and other stakeholders but needs to be more multilateral and multidirectional.
- Local stakeholders understand their own roles but not their role supporting the ecosystem.

Once GoG decided to develop innovations in a fastest possible way it has created the Georgia's Innovation and Technology Agency (GITA) under the Ministry of Economy and Sustainable Development of Georgia (MoESD) as the MoESD is a policy maker body in the

Digital field in Georgia, the major objectives of which is to make the broadband internet and ICT technologies accessible for the population, entrepreneurs, and especially, for the SMEs and promote development of innovation-driven digital economy of the country.

The MoESD is responsible to elaborate the legislation in the above mentioned fields and coordinates the process of elaboration of legislation in telecom, innovations and postal sectors, implements different reforms, projects, programs and activities.

Since the creation of GITA in 2014, there have been significant efforts to develop the digital ecosystem in Georgia. ICT-centric innovation development was one of the priorities of the Social-economic Development Strategy of Georgia, "Georgia, 2020". It fostered private sector competitiveness by improving access to finance and support in commercialization, developing the infrastructure necessary for innovation, and establishing an efficient communication network. To a large extent, it has laid the foundations of a vibrant ICT innovation ecosystem. Since 2020 the Georgian Government has made several attempts to adopt a new national innovation strategy; however, none have been published due to leadership changes in responsible institutions and changing policy priorities. As a result, all actors within the ecosystem were not aware of a clear vision or national innovation strategy. There is undoubtedly a need for one shared vision to engage all relevant stakeholders in sustainable digital transformation.

Although lacking a clear strategy, stakeholders shared a common consensus of existing issues. In Georgia, the public sector plays an essential role in supporting the ecosystem and is well connected to other stakeholders. It was clear GITA, as the implementation agency, is very active in the ecosystem, and actors were aware of GITA programs and initiatives. However, for the ecosystem to develop, stakeholders felt that GITA should no longer be the main player and it was time for the private sector to take the lead. Overall, the big picture was not clear, leading to some stakeholders misunderstanding their roles in the ecosystem. Consequently, several actors did not feel part of the ecosystem at all and focused solely on their own missions and servicing international markets. However, some start-ups aimed to be role models to inspire young entrepreneurs and support the ecosystem, encouraged by academic institutions and the public sector.

The Government plans to build the foundation to seed incentives and assets for innovation. The country's aim is to create a cutting-edge technology-driven economy that will foster more innovation and progress in the region. Georgia will be positioned as a digital hub with AI a natural extension of this. AI is seen by many as an engine of productivity and economic growth and may have a highly disruptive effect on the economy and society. Georgia has the potential to leapfrog digital development if existing ICT policies and programs are comprehensive enough to address opportunities in the economy. However, the development of the AI ecosystem requires some prerequisites, such as a well-developed ICT sector and good STEM education. AI should be a part of the overall digital ecosystem strategy.

3.2 Infrastructure and Programmes

- Good access to hard infrastructure in urban areas and affordable internet but there remains an urban-rural divide.

- Concentration of soft infrastructure in Tbilisi but creation of Techparks has helped dissemination of innovation in rural areas.
- Latency due to physical location of cloud service data centres but firms have access to hardware and software resources.
- Competitive potential as a regional data conductor undermined by its current level of maturity.

The Georgian government is investing heavily in providing access to both hard and soft infrastructure, although there remains a significant urban-rural divide. Tbilisi is the hub of economic activity and connectivity in the country. All stakeholders located in the capital benefit from affordable, high-speed internet access. The COMCOM data shows that Tbilisi and Adjara have the highest internet coverage, while Abkhazia has the lowest penetration rate. In April 2020, COMCOM informed the local press that it has already carried out large-scale work to install 5G internet infrastructure and soon will announce a tender for operators. Fiber is the most used technology in Georgia, and Wi-Fi the second most common, mainly in rural parts, where fiber connections are not available due to economic return on investment. Georgia benefits from a fully deregulated electricity sector, which provides a stable, uninterrupted supply for telecommunications networks. However, in some remote rural areas, stakeholders reported issues with basic infrastructure, including inadequate road coverage and limited access to running water.

Login Georgia has been developed by the Georgian Government, in cooperation with the World Bank, under the 2020-2025 strategy for developing broadband internet networks. The World Bank is providing EUR 35.7 million ($40 million) financial support for the project, which aims to connect people, enterprises, and institutions across rural Georgia to high-quality, affordable broadband internet and promote the use of digital services. It will enable 500,000 citizens in almost 1,000 settlements, including in mountainous areas, to enjoy quality internet and services like e-healthcare, e-education, e-governance, and others.

GITA has established five Techparks and innovation centres focused on the development of technologies and the innovation ecosystem. These offer physical space with fabrication laboratories, equipped with high technology machines, free open co-working space, training facilities, and business incubation. According to some actors these have had a positive impact but would only be sufficient for basic prototyping rather than advanced ICT research and development. Apart from the Techparks, universities provide laboratories for innovation, however these lack up-to-date equipment and are not open access. Mentoring, training and other soft infrastructure is adequate and GITA has established an ICT training program that aims to train 3,000 IT specialists by March of 2023. Although a positive step for the ecosystem, some stakeholders believed this is ambitious and the lack of demand for ICT and AI training is the real issue. It is vital to raise awareness of career opportunities and the benefits of digitalization to increase uptake.

Currently, in Georgia, there is no cloud infrastructure. Therefore, some companies use cloud services from companies like Microsoft, Amazon, Apple, and Google but are experiencing network lags. Cloud computing technologies could accelerate AI development and give AI

developers quick access to infrastructure environments (computing power, etc.) and data management and AI services. Cloud computing with AI can reduce costs and offer more flexibility, especially for small businesses, since they do not need to set up the complete infrastructure. Instead, firms could rent cloud platforms for a monthly fee and scale their services later if required.

However, cloud computing raises concerns about data security (including data loss, data breaches, privacy protection, and legal compliance regarding the data), unauthorized use of cloud services, accessibility of cloud services, and vendor lock-in. One of the important factors regarding the use of cloud infrastructure is digital sovereignty regulations imposed by many countries that require that customer data be stored domestically rather than abroad. Some of these concerns, especially those regarding privacy, security and legal compliance, could be addressed by physically locating the cloud inside the country. Physically close infrastructure will reduce network lag and increase cloud availability and service responsiveness.

Currently, the ecosystem perceives a lack of competitiveness regionally and nationally. However, in the region, Georgia has a competitive advantage of using existing telecommunications infrastructure, including the submarine Black Sea Fiber-Optic Cable System to develop the corridor between Europe and the Middle East via Armenia and East Asia via Azerbaijan. This gives Georgia the potential to position itself as a safe and trusted data conductor and digital hub.

3.3 Policy and Regulation

- Favourable business environment due to regulatory reforms but its implementation is yet to be demonstrated.
- Tax incentives create opportunities for foreign companies but hinders growth of local firms.
- Despite strong IP laws there is still a prevalent culture of piracy and copying.
- Strong ICT and SME policy but yet to be developed in the field of Artificial Intelligence.

Substantial efforts by the government have resulted in Georgia's success in the Ease of Doing Business world ranking, a measure of regulatory best practice. The country scored particularly highly for ease of starting a business, registering property, protecting minority investors, enforcing contracts, and getting credit. Stakeholders acknowledged significant improvements in regulations in a short space of time. Supportive policies and regulations can provide fertile ground for the efforts of entrepreneurs and innovators. However, to build a genuinely vibrant ICT-centric innovation ecosystem, all actors need to understand their responsibilities and have the capacity to deliver on them.

Tax incentives have enabled Georgia to attract a US technology company that will create 400 local jobs. Although viewed by some actors as positive for the ecosystem, start-ups and SMEs stated there is an issue in the discrepancy between tax regimes applied to foreign and local companies. This results in foreign IT companies paying less tax, enabling them to offer better salaries and recruit the already scarce talent from local companies. The private sector viewed this as potentially harmful to the ecosystem.

The players in the ecosystem recognize that there exists a culture of piracy and copying of intellectual property. It is particularly challenging for start-ups looking for venture capital, as US investors require international IP protection. Start-ups are reluctant to file patents in Georgia as this exposes their ideas and offers no IP protection outside of the country. Although the Government of Georgia has tried to strengthen the legislative and institutional framework relevant to intellectual property protection, awareness and implementation remain an issue. Individuals rather than businesses file most patents, which shows a need to develop a collaborative research culture with companies and universities.

Currently, there is no single government institution responsible for setting AI policy in Georgia. It is crucial to set AI policy goals, especially for business development, improving government services, and economic growth. There is also no specific legal regulation on AI. The most important legal act related to AI is the Georgian law on Personal Data Protection. The State Inspectorate is responsible for monitoring and ensuring compliance in this area. It recently recommended the Ministry of Internal Affairs to change practices regarding information registry, data retention dates, and deletion upon expiration dates.

3.4 Talent and Champions

- Capacity to develop technical capabilities but volume of talent remains small.
- High number of university students yet very little in the studies for innovation and entrepreneurship.
- Government attempts to reduce brain drain seeking better opportunities outside the country yet to show results.
- Bank of Georgia and TBC Bank identified as champions by the private sector for supporting innovation but more diverse champions are needed.

One of the biggest challenges identified by all stakeholders was the lack of technical skills, especially developers and digital analysts. SMEs and start-ups struggle to find suitable ready-to-work technical talent, and larger organizations have had to invest in internal training programs to develop graduates. There is intense competition for qualified personnel, and headhunting is rife. In a less mature ecosystem, such as Georgia, much of the best talent is migrating to Europe and the US for better opportunities. In addition, the growth and popularity of remote working is contributing to the brain drain. To attempt to reduce this, the government launched a "Work from Georgia" initiative to attract intellectual nomads to the country. However, this is yet to demonstrate real benefits to the local ecosystem.

There are a small number of stand-out university programs, but the volume of ICT graduates is not yet close to market needs. Apart from universities, private organizations offer subsidized courses in web and mobile applications, but this is still not enough. Over-qualification is common in Georgia. There is a high degree of mismatch between qualifications and skills directly pertaining to innovation, with an excess supply of higher or overqualification (European Training Foundation, 2019). There appears to be no coordination between qualifications required of the workforce and qualifications provided by the educational system. A clear skills gap exists in terms of competent business professionals and skilled

engineers. Although there have been valiant efforts to introduce entrepreneurship programs in universities, the education system is yet to generate good human capital for innovation.

According to ecosystem actors the education system is the main contributing factor to the labor market shortage. A large share of Georgian students continue to leave school without mastering basic competencies for work readiness (OECD, 2020). Investment in STEM education at all levels is essential to encourage interest in entrepreneurship and technology to grow the ecosystem long-term. This is also true for developing the AI ecosystem, which needs talents with AI research, development, and implementation skills. A humanitarian aid program in rural Georgia has helped introduce children to STEM by running Science camps and providing starter Robot Kits to strengthen their basic understanding of coding and machine learning. Many STEM education opportunities for young people are through informal education rather than in schools. Grass root projects should be supported and encouraged to help raise the aspirations of Georgian youth and increase uptake in STEM subjects in higher education.

Most stakeholders perceived Bank of Georgia and TBC Bank to be the champions providing support for innovation, social responsibility, and e-commerce. Some start-ups also expressed a desire and willingness to act as role models. However, Georgia needs more diverse advocates representing each group of actors to rally everyone around a common cause and drive initiatives.

3.5 Network and Markets

- Formal networks focused on supporting large firms yet to showcase effective support for start-ups and SMEs.
- Small domestic market with demand for digital consumption but unable to support innovators to scale up.
- Procurement has undergone digital transformation yet remains limited for ICT and AI development opportunities.
- Trade flows possible, encouraged and supported but focused on traditional rather than digital products.

Business Associations and formal networks are active in the Georgian ecosystem. However, some stakeholders perceived these as mainly supporting large companies and the ICT sector is underrepresented. This is especially true for the small AI ecosystem, AI stakeholders are not very well connected. Recent efforts to establish a Tech start-up Association, ICT Association, and an AI Association have been slow to gain traction and get off the ground. As a result, companies are unable to build local synergies and benefit from knowledge sharing and collaboration. In addition, no explicit mapping of the ICT ecosystem exists, limiting cooperation between players. Strong networks are a crucial ingredient for building innovation capacity, hence the ecosystem actors may focus on developing these.

Demand for digital consumption exists within Georgia, and citizens benefit from innovations in peer-to-peer lending and personal financial management products. The main challenge is the size of the market as innovators are unable to develop and expand. To be successful,

entrepreneurs need to focus their products and services on global markets. GITA is addressing this challenge by providing support to scale up abroad.

The Georgian public procurement system has undergone significant Public Financial Management reforms and is now more transparent, secure, and convenient. Cooperation between the private sector and the government has resulted in substantial savings to the state and citizens. Although there has been progress, the ecosystem believes public procurement offers limited ICT and AI development opportunities. Most Government departments develop their own IT systems in-house, so public procurement remains very difficult to access for start-ups.

Most stakeholders agreed the Deep and Comprehensive Free Trade Agreement (DCFTA) with the European Union (EU) and the more recent free trade agreement with China are positive steps for the ecosystem. Enterprise Georgia organizes trade missions and international exhibitions to connect producers to foreign buyers. Trade flows are possible; however, they focus prominently on traditional rather than digital products.

3.6 Capital and Resources

- Government remains the main provider of capital for innovation yet focused on seed investment.
- Efforts have been made to attract foreign investment but VC and Angel Investors are still needed to support the ecosystem.
- Despite the existence of national institute funding research there is still insufficient local funding for academic research to grow the digital ecosystem.
- Attempts to stimulate technology transfer however with modest results.

Georgia's digital competitiveness remains hampered by an immature capital market and a lack of private investment. The banking sector is one of the most digitally advanced in the country but remains risk-averse to lending. Due to high-interest rates and personal guarantees bank loans are unsuitable for financing start-ups. Alternative financing sources, such as angel, seed, venture capital, leasing and factoring, are largely unavailable from private sources in Georgia, and the nascent capital market infrastructure prevents easy exit from investment. There is a lack of government funding for research projects, and several stakeholders stressed that local funding is not sufficient for AI research. Access to financial resources is critical to innovators and growing the ecosystem. Foreign Direct Investments in Georgia has fallen since 2017 (Geostat, 2021). The country has the potential to be an attractive investment destination, so more needs to be done to unlock this potential.

Throughout 2016-2017, GITA developed three schemes to provide capital for innovation: the Micro Grants, the Start-up Georgia and the Matching Grants programs. Within the framework of the high-tech component of Startup Georgia from 149 received applications, 20 start-ups were selected and financed with the amount of 100 000 GEL (30,000 USD). These were evaluated by leading international experts from Silicon Valley and submitted to global investors in Silicon Valley. GITA complements its financial support with training, coaching, mentoring and consulting services for all programme beneficiaries. Many stakeholders felt

GITA had helped to kickstart the ecosystem, but there is a need to develop venture capital and nurture alternative funding sources such as crowdfunding.

Research and development expenditure in Georgia was only 0.290% of GDP as of 2017 (UNESCO, 2017). Many actors agreed that there is insufficient funding for the academic research needed to develop the ecosystem and pointed out a shortage of applied research projects. Another issue is that researchers often lack the soft skills required to write compelling funding applications, compounded by significant competition for European funding.

There have been some efforts in technology transfer. In 2019 GITA established a Technology Transfer Pilot Program to support commercialization of Georgian scientific results that respond to market needs. To date, outputs have been fairly modest with 74 applications and eight receiving support. Some ecosystem players believe that at present companies in Georgia are not developing new technology using existing knowledge. The challenge is that most research is still theoretical rather than applied, so there is a need for universities to collaborate with foreign firms to develop these applications.

3.7 Culture and communities

- Regular events happening across the ecosystem to help develop entrepreneurial culture but not foster collaboration
- Growing interest in entrepreneurship from Georgian youth yet the motivation is not always for the sake of innovation.
- Risk taking an uncommon value yet start-ups demonstrate more appreciation of failure.
- Active women in the digital ecosystem but not yet equally represented from rural and poorer communities.

Regular events organized by the public and private sector to foster innovation take place across the ecosystem. Actors recognized the Impact Hub, Startup Bureau, and Startup Grind as holding habitual gatherings to facilitate essential knowledge sharing. Although the small start-up community appears open and inclusive, not all stakeholder groups are actively engaged, especially in AI, potentially limiting ecosystem growth.

According to the ecosystem, there has been a surge of interest in entrepreneurship from young people in Georgia. Unfortunately, they often lack the resources and suitable business and technical skills to start competitive enterprises and focus on traditional sectors within their comfort zone, such as retail and tourism. Due to high unemployment, setting up a business is sometimes more for survival than a genuine interest in becoming the next unicorn. However, this mindset is changing, and the education system could help drive this change. Georgia could tap into the young people educated abroad who have the ambition to create their own ventures.

Risk-taking and failure are not yet embraced in Georgia as an opportunity for learning. Due to the lack of capital and resources, ecosystem members felt that failure is poorly viewed, and there exists a tendency for citizens to blame others when things go wrong. In Georgia SMEs

and larger companies tend to be more risk-averse than start-ups. The country needs to cultivate an innovative, entrepreneurial culture by sharing these fundamental values and developing a willingness to iterate and learn. These behaviors will help Georgia to create a more vibrant ecosystem.

Women are active but remain under-represented in the ecosystem. GITA data shows between 2018-2020, among the Matching Grants Program 95 winners, there were 33 female founders/co-founders. The ecosystem is trying to address this issue. Enterprise Georgia prioritizes women in their programs and the Bank of Georgia received a long-term local currency loan of 100 million Georgian lari (around 35 million US dollars) from the World Bank to help boost access to finance for small businesses and women entrepreneurs. Startup Georgia and Project Growth is a joint initiative specifically to help residents in villages to start-up companies. However, rural and poor communities are still unrepresented due to a lack of technical and business skills, information, infrastructure, and capital.
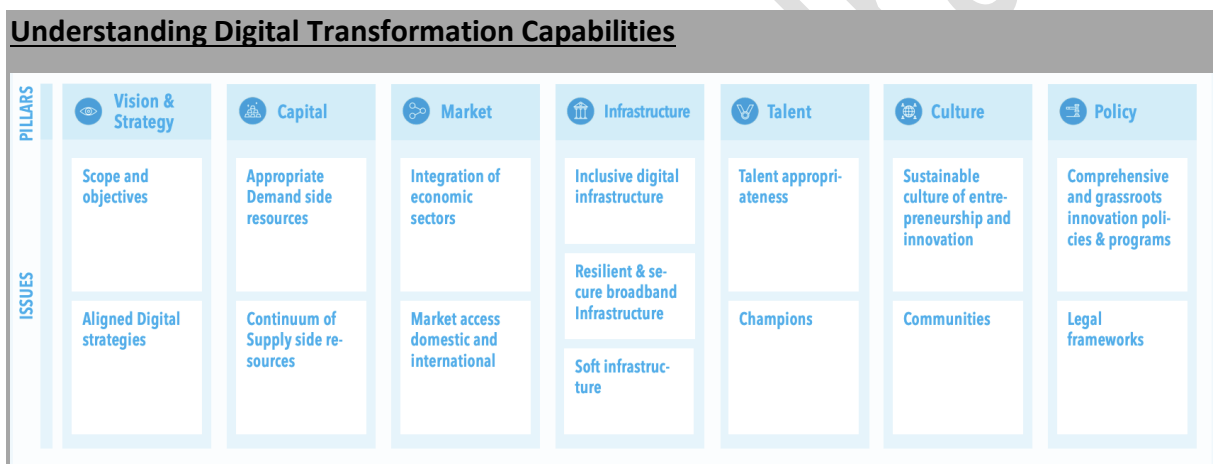
Figure 2: Elements constituting Georgia's digital transformation capacity

The image above presents the main elements, which are essential for understanding **Georgia'**'s digital transformation capacity.

Digital transformation is what happens when innovation is applied to solve problems through the use of ICT / telecommunications. The benefits to a country and its people are immense - increased productivity, economic growth and increased employment opportunities. The extent to which these benefits are within reach depends on the vibrancy of the ICT-centric ecosystem and the corresponding long-term vision and strategy that supports it.

All ecosystem stakeholders need to understand their potential as well as their very real capacities to make a difference - as they embark on transformation. ITU's digital innovation framework not only helps share this understanding, but also clearly defines what enablers can accomplish - as well as identify the obstacles they will encounter along the path of change. The key factors and components that enhance, encourage and facilitate digital transformation are clearly grouped and usefully organized in the diagram below.

Table 3: Understanding Digital Transformation Capabilities

4. Challenges and Opportunities in the Ecosystem

The three main ecosystems essential to **Georgia'**s digital transformation journey are: (i) the national innovation ecosystem; (ii) the ecosystem of entrepreneurs; and (iii) the technological ecosystem. These three ecosystems are closely linked to form **Georgia**'s innovation landscape, from ideation to market. There are challenges and opportunities that each ecosystem currently faces, but which also impacts all three. The following section contains a direct analysis of each ecosystem and ends with a macro overview of the challenges and opportunities facing the three ecosystems.

4.1 National Innovation Ecosystem

The national innovation ecosystem - including research institutes, universities and public sector entities such as national innovation agencies and public sector funding - plays an invaluable role in the national journey of innovation. innovation, especially in the launch of innovation.

Georgia's national ecosystem is organized and supported regardless of being at an early stage of development. The government took the initiative by forming GITA to provide the preliminary platform for innovation until the private sector becomes competitive enough to lead. Although the cornerstones have been built, stakeholders continue to work in silos and do not see the potential of the ecosystem as a whole. To mitigate this, the government must now create a clear innovation vision and strategy and bring all actors together to help the ecosystem overcome several challenges.

State Universities are struggling to foster innovation. With low student fees and no other government funding, universities depend on grants and design projects to meet grant requirements rather than ecosystem needs. The sustainability of these projects is an issue, so any benefits are often short-term. The exchange between universities and industry is limited, reducing digital innovation that can come from research. Research is slow to market, and there is a low success rate in tech transfer. Universities are trying to solve these issues by opening incubators and accelerators, but new global partnerships are needed to accelerate their transformation into leading innovation centres. Another challenge is that universities find it difficult to attract world class professors and researchers due to limited funding. As a result, they are not creating optimal human capital to make its way into innovation and entrepreneurship. Universities have made significant efforts to introduce entrepreneurship courses to students; however, the English language, being the main language for entrepreneurship and innovation literature, is still a barrier.

Support networks are generally well funded and provide appropriate programs. They are beginning to guide start-ups through the development lifecycle, create a supportive culture, and foster community. The critical issue is awareness, as citizens and established businesses do not understand the benefits of ICT. The public sector would benefit from awareness-raising, expanding the budget allocated to the education sector, and developing its national policies to grasp digital technology benefits fully.

4.2 Entrepreneur Ecosystem

The entrepreneurial ecosystem includes entrepreneurs, their support systems and organizations that first nurture business creation through the "valley of death[1]" and then nurture their growth as SMEs.

Georgia's entrepreneurial ecosystem is small but growing at a fast pace. In recent years the country has invested in public support programs and infrastructure to create a fertile ground for innovation. Still, it does not yet provide all of the resources entrepreneurs require to realize their ambitions. The main challenges facing start-ups are access to growth funding, human capital, and collaborative research and development opportunities.

GITA has formed a partnership with 500Georgia acceleration programme and Bank of Georgia to provide access to venture funding and investors to alleviate some of these challenges. However, the general lack of angel and venture capital funding is a barrier to growth. Some start-ups have secured US investors and have exited the ecosystem to set up operations there. Although this is a success, and it helps to raise the aspirations of other entrepreneurs, the local ecosystem is losing some of its best digital talent to other international ecosystems. Many start-ups follow a bootstrapping strategy to achieve their goals using self-sustaining resources, which slows down innovation and commercialization.

Access to appropriate human capital is an issue as the talent pool is small and competition for digital skills is fierce. A tax policy to attract foreign companies has been controversial as it has created unfair competition and reduced the availability of labor. Some start-ups have begun to hire students before they enter higher education and train them in-house. In the short term, Georgia needs to offer incentives to attract international talent from countries like Ukraine and Belarus.

Entrepreneurs need to stimulate innovation by building companies that deliver novel solutions. This is hampered by a low level of research and development and insufficient collaboration between public R&D institutions and SMEs. Some start-ups have gained international recognition due to winning competitions and act as role models, but more are needed to be leaders and champions in the ecosystem.

4.3 Technology Ecosystem

The tech ecosystem includes high growth tech companies and the ecosystems that support them that are embedded in local or global value chains. These include high-tech companies, their equipment manufacturers, systems integrators, companies in the ICT sectors, B2B technology platforms supporting SMEs, among others. Its development is essential to a country's ability to benefit from technological innovation and create high-growth industries and jobs.

The technology ecosystem is the newest in Georgia and comprises telecommunication companies, systems integrators, representatives of foreign companies, and a few ICT companies and AI start-ups. EPAM, a digital platform engineering and top digital and product design agency is the most recent member of the technology ecosystem. The government is trying to attract more international companies like EPAM to grow the ecosystem. In Georgia, banks are digitally advanced ecosystem players collaborating with AI start-ups and the fintech

community. The main challenges for this embryonic ecosystem are a lack of connectedness, ICT specialists, and cloud infrastructure.

AI is a natural part of the technology ecosystem and faces some of the same challenges. A recent report (PMC, 2021) describes the main issues: a lack of skilled labor and industrial development and trust. In addition, the lack of local cloud infrastructure is an issue. Some companies are using external cloud services but are experiencing network lags, and there are questions regarding data security and legal compliance with local data regulation. Nevertheless, local cloud computing technologies could improve AI development and support ecosystem growth.

The ecosystem is trying to address some of its challenges. For example, the public and private sectors have organized events such as DataFest Tbilisi - an annual international conference about data, technology, and communications, bringing together the data community from Eastern Europe and Central Asia to inspire, encourage, and create meaningful connections. In addition, the government has offered tax incentives to foreign IT companies to relocate, which has had some success in attracting foreign firms.

This ecosystem development is critical to Georgia's ability to leverage technological innovation and create high-growth industries and jobs. To achieve a mature technology ecosystem, the government should consider investing in cloud infrastructure, implementing electronic services, and attract technology companies facing regulatory and bureaucratic restrictions in other countries.

4.4 Macro Challenges and Opportunities

At a macro level, there are challenges that are facing all three individual ecosystems.

- Firstly, insufficient resources and funding are major challenges for Georgia, directly impacting education, research, and innovation capacities.
- Second, access to appropriate human capital is a challenge for all ecosystems as they compete to recruit the best talent and lack the skills necessary to exploit digital technology.
- Third, the lack of a shared vision leading to unclear roles and multi-lateral engagement of stakeholders in developing their innovation ecosystem.
- Finally, there is a lack of coordination between key building blocks (R&D investment, talent pools, culture, economic conditions, markets, and investment) needed to drive results.

The ICT sector is emerging, and Georgia is working hard to establish itself as a growing hub for information and communication technology. The EU-funded 'SME Development and DCFTA in Georgia' project have set up the Georgian ICT Cluster to help drive the sector's competitiveness. According to GIZ (2020), 90% of customers of ICT companies are local organizations representing banking or retail sectors and governmental agencies. Also, many IT companies work in the online gaming and gambling fields, only developing new applications to serve that industry. Currently, there exists a low awareness of Georgian ICT companies in

international markets. The government should continue to support export and cluster development which will be vital to the success of the digital innovation ecosystem.

5. Relevant Practices

The following practices were identified during the assessment process as noteworthy and potentially positive activities for the ecosystem. As a next step in this process and with further engagement, an in-depth collaborative analysis could identify champions and good practices throughout the ecosystem.

Georgia's Innovation and Technology Agency (GITA)

GITA was created under the Ministry of Economy and Sustainable Development (MoESD) to promote the commercialization of knowledge and innovations and stimulate usage in all fields of the economy. GITA aims to create an environment to grow innovations and high-tech products and develop high-speed internet nationwide. It is the implementing body of the National Innovation Ecosystem (GENIE) supported by the International Bank for Reconstruction and Development (IBRD) (2016-2021), granting Georgia $ 40 million to implement the innovation ecosystem.

Startup Georgia

The program "Startup Georgia" was established by the Prime Minister of Georgia and jointly prepared as a program by the Partnership Fund and GITA. The program consists of an innovative and high-tech component. The high-tech part finances projects up to 100,000 GEL in the following fields, aerospace production, automobiles, artificial intelligence, biotechnology, bioinformatics, computer engineering, computer science, information technology, nanotechnologies, nuclear physics, electromagnetic radiation, robotics, semiconductors, and telecommunications. Startup Georgia project received a total of 726 applications, of which 149 were for high-tech components

Impact Hub Tbilisi

Impact Hub is part of the world's leading social entrepreneurial global network (100+ locations) of collaborators focused on prototyping the future of business and society. It is a co-working space to meet, collaborate, produce, learn, network, create, and is popular among entrepreneurial circles in Tbilisi. Impact Hub is based in Fabrika, formerly a large textile factory and the city's cultural hotspot. It regularly hosts vibrant networking events for the digital ecosystem.

Data Fest Tbilisi

Data Fest Tbilisi is an annual international conference organized by ForSet, Tbilisi Startup Bureau, and Minimaxai about data and communication, bringing together journalists, CSO activists, marketing specialists, business professionals, government officials, data analysts, developers, and designers working with data. In addition, it serves as a platform for sharing the most recent developments in the technology ecosystem.

500Georgia

500Georgia is a world-class accelerator program designed to promote entrepreneurship in Georgia, help develop the tech ecosystem, connect with international networks, and help Georgian companies with their fundraising. This collaboration between GITA, 500 Startups and Bank of Georgia supports technology-focused and enabled firms with global potential. The program is a combination of intensive and remote training over seven months. The top companies are selected to spend four weeks in San Francisco for an immersion experience focused on elevating a global mindset and helping prepare for cross-border expansion. Since its inception in Silicon Valley, 500 Startups has invested in over 2,400 companies.

Women Startup

For the first time in Georgia, with additional funding provided by the European Bank for Reconstruction and Development (EBRD), Bank of Georgia offers women a new program, which will help women realize their business idea or expand an existing one. 25 000 000 GEL has been allocated within the program's scope for the successful realization of women's businesses in Georgia.

AI Georgia

AI Georgia aims to promote and raise awareness of artificial intelligence as a separate field in the country, conducting studies in this area and introducing AI technologies. AI Georgia's mission is to promote and facilitate the adoption of AI in the private sector and open and maintain the dialog between businesses, executive and legislative branches of the state. The purpose of this association is to: disseminate AI in the private sector, conduct and support local or international research; find, recruit or up-skill talent; provide assistance to the state to formulate the legislative framework. In addition, generate and share use cases of transforming business operations from traditional methods to advanced AI across different industries.

6. Stakeholders

Systemic analysis and mapping of actors - Information

Systemic analysis shows that innovation is driven by actors who know its general process and who know what role they play within this process and how this role is integrated with that of other actors.

Collaboration between the main players in the innovation ecosystem constitutes both the basis of the assessment process and the driving force behind the measures taken to build this ecosystem.

Table 4: Systemic analysis and mapping of actors – Information

Here is a sample of relevant stakeholders who were interviewed for this analysis:

	Stakeholders
ENTREPRENEURS	- Optio.AI - PAYZE.io - Pulsar AI - Stack Browser - TTM Group
ENTREPRENEURIAL Support	- Enterprise Georgia - Geolab - Impact Hub Tbilisi - Startup Georgia - Tbilisi Techpark - Total Courage
Private Sector	- Magticom Ltd - Microsoft Georgia - Nexia TA - Silknet JSC
Academia	- BTU University of Business and Technology - Free University of Georgia - Georgian Technical University - Ilia State University

Public Sector	- Georgia's Innovation and Technology Agency (GITA) - COMCOM - Ministry of Economy and Sustainable Development of Georgia - Sakpatenti - Shota Rustaveli National Science Foundation of Georgia - West Point Society
FINANCE	- Bank of Georgia - JSC TBC Bank

Table 5: Stakeholders

7. Ecosystem Maturity Map

Ecosystem maturity map – Information

The Ecosystem Maturity Map, also known as the Innovation Journey Map, sets out at-a-glance the work that needs to be done within the ecosystem to harness innovation on a transformative journey from pre-ideation to high growth. It describes each stakeholder's roles in support of entrepreneurs and innovators at each stage of the life cycle. The colour-coding identifies areas which are well-supported (green), inadequate (yellow) and missing / weak (red).

Table 6: Ecosystem maturity map – Information

Many resources are often wasted because of initiatives developed in isolation without a comprehensive understanding of how ecosystem actors can work together to implement national development priorities.

The ecosystem maturity map in **Georgia** shows an ecosystem in Developing state.

Figure 3: Georgia's ecosystem maturity map

Actors	Cycle Stage				
	PRE-IDEA	**IDEATION**	**START-UP**	**THE "VALLEY OF DEATH"**	**SME**
Entrepreneurs	Entrepreneurial Interest	Engage with Problems	Develop Business Models	Build Collaboration	Expand
Finance	Research Funding	Seed Funding	Angel Investment	Venture Capital	Business Finance and Loans
Entrepreneurial Support	Entrepreneurial Events	Hackathons and competitions	Co-Working and Support	Incubators and Accelerators	Business Association
Private Sector	Success Stories	Research Programs	Labprogramms	B2B & Support Services.	Skill Training Programs
Universities	Community of Entrepreneurs	Basic Research	Spin Offs	Soft Skill Trainings	Human Capital
Public Section	Vision and Strategy	IP & R&D Support	Tax Support	Public Procurement	Trade Policy

Table 7: Georgia's ecosystem maturity map

Profiling key stakeholder actions is necessary to accelerate digital transformation.

7.1 Entrepreneurs

Entrepreneurial interest is a growing trend in Georgia, particularly amongst young people and women. At the pre-idea stage, entrepreneurs start to explore innovation while support institutions such as the Impact Hub and Startup Factory help cultivate their interest by fostering an entrepreneurial culture and hosting gatherings. Some start-ups are finding relevant ideas to work on in the digital ecosystem. However, many are playing it safe and focusing on traditional industries with unsustainable business models. Programs to encourage entrepreneurs to focus on technology-enabled globally scalable ideas are having some success. Many entrepreneurs are gaining the business skills they need through incubators and start-up programs. However, finding technical co-founders can often be a challenge, and requiring the English language is sometimes a barrier.

Due to scarce financial resources and market size, there is little collaboration between innovators. Nevertheless, several entrepreneurs, such as the Tbilisi Startup Bureau, are motivated to act as private sector champions and support the ecosystem's growth. The main challenge on the ground is access to finance, so very few start-ups survive the valley of death to gain the status of high-growth SMEs or successfully exit the ecosystem. Georgia is trying hard to cultivate its first unicorn. To be able to accelerate their digital transformation, entrepreneurs must collaborate, learn continuously, differentiate themselves, and learn English, which will open up a global market to them.

7.2 Finance

Currently, GITA is the primary provider of pre-seed and seed funding, including the Digital Services Prototype grant and Innovation Matching Grants program to promote product, technological, or business process innovation. These grants are popular amongst innovators, and uptake is high. The funding offers the potential for early-stage ideas to develop into start-ups, but with limited angel investment, many companies are unsustainable long-term. The Bank of Georgia provides a range of loans for women founders and start-ups, which helps to slightly alleviate this. High-risk capital is not yet available in the Georgian market, and high-interest bank loans are unaffordable to most entrepreneurs. Furthermore, if innovators manage to cross the valley of death, they cannot access venture capital to grow into SMEs.

The banking sector in Georgia has been championing the ecosystem by providing support programs and investing in digital innovation. However, the government needs to do more to attract international investors. Venture capitalists need a good portfolio of start-ups, favorable regulation, and exit strategies such as good stock market, private equity, or corporate buyers. This needs to be a priority in order for the finance sector to grow.

7.3 Entrepreneurial Support

Several events organized by both the public and private sectors connect and inspire innovators at the pre-idea stage. However, some entrepreneurs feel these are focused on solving today's problems, rather than innovation. At the ideation stage, hackathons and pitching competitions encourage deep-tech and science-based projects and help innovators validate and develop their ideas. However, these entrepreneurs find it more difficult to survive because of the lack of venture financing required for these types of projects.

On the other hand, there is a plethora of support such as incubators, co-working spaces, and programs for start-ups. These allow innovators to work together and access resources and knowledge. These mainly focus on developing the idea, but the real challenge is providing appropriate support to cross the valley of death and scale globally. One international accelerator program has been successful in bridging this divide. However, support networks need to create more success stories to inspire innovators and develop a vibrant ICT ecosystem.

7.4 Private Sector

The private sector in Georgia is aware of successful entrepreneurs in the digital ecosystem. Many firms are trying to support them, but still, some skeptics exist from more established traditional industries. Georgia has an active Business Association which unites more than 600

companies of different sizes. However, the primary purpose is to present and protect the member companies' legitimate and objective business interests rather than support innovation.

Many firms are not engaged in funding research due to a lack of resources and operational focus. The biggest challenge is recruiting and retaining qualified personnel. To mitigate this, some companies have developed comprehensive training programs in-house. However, this mainly benefits individual businesses rather than the ecosystem as a whole. Training programs are viewed as a luxury by some SMEs. The prominent investors in advanced technological research are the banks, which also support the start-up community via programs and sponsorship of external accelerators. Public-private partnerships are the leading providers of support to develop businesses. To help more start-ups cross the valley of death, larger private companies could act as angel investors and help to fill the funding gap.

7.5 Public Sector

The public sector has adopted a leadership role in developing the digital ecosystem. However, the government is not yet providing and implementing a clear strategy and vision visible to all stakeholders. The non-alignment of stakeholders is slowing down digital innovation. The National Intellectual Property Centre is making efforts to raise awareness of and protect intellectual property. For example, Georgia has strengthened the legislative and institutional framework in this area and has introduced best practices in accordance with the EU-Georgia Association Agreement. However, there still exists a culture of piracy, and innovators are reluctant to protect their ideas.

The government has implemented a generous taxation framework that supports entrepreneurship, including a range of exemptions for businesses and several free industrial zones. Companies that export IT services can apply for a Virtual Zone Person certificate exempting them from corporate income tax. In addition, small business status pay tax on only 1 percent of their revenue, and some transactions that have an innovative component are exempt from value-added tax (VAT). Reforms have made public procurement more accessible and transparent, but it does not yet provide start-ups with digital innovation opportunities. The public sector could help strengthen the ecosystem by outsourcing more IT projects, focusing on strong research and development, and creating more success stories to attract investment.

7.6 Universities

Some universities are providing nurturing environments and communities to inspire entrepreneurs. Universities understand their role in the digital ecosystem and have established FabLabs and entrepreneurship centers to provide early-stage support. This vital infrastructure enables young entrepreneurs to test their ideas. In addition, accelerator programs develop the business skills needed by innovators to create start-ups. There are efforts to offer industry-aligned skills, but graduates are not leaving universities with the skills required by innovative businesses, who often have to train their recruits. The lack of human

capital impacts the whole digital ecosystem, as the small talent pool is insufficient to drive innovation.

The main challenge for universities is a lack of funding for academics and research. In addition, there does not appear to be a clear framework to support start-ups based on basic research, so entrepreneurs fail to commercialize research on a large scale. Strategic, long-term partnerships are required to drive academia-industry linkages through internship programs, research activities, or technology transfer.

8. Perspective on Priorities

The high priority objectives for the ICT-centric innovation ecosystem, formulated from the workshop with the main stakeholders of the ecosystem, are presented below.

Common Vision		
Georgia's vision is to create a cutting-edge technology-driven economy with an AI hub that will foster innovation and global competitiveness.		
Strategies		
The development of digital strategies that enable the development of advanced digital services and benefit the population, based on: • A digital economy driven by AI innovation and job creation • Easy access to local angel investment and venture capital • AI-driven competitive advantage for the key economic sectors supporting the economy (agriculture and tourism), for the new digital sectors (fintech), for the social sectors (education and health) extended to all regions.		

	Economic	**Social**	**Political**
	Digital strategies for AI-driven competitive advantage of key economic sectors supporting the non-ICT economy (agriculture, tourism).	Digital strategies for the development of the state services with access to education and health extended in all regions.	Digital strategies that support and protect intellectual property and provide safe access to data.

Table 8: High priority objectives for the ICT-centric innovation ecosystem

Catalysts [2]
Six groups of interdependent catalysts are needed to deliver a new digital vision in Georgia. They help develop and mature the digital ecosystem and align vision with strategies and actions.

Review and update the digital vision, strategies, data protection law, directives, regulatory organizational framework are recommended for adoption.	Establishment of cloud infrastructure.	Implementation of flagship AI projects, development of key sectors and access to the market and network, and direct foreign investment.	Mapping of all stakeholders within the ICT and AI ecosystem and assessment of current resources.	AI technology development programs, entrepreneurship and AI education. Setting up support frameworks for events and the development of AI digital communities.	Establishment of a permanent body to develop AI policy and strategy with long-term goals.
Project: Revision of vision and strategies.	*Project: Cloud Infrastructure for digital innovation.*	*Project: AI initiatives for key sectors.*	*Project: Digital Ecosystem Mapping.*	*Project: Support program for AI entrepreneurs.*	*Project:* *Permanent body for AI policy and strategy.*

Table 9: Catalysts

9. Key Performance Indicators

The strategic vision and recommended programme must address the systemic challenges that hinder the development of the digital ecosystem and its impact. To this end, the table below demonstrates how the recommendations can lead to a credible, measurable, and inclusive impact.

This table is based on the theory of change. This theory is generally used as a planning tool in the innovation cycle, as a way of showing how actions taken lead to change in the short, medium, and long term. It is generally used as a strategic tool for the development of social and sustainable projects but also to measure the concrete impact of government actions.

Desired Impact

A Georgia with a cutting-edge technology-driven economy and AI hub that will foster innovation and global competitiveness. Indicators: *Improvement of SDG indices: 1,2,4,5,8,9,10,11,12*

Long term results	Medium term results	Short term results	Recommendations[3]*
A vibrant digital ecosystem that is favourable to entrepreneurship and innovation, supporting AI. Georgian market has an international reputation as a test bed for AI. *Indicators:* *Improvement of GII, IDI indices* *Improvement of GCI indices* *Improvement of AI Readiness index*	The various regulatory tools, mechanisms and supports are operational. Government leading by example in commissioning AI enabled systems. *Indicators:* *Number of regulatory tools, mechanisms and operational support.*	A review of the digital vision, strategies, supports, laws and directives as well as the regulatory organizational framework recommended is adopted. *Indicators:* A common long-term vision for ICT focusing on AI as a priority, aligned with adopted strategies and recommendations.	DI 1,2,3,4

A vibrant Innovation ecosystem with AI integrated in key sectors. *Indicators:* *Improvement of doing-business indices* *Improvement of GEi indices* *Improvement of AI Readiness index*	Tools for stakeholders, skills, spaces and know-how are present in abundance and support talents across all of the regions. *Indicators:* *The talents of the ecosystem are active and competitive regionally and globally.*	Recommendations on infrastructure flexibility, technology development programs, entrepreneurship and STEM education and digital technology are in place. *Indicators:* *Number of recommendations implemented.*	CI 1,2,3
	Startups and SMEs can deploy their full potential and develop beyond their niche in ICTs. *Indicators:* *Number of startups and SME solutions active in key sectors.*	Recommendations on flagship AI projects, development of key sectors, market and network access, as well as foreign direct financing are in place. *Indicators:* *Number of initiatives and flagship AI projects developed for innovation in key sectors.*	IS 1,2,3

The players are mobilized and collaborate on flagship projects and initiatives. *Indicators:* *Improvement of the maturity of the ecosystem based on the stakeholder interaction grid.*	The measures and mechanisms to search for information on the ecosystem are operational. *Indicators :* *All stakeholders are informed of the activities and resources in the ecosystem.*	A mapping of actors and existing resources. *Indicators:* *Number of mechanisms put in place for development and information research.*	RE 1,2, 3
	The mechanisms and measures allowing the development of digital communities are operational. *Indicators:* *Stakeholders work together to achieve the shared vision.* *.*	Support frameworks for events and the development of digital communities are in place. *Indicators:* *Number of initiatives for collaboration, networking and information sharing.*	CE 1

	Mechanisms and measures to promote new models of public and private partnership are operational *Indicators:* *The necessary resources exist with sound governance for the initiatives.*	An AI body and a secretariat equipped to supervise flagship public and private projects. *Indicators:* *Appropriate governance with a structure equipped to support initiatives.*	PE 1, 2, 3

Table 10: Predicted impact

10.Next Steps

Decisive and active intervention can help transform an ICT ecosystem, making it more innovative and a true driver of accelerated digital expansion in all aspects of society - with real gains in public, professional and personal life.

Stakeholders, based on co-creation and ecosystem priorities, shared recommendations that helped conceptualize the following priority projects.

The value of this assessment - which clearly identifies the main obstacles and catalysts that already exist in the ecosystem - is that it provides the ideal platform for the launch and development of high impact flagship projects. Each of them would help accelerate digital transformation and each would be designed to be of unique relevance to Georgia.

Based on this platform, and as a next step, further engagement is needed to generate a more in-depth assessment to support the creation of a fundable project document. This digital innovation profile provides a valuable first glimpse of both the ecosystem and existing practices. The profile is designed to raise awareness and engage all stakeholders in implementing flagship projects - which in turn fosters an enabling environment for the ICT-centric innovation ecosystem, helping to unleash its full potential and ultimately help bridge the innovation gap.

Annexes

ANNEX 1: Detailed Recommendations

These recommendations are inspired by the co-creation workshops in which all stakeholders participated.

Type	Recommendation	Sub Recommendations	Actions	Direct Key Performance Indicator
DI-1	Establish a permanent mechanism/body to set vision and long-term AI strategy.	This should involve AI and ICT experts from academia, business, and industry (national and international). This body should be provided with political, administrative, and financial support.	Map out AI and ICT experts in Georgia and internationally. Consult the International Research Centre on Artificial Intelligence under the auspices of UNESCO (IRCAI). Gather all AI stakeholders to recruit members and set terms of reference.	A permanent body that meets regularly and is responsible for long-term AI strategy and implementation. A common long-term vision for ICT focusing on AI as a priority, aligned with adopted strategies and recommendations.
DI-2	Develop a long-term AI Action plan to implement the strategy.	Find a good niche, the right focus and competitive advantage where AI can be used.	AI body to identify priorities and strategic economic sectors to focus AI development and allocate resources. Commission implementation agency.	An AI Action Plan with measurable goals and financial resources is implemented and visible to all stakeholders.

DI-3	AI policy goals should support business development, improving government services, and economic growth especially in Georgian key economic sectors.	AI policy should include security, ethics and privacy protection. Develop cybersecurity policies for infrastructure and data as well as blockchains.	The main reference point to AI ethics are OECD and UNESCO recommendations. OECD identifies five complementary values-based principles for the AI: AI should benefit people and the planet by driving inclusive growth, sustainable development and well-being. AI systems should be designed in a way that respects the rule of law, human rights, democratic values and diversity, and they should include appropriate safeguards – for example, enabling human intervention where necessary – to ensure a fair and just society. There should be transparency and responsible disclosure around AI systems to ensure that people understand AI-based outcomes and can challenge them. AI systems must function in a robust, secure and safe way throughout their	A strong AI policy that includes security, ethics and privacy protection. Number of Government commissioned AI enabled systems.

			life cycles and potential risks should be continually assessed and managed. Organisations and individuals developing, deploying or operating AI systems should be held accountable for their proper functioning in line with the above principles.	
DI-4	A review of the current digital vision, strategies, supports, laws and directives as well as the regulatory organizational framework. Ensure a policy environment that will open the way to deployment of trustworthy AI systems.	Georgian law on Personal Data Protection should be reviewed as a priority to enable AI development. Open data initiatives should be encouraged. Development of AI international standards for public administration bodies.	Government should review existing policy to align with international standards (The EU's Artificial Intelligence Act). Review Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL LAYING DOWN HARMONISED RULES ON ARTIFICIAL INTELLIGENCE (ARTIFICIAL INTELLIGENCE ACT) AND AMENDING CERTAIN UNION LEGISLATIVE ACTS	Updated Data Protection Policy to enable AI development.
		IP Policy and implementation should be reviewed. Awareness of IP should be raised within the business community.	The National Intellectual Property Centre should collaborate with other stakeholders to develop an action plan.	Increase in patent applications from businesses. Number of patent applications related to AI.

CI-1	Empower people with the skills for software and hardware development. To enable AI by creating an education system focused on STEM skills.	Support grass roots projects working with children and high school students in rural communities to introduce STEM skills.	Identify and engage with current projects. Assess participation levels and provide support where necessary. Use as a test bed for developing STEM skills for school curricula.	Increased number of children participating in outreach programs. Introduction of programs to school curricula. Improvement in OECD student assessment scores for Science.
		Introduce AI competitions (AI hackathons, robot competitions and STEM Olympics) at schools and universities.	Engage with incubators and support networks to organize and host events. Identify AI experts to support events. Recruit AI Entrepreneur in Residence. Create AI role models and success stories.	Number of events per year. Number of participants and ideas generated. Number of ideas that register as start-ups. OECD student assessment scores for Science.

		Link with international universities to embed their student projects in Georgian companies.	Consult with Georgia universities and organise a project steering to set up and manage an international placement exchange programme. Build partnership with the International Research Centre on Artificial Intelligence under the auspices of UNESCO (IRCAI). Development and use of open education resources. Jozef Stefan Institute has established a UNESCO Chair on Open Technologies for OER and Open Learning. More about this at https://unesco.ijs.si/about/ Promote placement opportunities to Georgia businesses.	Number of international student placements and Georgia companies engaged.
CI-2	Foster accessible AI ecosystems with digital infrastructure	Invest into the development of local Georgian cloud infrastructure.	Develop and support the development of local cloud infrastructure and attract global cloud providers to Georgia. Or move government services to the cloud. Government clouds can operate under direct auspices of the government or could even	Local cloud infrastructure accessible to all ecosystem players.

			be completely owned and operated by the government.	
		Develop a fully operative and country-wide 5G network.	Engage with and support telecoms providers to develop 5G infrastructure.	Fully operative and country-wide 5G network.
CI-3	Prioritise foreign direct investment in the ICT sector.	Continue to offer tax incentives and favourable business regulations for international and local ICT companies especially in the field of AI.	Review existing policies to ensure they remain attactive to both international and local firms.	Number and size of ICT/AI companies relocating to Georgia. Number of new ICT companies registering in Georgia. Number of Foreign Direct Investments.
		Cooperation with large international ICT companies to encourage them to relocate and attract AI talent to Georgia.	Enterprise Georgia should expand relationships with international ICT companies.	Number of Foreign Direct Investments. Number and size of ICT/AI companies relocating to Georgia.

		Attract international angel and VC investors.	Develop relationships with international AI incubators such as Tech Nation in the UK to attract international investment.	International angel and VC investors in the Georgian ecosystem.
CI-4	Create a local angel network in Georgia and a wider culture of business investment.	Create a scheme and tax incentive for individuals and businesses to invest in startups.	Work with the Business Association and stakeholders to promote the scheme. Review best practice examples including SEIS in the UK. Commission implementation agency to manage it.	A virtual and physical network of local angel investors is actively in place. Number of startups and investors registered with the scheme. Number of local investments made.
IS-1	Use AI to improve agricultural output in Georgia.	AI can improve agriculture by helping farmers to grow more crops with fewer resources. AI can improve soil and crop management practices and minimize overall spending by providing farmers with real-time insights from their fields, allowing them to identify areas that need irrigation,	Study best practice examples and assess suitability for Georgia. Pilot small programs and scale if successful. One best practice example of AI use in agriculture is satellite analysis of Earth from Copernicus' Earth observation system. The pilot project (taking place in Slovenia, Denmark, and Austria from 2018 to 2020) has	AI being used in the agricultural sector in Georgia. Number of pilot AI projects in the agricultural sector.

		fertilizer, or pesticide treatment. The result is reduced use of herbicides, better harvest quality, higher profits, and significant cost savings.	developed a prototype of yield map prognosis, automatic detection of crop types, moisture analysis, crop damage, crop cycle (crop evolution among regions with smaller territorial units).	
		Aquaculture is another field, where the use of data and AI techniques can help farmers to optimize their processes.	Pilot research project Aquasmart (taking place from 2015 to 2017) developed tools that can help companies estimate daily biomass better, optimize feeding rates, reduce mortalities and improve management practices for fish production. This project developed online training programs for a highly skilled workforce. The project demonstrated AI-driven optimization of farming processes and AI-based training programs can improve the efficiency and profitability of businesses while reducing the negative environmental impacts of agriculture and aquaculture.	AI being used in the aquaculture sector in Georgia. Number of pilot AI projects in the agricultural sector.

IS-2	Use AI to improve urban water management to improve the lives of Georgian citizens.	The increasing demand for clean and continuous water supply requires constant evaluation of the existing water ecosystems regarding the water supply, wastewater treatment, and reuse potential.	Study best practice examples and assess suitability for Georgia. A pilot project in Skiathos Island in Greece (2017 to 2021) provided monitoring infrastructure for the collection of real-time data across the water lifecycle (for surface water and groundwater), deployment of advanced data mining and data visualization tools, and decision support services for better water management. With the project's solution, stakeholders can monitor urban water resources in real-time while AI technologies support their urban water management decisions.	AI being used to improve the urban water management sector in Georgia.
IS-3	Use AI for mobility data analysis to improve the efficiency of the key sectors.	Artificial intelligence and predictive simulations on anonymized and aggregated data can give organizers of events, transportation planners, policymakers, or businesses insight into their users'	Engage with mobile operators to provide user data that can be analyzed by AI to support strategic sectors. Mobile operators can collect a lot of data about their users, including their locations. This provides an opportunity to analyze the movement flows of mobile network users during the day, on events	Pilot AI projects in strategic sectors utilising AI.

		mobility and habits.	or specific locations. Analysis can also distinguish between users of a mobile operator and users using roaming (for instance, tourists).	
RE-1	Map country resources in the area of research and development to support research and development policy.	Gather universities and research centres to analyize strengths and weaknesses and capacity for AI research.	Good practice: A pilot AI project Science Atlas has provided tools for exploring the scientific community and visualizing the researchers' collaboration and competencies. The project has integrated data about researchers, projects, and organizations from different sources and provides tools for their visualization and analysis.	A comprehensive map of ICT/AI resources in Georgia that is visible and available to all ecosystem stakeholders.
RE-2	Map country resources in the area of ICT/AI development.	Assess AI readiness of Georgia.	Use assessment to support AI strategy and policy being developed by the AI body.	An AI readiness assessment.
CE-1	Twin with AI start-up communities in Europe.	Increase international efforts to establish a strong AI community with solid connections between stakeholders.	Develop relationships with international AI accelerators and communities.	A well-established AI community with solid connections between stakeholders.

		Create public and private sector Initiatives that change failure perception.	Create and publicize entrepreneurial stories that focus on learning from failure. Build on the success of Fuckup Nights Tbilisi.	Number of events focused on failure as a learning tool.
		Organise international events and knowledge exchanges.	Build on events such as DataFest. Organise and host specific events for Women in Technology.	The number of collaborative AI related commercial projects. Equal representation of women in the digital ecosystem.
PE -1	Facilitate public and private investment in research and development to spur innovation in trustworthy AI.	Support programs for developing entrepreneurial culture among researchers.	Learning modules on start-up entrepreneurship need to be provided, facilitated by the private sector and academia.	An increase in AI research within universities. An increase in the number of AI related patents.
		Provide research funding and grants for collaborative industry-led applied AI research.	Targeted support should be provided to foster the development of spin-offs from universities and research institutions.	An increase in AI research within universities. An increase in Tech Transfer and commercialization of research.

PE-2	Open access to government data to support public procurement.	Governments need to be accountable and transparent for their public spending decisions to prevent losses through good governance and build healthy and sustainable economies. Open data acts as a powerful instrument in this respect by enabling authorities, providers, data journalists, transparency activists, and regular citizens to identify fraud or uncompetitive markets through connecting heterogeneous and originally unconnected data sources.	Best practice example: Pilot project TheyBuyForYou (2018 to 2021) has shown that anomaly detection techniques applied over a set of open disparate data sets, including procurement, company, and spending data, provides a viable solution for analysis of public spending. The Slovenian Ministry of public administration uses the developed web platform to support decision-making regarding public spending and legislation governing public procurement.	Number of public procurement calls that target innovative AI solutions.
PE -3	Use AI to improve the health service.	There are several successful AI projects worldwide, including medical data analysis (for instance, in medical imagery), improving clinical workflows, improved cost control, and	Best practice example: One pilot project in 2005 has shown that AI-based methods can help regional public health institutes perform their tasks more effectively and implement decision support methods to plan the development of public health services.	Use of AI in the Georgian health service.

		automating and predicting processes in hospitals.		

Table 11: Recommendations

ANNEX 2: Methodology

This study was carried out using a global comparative framework developed by the ITU for the diagnosis and development of ecosystems centered on ICTs. The analysis of a country consists of five steps which aim to reduce the disparities in digital innovation using a Practical Kit to strengthen ICT-centric ecosystems that allow the definition of common objectives, diagnose the ecosystem, formulate recommendations, set up an implementation framework and propose a monitoring and evaluation method.

The practical kit is available:
https://www.itu.int/en/ITU-D/Innovation/Documents/Publications/PolicyToolkit/D-INNO-TOOLKIT.1-2018-PDF-F.pdf

To develop the recommendations, it is necessary to draw inspiration from good practices from other ecosystems without necessarily copying them.

A good practice is a tested practice that produces an impact based on evidence and positive results and which can be scaled up and replicated. Good practices are needed to help develop flagship projects, benchmark the strengths and weaknesses of a practice, and initiate evidence-based policy or program development. Good practices allow actors to effortlessly add value to initiatives in their ecosystems. However, a good practice should not be reproduced "as is", because every ecosystem and every project is different.

ITU has developed a database of good practices, a framework to better develop these recommendations in a country's ecosystem. For more information, please see: innovation.uit.int or contact: innovation@uit.int.

Table 12: Definition and identification of a good practice

ANNEX 3: Keywords, Definitions, Acronyms and Abbreviations

Key Word	Definition
Vision	The vision defines an ideal to be achieved after a given time. Its objective is to mobilize the stakeholders for its realization while giving the necessary direction to obtain the desired situation.
Strategies	A strategy defines the main axes to be developed in order to obtain the objectives and results towards the vision. The transformation of value chains for each sector with the contribution of digital technology is one of the major research objectives. The strategies should also define the roles and responsibilities of non-digital actors and how their contributions reinforce the defined objectives or sub-objectives. Four pillars of strategies are proposed for sustainable development: political, social, economic, environmental. For each strategy to be developed, it is recommended to develop a theory of change which unites and measures the contributions of the actors.
Catalyst - Dynamics of innovation (**DI**) with digital technology	Measures that allow innovation to exist. They support the general environment for innovation. A dynamic innovation environment needs a coherent **regulatory and organizational framework** that guides, encourages and fosters a culture of innovation, mindset, projects and programs.
Catalyst - Capacity for innovation (**CI**) with digital	Measures that make it possible to have sufficiently developed **infrastructures and talents** within the ecosystem, which will be conducive to digital transformation. They give innovators the tools, skills, spaces and know-how they need to be successful.

Catalyst - Innovation in key sectors (**IS**) with the contribution of digital	Measures that i**ntegrate innovation in key sectors**, so that startups and SMEs can unleash their full potential and expand beyond their niche, making transformation in other sectors possible.
Catalyst - Research in the digital ecosystem (**RE**)	Measures and mechanisms to search for information on the ecosystem, in particular the **mapping** of actors and existing resources.
Catalyst - Knowledge sharing in the digital ecosystem (**CE**)	Mechanisms and measures to share knowledge to accelerate the mobilization and **collaboration of stakeholders.**
Catalyst - Partnership in the digital ecosystem (**PE**)	Measures and mechanisms allowing access to resources and networks, to develop a **public-private partnership model,** to focus actors on ecosystem projects.
Theory of change and indicator development	Measures and mechanisms allowing access to resources and networks, to develop a public-private partnership model, to focus actors on ecosystem projects.

Table 13: Keywords, Definitions, Acronyms and Abbreviations

[Please insert any other keywords used within the DIP]

[1] A post-ideation period when innovators need significant investments and a lot of support, and the risk of business failure is high.

[2] Enablers.

[3] An annex to this report exists in a separate document and details the recommendations and methodology used, as well as other information useful to the sponsor of the report.