AT Innovation Ecosystem Design - A Kenyan Case Study

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Abstract

Innovations within the AT space frequently fail to get to market and therefore to the people who could benefit from the products. The Scoping Report which underpins the AT2030 programme identified the need to test and develop "what works" for AT innovation to ensure new products, services and approaches are able to scale and reach people, especially people living in low- and middle-income countries. This paper sets out the initial thinking for an East Africa Innovation Ecosystem. We present the emerging thinking from initial scoping exercises and product trials which have helped to shape the newly launched Innovate Now ecosystem. We outline the ecosystem including the core elements – the accelerator programmes and Live Labs. Live labs will allow for rapid innovation testing and user feedback. Thus, increasing user-involvement in the design and development process, and reducing the time to market. The Innovate Now ecosystem is growing and is being led by AMREF. Successful graduates of innovate Now will be connected into the Innovation Scale Fund which will be launched by AT2030 next year (2020).

1. Introduction

As part of the AT2030 programme, an inclusive innovation ecosystem in Nairobi, called Innovate Now, is being developed with a focus on Assistive Technology (AT) and disability inclusion. The aim of AT2030, which is funded by UK AID (UK Department for International Development) is to test "what works in AT" to create a lifetime of potential. The Innovate Now ecosystem is being led by AMREF Enterprises and has been co-developed with a wide range of actors in east Africa and beyond. Those consulted include policy makers, entrepreneurs, academics, manufacturers and investors. The investigations have been led by UCL, GDI Hub and the University of Nairobi with support from NGOs, industry collaborators (e.g. GSMA), Tech Hubs, Investors and the Kenyan Government.

This paper briefly reviews the context for establishing the Innovate Now ecosystem, explaining the approach taken, and describes the elements which make up Innovate Now along with the future plans for AT innovation within the broader context of AT2030. In the remainder of this introduction the background to Innovate Now is explored. In section 2 we present the approach taken to designing and developing Innovate Now, including the use of interviews and initial trial designs and

in section 3 the findings are given. Section 4 discusses next steps for disability interaction through novel innovations.

The changing nature of AT

Innovators are increasingly being encouraged to take challenge-led approaches to the design of new technologies. Tacking inclusion for people with disabilities is one such challenge (1). This is helping to change the nature of Assistive products (APs). This change is also being driven by advances in digital technologies which are enabling new methods of screening, manufacture and distribution of devices; as well as new devices themselves. Furthermore, there is a trend for increased inclusivity in mainstream products through the application of universal design principles (1). Examples of recent innovations in this space include Office 365's new range of accessibility features which allow for automatic captioning of presentations as well as compatibility with eye-tracking devices. Finally, change is being driven by new forms of interaction which are now possible (e.g. gesture control). Within the more traditional spaces of AT e.g. wheelchairs and prosthetics, digital manufacturing practices are enabling new approaches to the design, development and distribution of products. For example, Motivation (2) have leveraged 3D printing to design new wheelchair seating and AMPARO (3), NONSPEC (4) and DREV (5) are driving innovations in prosthetics. However, despite this progress, 90% of people do not have access to essential priority assistive products (6). Within the AT2030 programme we are looking to understand the reasons for innovation bottlenecks and develop tools and approaches to overcome these.

AT is also being influenced by the ubiquitous nature of mobile. Within the last decade, mobile phones have become one of the most ubiquitous piece of technology in the world (7). Driven by a low entry price, flexibility of application and reduced need for physical infrastructure to support network operations, several LMICs have leapfrogged directly to mobile phones. This is in contrast to the relatively low rates of adoption of earlier technologies such as broadband Internet and the Personal Computer. This has created a unique situation which Governments, NGOs and the private sector have sought to leverage. They have worked to use the power of mobile technology to roll out innovative products and services that can a widespread audience in a very short time span. The most notable case is the diffusion of mobile banking services in Sub-Saharan Africa which enabled an unprecedented number of people to access better financial services which have subsequently led to significant reductions in poverty levels of individuals (8).

National and international organizations in the private and public sector have been quick to grasp the potential for mobile to spearhead innovation. Several initiatives for mobile developments have been established around the world. The most notable is the "Mobile for Development" initiative led by the Group Special Mobile Association (GSMA) that aims to promote sustainable businesses working in the mobile space that have the potential to deliver significant socio-economic impact towards all 17 SDGs. In the 10 years of operation "Mobile for Development" has supported social enterprises operating in mHealth, agriculture, digital identities and women's rights. Over the past year, and in collaboration with GDI Hub through AT2030, increasing attention has been placed in understanding the potential role of mobile phones as ATs and how mobile technology could deliver a significant impact on the lives of people with disabilities across the world. Example innovations include new screening approaches - Hear X(9) and Peek (10) which use mobile as a screening tool for hearing and sight loss respectively. Despite these and other advances, many innovations remain focused on high income countries and only available to smartphone users which are not predominantly used by people with disabilities especially in low income settings (11).

One area which will drive the future of innovation is where the innovation takes place – we therefore next review the emerging innovation hotbed that is Silicon Savannah to assess its ability to deliver an AT Innovation ecosystem.

Leveraging Silicon Savannah for AT Innovation

Tech Hubs are expanding rapidly in Africa. Research for the 2016 World Development Report tracked 117 individual Tech Hubs across Africa (12). The Nairobi innovation ecosystem started in approximately 2010 with the establishment of iHub and has thrived in part due to the decentralised nature of the Hubs, which follow a "Community-centred approach" (12). This community-centred approach is driven by demand and market need and has flourished with limited involvement from Government. Similarly, most of the Kenyan-based Tech Hubs sit outside of academic institutions. Despite this, recent analysis from the World Bank shows that a "balanced partnership" with Government and academic institutions "boosts sustainability for both hub and incubator models". The same report singles out the opportunity for tech hubs to partner with academic institutions to ensure a deeper connection to the innovation community and ensure connectivity to operating models which are better able to harness the burgeoning innovation within the ecosystem (12). This therefore shows an opportunity for Innovate Now to create a balanced partnership of Government and academic institutions as well as Disabled People's Organisations (DPOs), Non-Government Organisations (NGOs) and the private sector actors within the AT space. We propose to do this through the creation of an innovation ecosystem.

What is an innovation ecosystem?

An innovation ecosystem (IE) comprises two distinct and traditionally separate economies – the research economy and the commercial economy (13). Innovation ecosystems are diverse in type and can mean different things to different people. A challenge of innovation ecosystems is that they can frequently fail to define upfront their success criteria, which makes it difficult to compare them to one another or to understand when they have been or haven't been successful (13).

To overcome these potential challenges, Innovate Now aims to use initial research to set a definition of Inclusive Innovation and develop metrics which we will be measured against to derive how successful we have been, and where we need to improve. In taking this approach we hope to build on the following advantages of IE thinking identified by (13):

- allow for a geographical shift in innovation activity - in our case to East Africa;
- Motivate successful projects;
- Develop helpful systems thinking in our case across the AT space;
- Contribute to high-tech economic regional development in Nairobi and East Africa;
- Contribute to the global thinking on technopolis and innovation.

This broader community of innovation (which has become Innovate Now) has and will embrace knowledge/research ecosystems which exist within the Universities and public research institutes within Nairobi. Furthermore, it looks to develop close ties with Charities, DPOs and NGOs who are frequently best connected to AT users and know best the benefits and limitations of the systems and environments in which APs are used.

The need for an inclusive innovation ecosystem?

Diversity and inclusion (D&I) are known levers for driving innovative products, services and business solutions (14). However, evidence of successful inclusive innovation is patchy (14). In the initial scoping work undertaken for the AT2030 programme a recurring theme was the need for user-involvement across the design, development and deployment of AT. The lack of user-Involvement in

the design of APs has been shown to increase abandonment rates (15). Abandonment rates in high-income settings such as those across Europe are high – the generally accepted rate of abandonment is 30% (16). This figure could well be higher in lower-income settings were drivers, such as poor infrastructure, hinder the usefulness of products and poverty can drive short-term gain in the form of sale of the AP for cash. Sale of the AP can also be driven by a lack of usability of the product due to limited training and a hostile environment making it unusable.

User-centred design can take on different levels of involvement from informants to full co-design. Full co-design is known to be much more successful however it takes time and there is a learning curve between designers (who need to better understand the users) and users (who need to better understand the jargon used by designers) (17). Methods can be developed to help bridge this gap such as those proposed by (17) who shared information with both sides ahead of a co-design session leading to increased efficiently in the co-design process. It should be noted that co-design must take account of the full ecosystem of service delivery and should therefore also engage healthcare professionals (who will provide AP selection support, training and rehabilitation care). Ensuring close cooperation in the early stages of design between healthcare professionals and designers is known to make the products much more usable (18).

This upskilling of people – both designers and users – must be incorporated within the ecosystem, and it must go further, empowering users to become designers and well-informed co-designers by providing open access to digital skills development and business curriculum. Digital skills development must provide access to new manufacturing and prototyping methods such as 3D printing but also skills to take advantage of mobile. This is one element of Innovate Now which will help ensure innovations better reach the marketplace – by providing the testing resourced through co-design to give space for design iteration and also for failing. Failing fast and going 'back to the drawing board' must be encouraged if we are to see the best ideas reach people who need them.

Designing to overcome the Valley of Death

Once a design has been proven – there is a proof-of-concept – the next huge hurdle for innovators is to show a market fit for their innovation. This hurdle is a part of the Valley of Death (VoD). The VoD for AT is known to be longer and deeper for AT (19). This is in part because it has often been seen as a "niche" market and niche markets are known to require outside entities to provide the necessary resources to enable the transfer of technology from producer to consumer (20). It is further compounded by the fact AT is often delivered through a Service Delivery Method (SDM). This problem is discussed by (21) who highlight that end users are not the ones who decides whether their needs have been met, and products are chosen from a prescribed list. This results in the SDMs themselves becoming a barrier to innovation (21). Furthermore, *'chicken-and-egg' challenge* can results in AT marketplace – industry, especially SMEs are *"reluctant to invest in products without an expressed demand from service providers, whereas service providers cannot get engaged unless there are products to work with" (21).* We intend for Innovate Now to address the full ecosystem in which AT is privded included the service delivery methods.

2. Approach

Scoping the ecosystem: Innovate Now

Innovations within the AT space frequently fail to get to market and therefore to the people who could benefit from the products. The Scoping Report (22) which underpins the AT2030 programme identified the need to test and develop "what works" for AT innovation to ensure new products,

services and approaches are able to scale and reach people, especially people living in low- and middle-income countries.

The initial business case for AT2030 made provision for an Inclusive Innovation Hub development within Nairobi. However, following a 3-week scoping trip in Nov 2018 the idea of a Hub was transformed into one for an ecosystem. The reasons for this were:

1. There are already a number of hubs within Nairobi all of which have the potential to support AT innovators. However, only one AT innovation was identified that had been supported by the Tech Hubs within Nairobi despite great enthusiasm to better support such innovations.
2. Hubs noted turning away innovators with ideas who were disabled due to a lack of facilities to support the innovator including one case of a lack of sign language interpreters. This supports the need for a wider inclusion agenda across the Tech Hubs in Nairobi and beyond.
3. There is both a top-down (i.e. has the support of the Kenyan Government) and bottom-up desire to support AT innovation. This is demonstrated thorough the recent formation of the Association of Start-up and SMEs Enablers of Kenya (ASSEK, www.assek.ke)
4. AT innovation and inclusive innovation more broadly are seen as exciting areas to explore and ripe for investment within the African context, and the Government of Kenya were supportive of the ecosystem approach.

Key criteria for leading the Innovate Now ecosystem were developed. These are:

*   Experience of delivering accelerator programmes;
*   An East Africa network;
*   Experience within the AT (or health) sector;
*   Access to AT users;
*   Desire to become part of a global programme.

Possible lead partners were approached and the idea for Innovate Now discussed. Following this initial round of discussions AMREF Enterprises were selected as lead partner for Innovate Now and a Director was identified. AMREF are now building the wider ecosystem partnership with the support of the University of Nairobi, Government of Kenya, GSMA and GDI Hub.

In parallel with the scoping trip a number of interviews were conducted with innovators, investors and AT experts. These interviews helped to develop our investment thesis for the Assistive Technology Innovation Scale Fund (AT-ISF). The AT-ISF will issue grants to innovators to enable them to gather the required evidence necessary to scale their AT solution. The AT-ISF will be available to graduates of Innovate Now as well as innovators globally.

Learning from the early Product Innovation Trials

The Innovate Now ecosystem has been further enhanced through learning from the design of two trials of novel AT. One, the design of a thermoplastic socket for lower-limb amputees, and the other supporting testing of 3D printing and local manufacturing of wheelchairs. The product innovations have been led by AMPARO, an innovator-led start-up, and Motivation (an NGO and Social Enterprise), respectively. AT2030, through the UCL-led team, has worked to develop trials which would enable the impact of the innovations to be tested with AT users. Conducting these trials before starting the Innovate Now ecosystem allowed us to fully understand "what works" when developing testing protocols in Kenya/East Africa? These early trials have also allowed us to develop partnerships with testing sites. The trial partners are shown in Table 1.

Table 1: Partnerships used to test products

Innovator	AMPARO	Motivation
Study Design Support	GDI Hub & Oxford Clinical Allied Technology and Trial Services Unit (OxCATTS)	GDI Hub
Testing partners (trial sites)	APDK & Cure Hospital	Bethany Kids
Local research partners	APDK & Cure Hospital	University of Nairobi

Through the initial trials with AMPARO in particular we have discovered:
- Start-ups and NGOs have benefit from assistance in developing detailed protocols for clinical trials and implementing these
- A partnership co-design approach ensures a robust strategy to collect strong evidence for research purposes, which develops investment case
- Obtaining ethics approval requires time and support from both the research team at GDI and in-country organisations
- Setting up collaborations with sites for trials can be difficult for individual organizations and could be facilitated by the Innovate Now Ecosystem once in place
- Development of guidelines and walkthroughs explaining requirements for research and study designs could be extremely valuable for future start-ups supported by the Innovate Now Ecosystem.

We are currently conducting the Motivation trial which will conclude this year and will further enhance our learning.

Developing focus through Innovation Deep Dives

The Innovate Now ecosystem has been and will continue to be informed by other areas of the AT2030 programme. Specifically, the innovation deep-dives are helping us to develop challenges and specific areas which require focussed innovation. These are being conducted alongside work to develop product-specific narratives ('product narratives') of marketplace conditions globally for wheelchairs, hearing aids, glasses, lower-limb prostheses, and mobile with accessible software. The product narratives work is being led by the Clinton Health Access Initiative.

The innovation deep dives consist of a series of interviews with innovators within a specific AT domain. By interviewing current start-ups, innovators, established manufacturers and key opinion leaders in each field, we aim to scope out the current innovations occurring in each technology field with a focus on products and services aimed at LMICs. We are looking to assess what technologies and innovations are driving major changes, what products will be available in the next 10-15 years, and what aspects of design and delivery are stagnating or causing barriers to the successes of related innovation, and their potential to scale up. As these are completed new innovation challenges will emerge for innovate now to tackle. We welcome collaboration on these and will be publishing results on the AT2030 website (www.AT2030.org).

3. Findings

The design of Innovate Now – from Hub to Ecosystem

The innovate Now ecosystem has three areas of work - all of which help to overcome the valley of death for AT innovation (see Figure 1).

Figure 1 shows the journey of an idea from concept (left)to sustainable growth (right). When an idea is formed it is at the origin of the graph it has not yet made a profit or loss. However, as the idea is explored through design and development losses are incurred, these are often subsidised by grants, which often develop an idea to proof-of-concept. The proof-of-concept then needs to demonstrate a product-market fit through the validation stage. This is where Innovate Now will be active through three elements:

1. **An Accelerator Programme for AT entrepreneurs** - the first call will support 10-20 innovators in the later part of 2019 providing business and marketing development; supporting the design of experiments; legal and IP support; as well as the provision of domain specific expertise and study design (building on what has been learned from the early product trials).

2. **Live Labs** connected to the Accelerator will be series of Live Labs – these are spaces where AT users can test and give rapid feedback to innovators on new AT ideas. Live Labs will be established in places where there is already a large number of potential AT users e.g. hospitals, which are willing to support testing) and the idea is to cluster innovators around live labs themed by area of intervention.

3. **Capacity Building of the Innovation Ecosystem in East Africa** through the creation of an inclusive innovation mission across the ecosystem is the final element of Innovate Now. The Innovate Now Director will advocate for AT innovation and network and connect existing programmes of work. A Steering Committee of key regional partners and investors will make recommendations for investment and backing of approximately 2-3 businesses per year who graduate from the Accelerator.

These three elements will be essential in ensuring validation of a product-market fit. Growth will be available through the Assistive Technology Innovation Scale Fund innovators globally, including those coming out of the Innovate Now ecosystem.
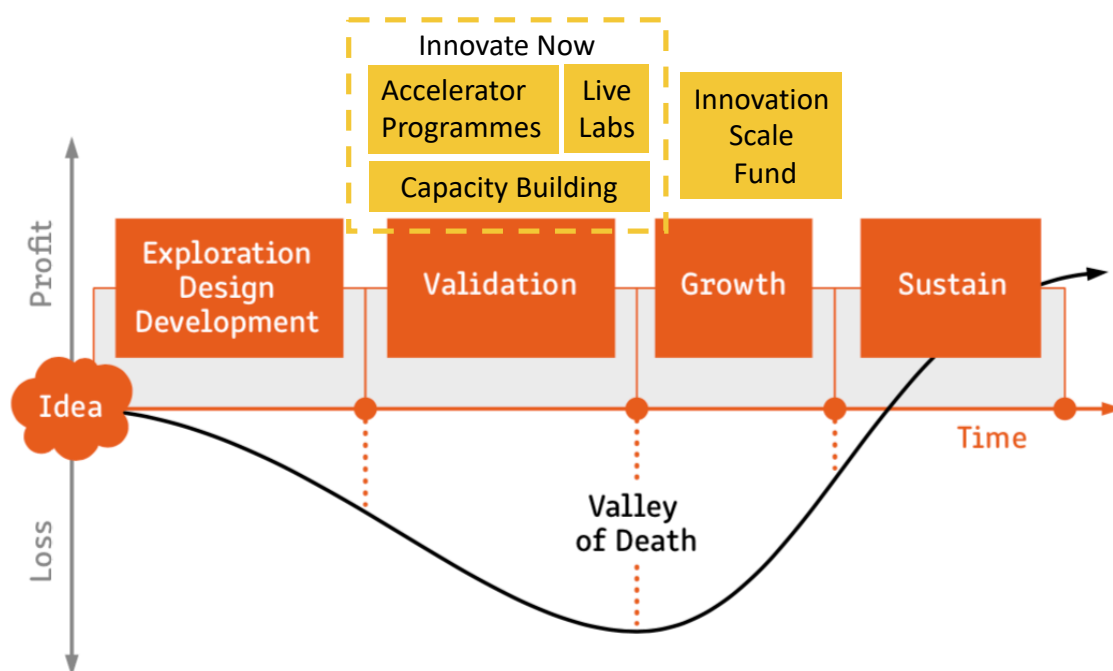

Figure 1: Innovate Now Ecosystem

Innovate Now was launched earlier this year and showcased at the Mobile 360 global conference in Kigali. Applications for its first accelerator programme are now open. Over the next 6 -9 months a second call will go live and our first round will graduate. Each round will further inform our model and research findings.

As was shown earlier for an ecosystem to be successful there must be clear impacts and outputs. We have defined the following metrics, which will determine if we are successful or not over the enxt three years:

- Supported over 64 start-ups creating 40 sustainable businesses
- Reached (impacted) 300,000 people
- Ensures 25% of start-ups are scaling

Developing the details of Innovate Now

The Innovate Now ecosystem will draw upon a wide range of partners to be able to deliver the expertise needed to prove a market fit for innovations. A key part of this is developing the clinical testing protocols in such a way that they provide the level of evidence needed with minimal cost. For this the Innovate Now programme will continue to draw on the expertise of Oxford Clinical Allied Technology and Trial Services Unit (OxCATTS) based at Oxford Brookes University. OxCATTS will provide multidisciplinary expertise in clinical trial case development design, set up, management and translation for the accelerator programme in a smart modular format so innovators can choose individual or a suit of modules to meet their bespoke needs. The support will be tailored to individual businesses, organisations or projects, working in close partnership to configure the trials, the service activity modules delivered and the level of support. Support covers bespoke modular units for individualised customer needs, through to full-suite trial management, providing rapid cost-effective solutions. Expertise of OxCATTS includes: design, health economics, statistics and data management and analysis, regulatory and governance needs, trial management alongside stakeholder involvement and engagement. The Innovate Now ecosystem will also offer a range of testing sites, each with a dedicated product or disability focus.

The second core strength of innovate Now will be in AT business model development and new financing possibilities which are being co-developed by AMREF and GDI Hub. Financing will be available through the ecosystem including access to the AT-ISF to provide investment to businesses which demonstrated a market fit, received initial investment, and have some revenue stream but require further investment to scale. Finally, the AT innovators will have access to global expertise through the AT2030 partners.

The AT2030 partnership and the programme will continue to identify innovation gaps, which in turn will be answered though Innovate Now through new challenges. These in turn will drive innovations, which, through unique partnerships, will be helped to reach the marketplace and ultimately impact AT users lives in a positive way. As more AT users engage more actively in society, new challenges will be presented. This cycle is detailed in Figure 2.
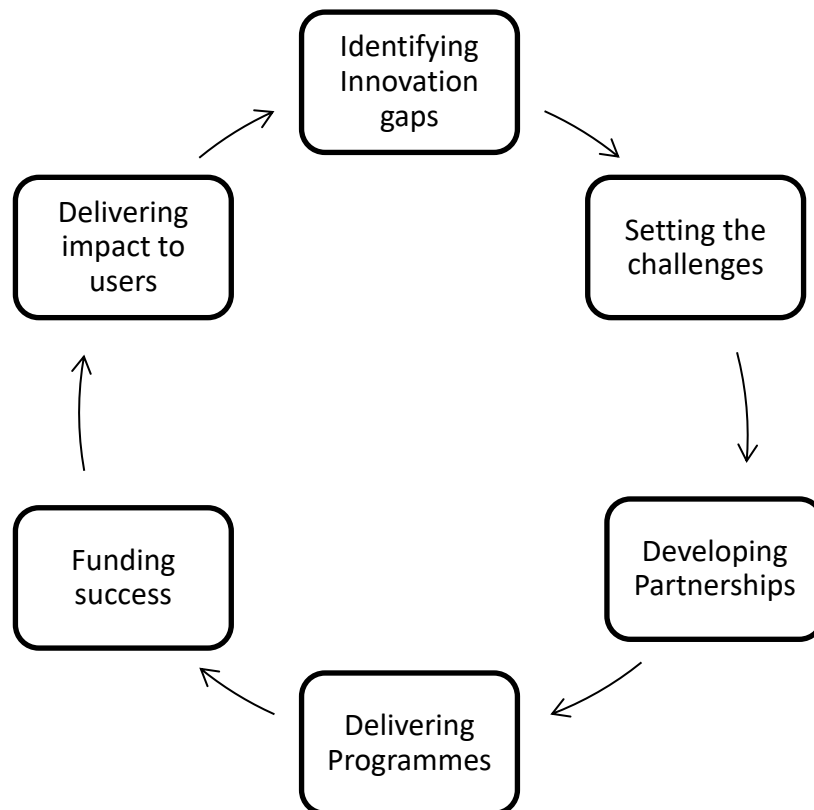
Figure 2: Innovate Now process for driving successful products to market

4. Discussion

Helping to foster a global AT innovation ecosystem

The future success of Innovate Now will be determined not only by what happens in East Africa, but also by the global landscape of investment into AT. We aim to work with the research sub-programme of AT2030 to help drive a reimagining of the financial-political landscape. This work has recently been set out in a working paper (23). It will explore industrial and innovation policy landscapes which will be enable the thriving of the AT value chain through challenge led missions. Such challenge-led policies are able to embrace the barriers that often exist when interacting with multilevel systems (23). This is essential when dealing with ATs as such innovation crosses into multiple sectors and requires the participation of a range of stakeholders as has been demonstrated already within the formation of Innovate Now. Innovate now's success will ultimately be found through partnerships which deliver evidence and leverage investment.

Conclusion

The core elements of the Innovate Now ecosystem have now been established and are the accelerator programmes and Live Labs. The accelerator will provide both commercial and research support. Live labs will allow for rapid innovation testing and user feedback. Thus, increasing user-involvement in the design and development process. The innovate Now ecosystem is growing and is being led by AMREF. Successful graduates of innovate Now will eb connected into the Innovation scale fund which will be launched by AT2030 in 2020.

The innovation ecosystem will continue to take a challenge-led approach to deliver new forms of disability interaction and new AT. In doing so it will drive the thinking behind *undisciplined* research, which looks to go beyond traditional thinking to tackle the wicked problems facing the achievement

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of the SDGs (1). Through a partnership approach it will deliver new AT to market with the aid of the new Assistive Technology Innovation Scale Fund. Finally, it will actively pursue new challenges as they emerge – many of which will have a digital focus.

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