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The Creation and Management of Innovations in Healthcare and ICT: The European and African Experience

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Keywords
Innovation creation · Innovation management · Frugal innovation · Healthcare and ICT · Systematic early dialogue

Abstract
The purpose of the study was to gain new insights into innovation systems by comparing state-of-the-art of existing approaches of innovation creation and innovation management in healthcare and ICT. It is unique, in that it compares countries in Africa with countries in Europe in order to identify similarities and differences regarding the creation and management of innovations. The main similarity is that early dialogue between different stakeholders was underrepresented during the whole innovation process in all countries. Our results also indicated that the various stakeholders often work in silos. The main difference was that the countries face problems at different stages of the innovation process. Whereas European countries face more problems in the innovation creation process, African countries experience difficulty sustaining and managing innovation. To overcome barriers, we suggest the application of systematic early dialogue between all key stakeholders.

Introduction

The 2008 financial crisis and the economic and public debt crises that followed [1, 2] put countries around the globe under immense economic pressure [1], with many facing a reduced gross domestic product (GDP), increasing public debt, a higher unemployment rate, reductions in recourses, and increasing poverty. Furthermore, the

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crisis caused major threats to global public health [3]. The impact it had on national economies and the responses it evoked greatly differed between developed countries and middle- and low-income countries [4].

In addition to recovering from the 2008 crisis, the European Union (EU) member states are challenged by stagnating population growth [5]. An aging population is expected to negatively impact economic productivity. An aging society also poses challenges to healthcare systems [6]. Conversely, African countries are facing challenges due to growing populations. It is expected that half of the global population growth until 2050 will occur in Africa [5] as its population is predicted to increase from 294 to 742 million by 2030 [7]. There, the rapid change in demographics is set to present challenges to healthcare, too.

To overcome the challenges the world is currently facing, there is a pressing need to find new sources of growth [7]. Innovation is seen as the key to achieving long-term economic growth since it provides the foundation for new businesses, creates new jobs, improves processes and products, and contributes to poverty reduction [7, 8]. It also impacts health, the environment, and other policy areas that are important to the well-being of citizens [7]. Therefore, innovation can play a pivotal role in addressing many of the developmental challenges [9] and is considered an important pillar of development [10]. It is thus not surprising that policy makers, researchers, the industry, and civil society place innovation high on their agendas [7].

Our understanding of innovation has changed dramatically over the last decades. It is no longer seen as a linear process limited to national borders [7, 11] but as something that occurs in a complex ecosystem, in which different actors, such as large and small companies, universities and research institutions, venture capital and funding organizations, and governments continuously participate and interact on a national and increasingly global stage [7, 12]. Despite the challenges that countries have in common, their innovation performance differs greatly. Mature innovators, such as the USA and Europe, are challenged to keep up with the innovation performance of new emerging markets, especially in east Asia.

Differences in the diffusion of innovations between countries and continents highlight the fact that innovation appears in open and innovation-friendly environments and is determined by infrastructure, workforce, and values as well as attitudes towards innovation and new technologies. Legislation, governmental support, the capacity to invest in research and development (R&D), and the success of funding schemes are also critical [11, 13]. Governments can play a crucial role in creating an innovation-friendly environment by promoting effective resource allocation in R&D while considering factors such as workforce quality, financial markets, knowledge creation and diffusion, and avoiding blanket cuts to public expenditure [7, 11].

Study Background

Since innovation is the key for improving quality of life and maintaining competitiveness on the national and global market, the interdisciplinary research project *innXchange* (Increasing Innovation Potential by European-African Cooperation) aimed at building the capacity for innovation creation and innovation management in African (i.e., South Africa and Kenya) and European partner institutions (Germany and The Netherlands). Countries were chosen based on their innovation performance. The Netherlands and Germany are ranked in the top 10 most innovative countries in the world (in 2nd and 9th place, respectively); South Africa and Kenya are the highest-ranked of the Sub-Saharan African countries (58th and 78th, respectively). It is important to point out that the countries chosen do not represent the 2 continents, but rather specific blocks of countries with similar rankings [14]. The 4 participating countries are members of the ERA-net ERAfrica scheme that funded this project. They had a shared interest in allocating funding to study specifically interfacing challenges in innovation in healthcare and ICT, and therefore decided the collaborate on this project to assist the relevant organizations to improve their capacity and/or their enabling environment for research and innovation.

The innovative approach of *innXchange* was to gain new insights into existing innovation systems by exchanging perspectives and comparing state-of-the-art current innovation creation and innovation management approaches in the healthcare and ICT sector in African and European countries.

Our hypothesis was that differences exist in the way innovations are created and managed in African and European countries. Healthcare and ICT were chosen as study fields due to their high innovation potential. The conjunction of healthcare and ICT, in particular, has changed the landscape of traditional healthcare approaches in recent years. New ICT solutions allow the generation of large amounts of data, also known as "big data", which are increasingly used to improve the understanding, diagnosis, treatment, and prevention of diseas-

Table 1. Methods and experts' profiles

Innovation camps (case studies)	Innovation camps were organized in all countries at the same dates (a 2-day workshop) There were 15–20 participants per innovation camp in each country Experts were invited based on their expertise in innovation and healthcare and ICT Participants discussed the 4 different case studies and shared their expertise on innovations in healthcare and ICT **Topics:** M-health/e-health tools to overcome the shortage of healthcare professionals (South Africa) Uptake of digital solutions by healthcare systems (Kenya) Diffusion of "-omics" technologies and personalized medicine (The Netherlands) Acceptance of emerging ICT and healthcare technologies (Germany) **Expert Profiles:** Senior researchers, CEOs of SMEs, policy-makers (incl. the European Commission), medical doctors, experts in big data and data science, HTA experts, representatives of pharmaceutical companies, NGOs, funders, and PhD students
SWOT analysis and complementary survey	In total, 40 invitation e-mails were sent to selected experts in the field Ultimately, 23 out of the 40 invited experts from the 4 countries participated (a response rate of 57%) We aimed for equal gender representation but according to the availability of the experts, more men participated in the study There was an age range of 25–60 years Interviews and complementary surveys were conducted via phone or in person over 2 weeks (07.03.2016–18.03.2016) Interviews were conducted by the country project coordinators, following a semi-structured questionnaire **Expert Profiles:** Senior researchers, CEOs of SMEs, policy-makers (incl. European Commission), medical doctors, experts in big data and data science, HTA experts, representatives of pharmaceutical companies, NGOs, and PhD students

es. Furthermore, ICT solutions have enabled patients and citizens to take an active role in the treatment process. New ICT solutions in healthcare are seen as promising tools to make healthcare systems more efficient and effective, with substantial benefits for both public health and the economy.

Methods

A manifold methodological approach was applied to collect information to provide an inclusive and detailed picture of how innovations in the ICT and healthcare sector are created and managed in the participating countries from Europe (Germany and The Netherlands) and Africa (Kenya and South Africa). We defined innovation according to the 3rd edition of the Oslo Manual as: "…the implementation of a new or significantly improved product (goods or services), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations…" [15]. For the purpose of the study, the project partners agreed to divide the innovation process into 2 parts. The first is the creation part, from first idea (to invention) to innovation to market, hereafter referred to as innovation creation. The second part is called innovation management, which covers the technology transfer/uptake from market to implementation.

The project started with a narrative literature review to determine the status quo of innovation creation and innovation management in the 4 countries. Based on the literature review, semi-structured interviews and a survey were conducted. The interviews were designed as an analysis of strengths, weaknesses, opportunities, and threats (SWOT). The survey was conducted to highlight gaps and needs in the innovation process in these countries. To retrieve insights from different points of view, 40 experts, representing different key stakeholders (Table 1) from the 4 participating countries, were invited to participate in the interview in person or via phone. These experts were asked to fill in a complementary survey consisting of 22 open and closed questions related to innovation creation and innovation management. Verbal informed consent was obtained from all participants before the interview and survey.

For the second part of the project, the project partners organized "innovation camps" (ICs) in each participating country. High-level representatives from the different key stakeholder groups were invited to participate in the camps, and 15–20 experts (Table 1) participated in the ICs in each country. The project part-

Table 2. *innXchange* key findings

	Africa		EU	
	South Africa	*Kenya*	*Germany*	*The Netherlands*
Innovation Creation	Frugal innovation (local needs) Innovations mostly appear in undefined settings outside of industry Silo thinking A lack of governmental support A lack of financial support Gaps in education A lack of innovation literacy and empowerment	Frugal innovation (local needs) Innovations mostly appear in undefined settings outside of industry Silo thinking A lack of governmental support A lack of financial support Gaps in education A lack of innovation literacy and empowerment	Innovations appear in predefined settings (mainly in industry) A lack of creativity (society is often sceptical about innovation) Silo thinking Unsupportive innovation environment A lack of financial support/inappropriate funding schemes Inappropriate regulation/ overregulation A lack of governmental support	Innovations appear in predefined settings (mainly in industry) A lack of creativity Old Boys' networks Power on innovation agenda Silo thinking A lack of financial support/ inappropriate funding schemes Inappropriate regulation A lack of governmental support
Innovation Management	Silo thinking Corruption A lack of governmental support A lack of IP rights infrastructure/regulation Complex bureaucracy Gaps in education A lack of innovation literacy and empowerment	Silo thinking Corruption and mismanagement A lack of governmental support A lack of IP rights infrastructure/regulation Gaps in education Failure to sustain innovations A lack of innovation literacy and empowerment	Silo thinking Inappropriate regulation A lack of financial support/ inappropriate funding schemes A lack of governmental support	Silo thinking Inappropriate regulation A lack of financial support/ inappropriate funding schemes A lack of governmental support

ners developed 4 case studies (for topics, see Table 1), which addressed different parts of the innovation process in the healthcare and ICT sectors. Two case studies addressed the process of innovation creation in South Africa and Germany while the other 2 focused on innovation management in Kenya and The Netherlands. Participants were asked to share their beliefs and suggest potential solutions for the problems presented in the case studies. The project partners decided to have a European and an African country in each part of the innovation pipeline, in order to be able to make cross country comparisons.

Results

To present the findings from the semi-structured interviews and ICs, the project partners decided to present the main similarities and differences between the 4 participating countries in both phases of the innovation process separately. They divided the process into innovation creation and innovation management (Table 2). In total, 23 of the 40 invited experts participated in the interviews and survey (a response rate of 57%).

Innovation Creation

By analyzing the results of the interviews and the ICs, the following similarities were identified. Participants believed that there are great opportunities in both African countries to innovate, especially in the healthcare and ICT sectors. Furthermore, the African participants highlighted the importance of frugal innovations and frugal mindsets to address the challenges the countries are facing. Particularly in environments with resource constraints, frugal innovations are urgently needed. Despite the discussed potential for innovation in Africa, several barriers were indicated. The main barriers to innovation creation that all countries had in common were a lack of government and financial support and a silo mentality. In Kenya and South Africa, the low level of innovation literacy and citizen empowerment were highlighted as factors hindering or slowing down the innovation creation process. The African countries also experienced a lack of regulatory and legal frameworks that would support innovators in bringing innovations to the market.

Most of the European study participants shared the opinion that, in comparison to Africa, the EU seems to be less creative and that mindsets are often too traditional. It was also indicated that the problems the countries are facing and the environments in which innovations appear could not have been more diverse. It was emphasized that this must be taken into account when comparing the 4 countries. In both European countries, the regulatory frameworks and funding schemes were often criticized by the participants of the ICs and interviews and deemed in-

appropriate and often outdated. Participants stressed that regulatory and legal frameworks need to adapt to new technologies quicker and regulate effectively without hindering innovation by overregulation. An example of the latter is the heavily regulated genomics research in Germany, which slows down innovation processes. Participants indicated that Germany will be left behind in many research areas such as "-omics" technologies due to restrictive regulations thought to have been introduced mainly for historical reasons. Another barrier that was identified in Germany was that the society is often sceptical about innovation and prefers current ways of working to being open to new solutions and technologies. The power of large companies and "Old Boys' networks" was criticized in The Netherlands; it was thought that the innovation agenda was shaped in the interests of a few companies, making it difficult for SMEs to innovate and bring new products to the market. Moreover, lacking active stakeholder engagement, missing systematic dialogue, and silo mentality were also identified as barriers which negatively impact innovation creation.

Innovation Management

Similar to innovation creation, all participating countries experience barriers to innovation management related to silo thinking, a lack of governmental and financial support, and issues related to legal and regulatory frameworks.

Rather than problems with the creation process, as European countries have, African countries experience difficulties in later stages of the innovation process, namely in managing and sustaining innovations. First, participants indicated that the regulation of intellectual property (IP) rights has a huge impact on the innovation management phase in Kenya and South Africa, and that IP regulations are often inappropriate and poorly developed in African countries. Innovators are concerned that their products can be copied by international competitors because IP protection is often weak. In South Africa, in particular, applying for IP rights was thought to be too bureaucratic and innovators often lack the knowledge required to apply for patents. The second barrier shared by the 2 African countries was corruption and mismanagement, where capital is often not used as intended. Third, South Africa and Kenya have immense gaps in education and skills are often lacking to sustain or manage innovations. Participants highlighted that both countries experience a low level of innovation literacy. Finally, both countries also experience problems regarding the scaling-up of frugal innovations because skills, money, and legal frameworks are lacking.

Germany and The Netherlands face similar barriers to innovation management: silo thinking, inappropriate regulation, and a lack of government and financial support. Compared to African countries, IP rights and applying for IP rights were not seen as problematic in European countries. Moreover, the results indicated that there is no need for more regulation in the EU. However, there is a clear need to update regulations and make them "smarter" and to adapt to new technologies and innovative solutions quicker.

Discussion

This study was conducted to gain new insights into existing innovation systems by exchanging perspectives and comparing state-of-the-art of existing innovation approaches in the healthcare and ICT sectors in 2 European and 2 African countries.

The main difference was that the countries experienced barriers to innovation at different stages of the innovation process. Whereas the European countries face problems in the innovation creation process, African countries face problems in sustaining and managing innovations. The main similarity was that there is no well-developed systematic approach for how innovations are created and managed in all 4 countries. Furthermore, systematic and active engagement among the stakeholders are often missing or underrepresented.

Before discussing the findings in detail, it is important to keep in mind the circumstances and ecosystems of the studied countries in which innovations are created and managed. The settings could not have been more diverse. Furthermore, it is necessary to point out that our findings address issues regarding healthcare and ICT, and that this may be different for other sectors which were outside of the scope of this study.

Innovation Creation

As the results of the ICs and interviews highlighted, the creation of innovation was often not seen as a problem in African countries. Moreover, it was discussed how the Western world can learn from Africa's creativity. Most of the participants shared the opinion that many African countries have great innovation potential to address challenges, e.g., in healthcare or agriculture. However, this potential can only be realized when barriers are removed. Our results are in agreement with the relevant literature which indicates that, despite major deficits in skills [16], a lack of resources [17], and poorly developed infrastruc-

ture [18], African people develop products or improve processes to meet their specific local needs [19]. Often, innovations stem from urgent needs to find forthright and sustainable solutions to address the multiple challenges the continent is facing [19]. Many of these innovations are mainly driven by the ideas of individuals with a frugal mindset, and they evolve from the bottom up, often being referred to as "frugal innovations" [20]. According to Hossain et al. [20], frugal innovations "comprise innovative mixtures of available knowledge and technologies to solve urgent local needs." Instead of being re-engineered solutions, frugal innovations are often disruptive and based on new product architectures [21]. The novel approach of frugal innovation emerged to improve the economic opportunities of the poor [22]. Particularly in Africa, frugal innovations in the banking [23], healthcare [24], agriculture [25], and energy [26] sectors have the potential to change the lives of millions of people [22].

One main facilitator of frugal innovation was the diffusion of mobile broadband, which has enabled the emergence of the digital economy and increased the innovation potential in Africa [27–29] as illustrated by the example of Kenyan's mobile money system, M-PESA (M for "mobile" and PESA being the Swahili word for "money") [22]. The idea of M-PESA was to increase access to financial services and offer financial inclusion for the poor and unbanked [29]. Based on this frugal idea, M-PESA has disrupted the existing banking and financial institutions by forcing them to lower prices and speed up the process of check clearance [23]. Not only did M-PESA diffuse to other countries, it also spilled over to other sectors and enabled innovations such as the agriculture microinsurance, Kilimo Salama [17, 23]. The implications of M-PESA are explained in more detail elsewhere [22, 23, 30, 31].

As highlighted in the results, frugal innovations in healthcare can greatly contribute to improve the well-being of citizens in Africa. This finding is in agreement with the international literature [32]. There is evidence that frugal innovations are already successfully used in several countries around the globe to improve access to healthcare for under-served patients [32, 33]. Frugal innovations can enable doctors or citizens to use simple, low-cost, and easily operated technologies in low-income settings. Furthermore, applying such technologies means that health threats can be prevented, diagnosed, and treated [24, 34].

Beside the discussed potential that innovations can have in Africa, several barriers were highlighted which impact the creation of innovations. In accordance with the literature [35], silo thinking and a lack of stakeholder engagement were often mentioned as challenges with a huge impact on innovation creation.

As our results highlighted, most of the European participants of the study shared the opinion that certain European countries display a lack of creativity and a frugal mindset. Furthermore, it was indicated that innovations in the healthcare and ICT sectors mainly occur in industry in predefined settings and are associated with high R&D spending.

Europe has always been characterized as being a world-leading inventor [11]. Science, technology, and innovation (STI) are top priorities of European governments. However, countries from other continents, especially east Asia, have increased their innovation capacities in recent years and are catching up with the mature innovators like the USA and Europe [11]. It can no longer be said that Europe enjoys "old monopolies of know-how and technology or dominates the ownership of planetary resources" [11]. Moreover, the EU is facing challenges to attract and retain global inventors since many innovators and inventors rather go to the USA, Canada, and Australia, than to Europe [11].

Even though Europe, and especially the 2 participating countries which are ranked among the top innovation performers globally [36], is still seen as top innovator, our study participants highlighted several barriers which greatly impact the innovation creation process. Many of the participants of the ICs and interviews expressed criticism and concerns regarding the innovation ecosystems. The main problem that was identified was that innovations in Europe mainly occur within the formal sector and in highly regulated and predefined settings. Participants shared the opinion that creativity is driven by ideology and there is a lack of open mindsets in Europe. Rather than thinking outside the box, many Europeans prefer to work in traditional ways. This expressed need for more creativity is also highlighted in the literature and policy reports [8, 11]. Europe needs to understand the changing landscape of innovations [37]. Due to the emergence of frugal innovations, innovation no longer has a linear association with R&D spending [38]. Therefore, being a top R&D investor does not necessarily make one a top innovator [38]. For instance, as Heeks [39] highlighted, the traditional mindsets and the lack of creativity have led to a situation where Europe is lagging behind Africa in certain areas such as m-money. He also indicated that changes in mindset and ways of working in the USA and EU "may be particularly difficult given legacy attitudes towards the Third World." Due to stagnating economies

and restrained resources, the demand of lower-cost solutions is increasing in Europe. There is the risk that Europe will lose these market segments of lower-cost solutions to emerging markets if mindsets do not change and stakeholders do not leave their comfort zone. Pansera [40] pointed out that Western countries "should learn from emerging countries how to be frugal and competitive at the global market." Crisp [41], furthermore, stated that instead of teaching the rest of the world, the West should start considering learning from others and that mutual learning will benefit all.

Next to the lack of creativity, regulation and legislation were highlighted by most of the participants as barriers which greatly impact the creation of innovations in the EU. Specifically, it was criticized that legislations are often outdated, inappropriate, and do not address new digital technologies and innovations appropriately. Similar challenges are also discussed in the literature and policy reports [11, 42]. Particularly in healthcare, a sector with a strong ethical dimension, regulation can either enable or constrain innovation [43]. For example, several participants from Germany criticized how the regulation of the application of "-omics" technologies in healthcare is restrictive. It was argued that if legislation does not adapt quicker to digitalization and new emerging technologies, Germany will face the increased risk of falling behind other countries in research. It is obvious that regulations need to facilitate innovation rather than hinder it [11]. However, it is important to find the right balance between protecting citizens (e.g., by data protection) and not hindering research with outdated and inappropriate legislation [44].

Participants from The Netherlands criticized that large companies often do not want new innovative solutions because they are afraid of losing power and market shares. Young and small businesses, in particular, often experience difficulty obtaining resources to scale-up their innovations and expand [35, 45]. In order to remain a top performer, a stronger involvement and recognition of small and medium-sized enterprises (SMEs) will be important, because SMEs have great innovation potential and provide creative solutions to problems [45, 46]. The government needs to provide a supportive infrastructure for SMEs, since it is argued that they can contribute greatly to initiating change and creating new technologies [46].

Innovation Management

As presented in the results, African innovators are often faced with challenges when managing and sustaining innovations. Poor infrastructure, gaps in education, weak protection of IP rights, and silo thinking were highlighted by the African participants as major barriers to innovation management. These are also discussed in the literature [17].

It is widely accepted that education is a key driver of innovation, and that without a well working education system new ideas and technologies are less likely to scale-up and diffuse [17, 27]. In agreement with the literature, our study shows that Kenya and South Africa experience major gaps in education [17, 47, 48]. Even though many African countries have had an immense improvement in primary-school attendance, the gross secondary-school and tertiary education enrollment rates are still the lowest worldwide [17]. Evidence indicates that innovative approaches are already being successfully implemented in several African countries, drastically improving the education systems [17, 27, 49]. A recent example is an e-learning program developed in Kenya. The program aims to provide training and education for nurses in the treatment of severe diseases, such as malaria, HIV, and tuberculosis [49]. By applying this e-learning program, almost 12,000 nurses can be trained in 1 year compared to the traditional classroom-based approach, with which, due to the lack of resources, only 100 nurses can be trained [49].

The African participants highlighted the importance of IP rights with regard to innovation management, which is consistent with the literature [50]. Many African countries still apply outdated legislation to protect IP rights [51]. Furthermore, legislation differs significantly in different countries, making collaboration between countries even harder [52]. Only a small number of judges and experts have expertise in IP regulation, making its application difficult, costly, and time-consuming [52]. Many inventors and innovators are working in secrecy and are not asking for feedback because they are afraid that their ideas will be picked up and then scaled-up by others [52]. This is in line with the *innXchange* study findings that innovators are often working in silos. The above-described problems partially explain why African countries account for only 0.1% of the world share of patents submitted to the US Patent and Trademark Office (USPTO) [16]. There is a clear need to update IP legislation according to the TRIPS (Trade-Related Aspects of Intellectual Property Rights) agreement and invest in education about IP rights management [52].

Participants also indicated that corruption, mismanagement, and weak political systems greatly impact innovation management in Africa. Those problems are also widely recognized in the literature [53, 54]. As highlighted by Oluwatobi et al. [55], increased control of corrup-

tion, improved effectiveness of governments, and robust regulatory frameworks will improve rates of innovation in Africa.

In contrast to Africa, the management of innovation was not seen as a major problem among the European participants in our study. The majority shared the opinion that Europe is relatively well-positioned with regard to the management of innovations. However, they stressed the importance of breaking down silos in healthcare. Particularly when looking at the emergence of "-omics" technologies, a silo mentality in legislation often hinders the innovation process. This is also discussed in the literature [56]. Often, regulations address only certain aspects instead of covering the whole complexity of new technologies and approaches. To successfully innovate and manage innovations, the traditional health science R&D silos and big data silos need to be broken down [44]. Rather than acting with reserve, governments and the EU need to be more forthright when new technologies or products emerge [11].

Overall, many European countries are relatively well-positioned where innovation management is concerned. However, in the global environment, rather than just offering guidance, European countries should share their experiences and also their failures with other countries. By learning from others' mistakes, African countries can avoid repeating the mistakes that Europe has made in the last decades.

Recommendations

To overcome and address the challenges in innovation creation and innovation management, the *innXchange* project participants emphasized the importance of systematic early dialogue (SED), proinnovation environments, and public-private partnerships (PPPs).

Systematic Early Dialogue

Even though African and European countries are facing societal and economical challenges, the project identified that, in all participating countries, a systematic approach to create and manage innovations is missing. Often, early dialogue and collaboration between different stakeholders from different areas are lacking. To overcome the problems described above that attend innovation creation and innovation management, the project participants have emphasized the importance of SED between the key stakeholders as a policy tool to improve the innovation process. Companies, universities, policymakers, and other stakeholders are often working in silos but not collaborating with each other. To successfully create and sustain innovations, a systematic approach is needed. Stakeholders across disciplines and sectors must communicate and collaborate from the beginning and in a systematic manner.

Proinnovation Environment

It will be crucial to create innovation friendly environments. Particularly in times of financial constraint, innovations will be the key for sustainable growth and the improvement of citizens' well-being. Since new innovation approaches, like frugal innovations, are increasingly disrupting the mature (developed) markets, changes in mindset are urgently needed to keep up with the emerging markets. Western countries need to change their mentality and, instead of teaching others, should start learning from emerging economies. Moreover, regulations need to be adapted, revised, and updated, to cater appropriately for the new emerging technologies. Education is also a key parameter in the innovation process. Particularly in the African countries, gaps in education, deficits in skills, and weak protection of IP rights challenge the management of innovations. Governments need to provide prerequisites such as education, legal structures, and financial support to create a proinnovation ecosystem. On the other hand, it is important that innovators are not overwhelmed by extreme governmental bureaucratic demands while trying to introduce a new technology or product to the market.

Public-Private Partnerships

To improve a multi-stakeholder SED, PPPs can help facilitate collaborations and combine public and private funding. The Innovative Medicine Initiative (IMI) is the flagship PPP for healthcare in the EU. The IMI aims to improve the development of new and safer medicines for patients in a timely and effective manner [44]. African countries are increasingly recognizing the importance of strategic alliances and partnerships to address the challenges they are facing. Without collaborations between stakeholders, innovation can often not be realized. In Kenya, universities and small companies are currently joining forces with government institutions and foreign international companies, such as IBM and Philips, to adapt a multidisciplinary approach to overcome challenges. Both the above companies have opened research and innovation centers in Nairobi to strengthen the develop-

ment and management of innovations in healthcare. There is a clear need for more PPPs like the IMI or the examples from Africa for the improvement of the innovation process and to be able to "leapfrog" into a future of sustainable growth. Only when all relevant stakeholders, in both Africa and Europe, start learning from each other and working together from the early stages of the innovation process, can current barriers and hurdles be overcome.

Conclusion

Not only is innovation seen as a key driver for economic growth, it will also make the difference in tackling the many urgent developmental challenges currently faced by the world. This study highlights several similarities and differences concerning innovation creation and innovation management in African and European countries. SED, PPPs, and proinnovation environments can help to address the many challenges these 2 continents face with regard to innovation in healthcare and ICT.

Lessons Learned

Due to the emergence of frugal innovation, innovation is no longer in a linear association with R&D spending. Instead of only teaching the rest of the world, developed countries should start considering learning from others and that mutual learning can benefit all. To overcome barriers to innovation creation and innovation management, the project participants of *innXchange* emphasize the importance of SED, proinnovation environments, and PPPs.

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