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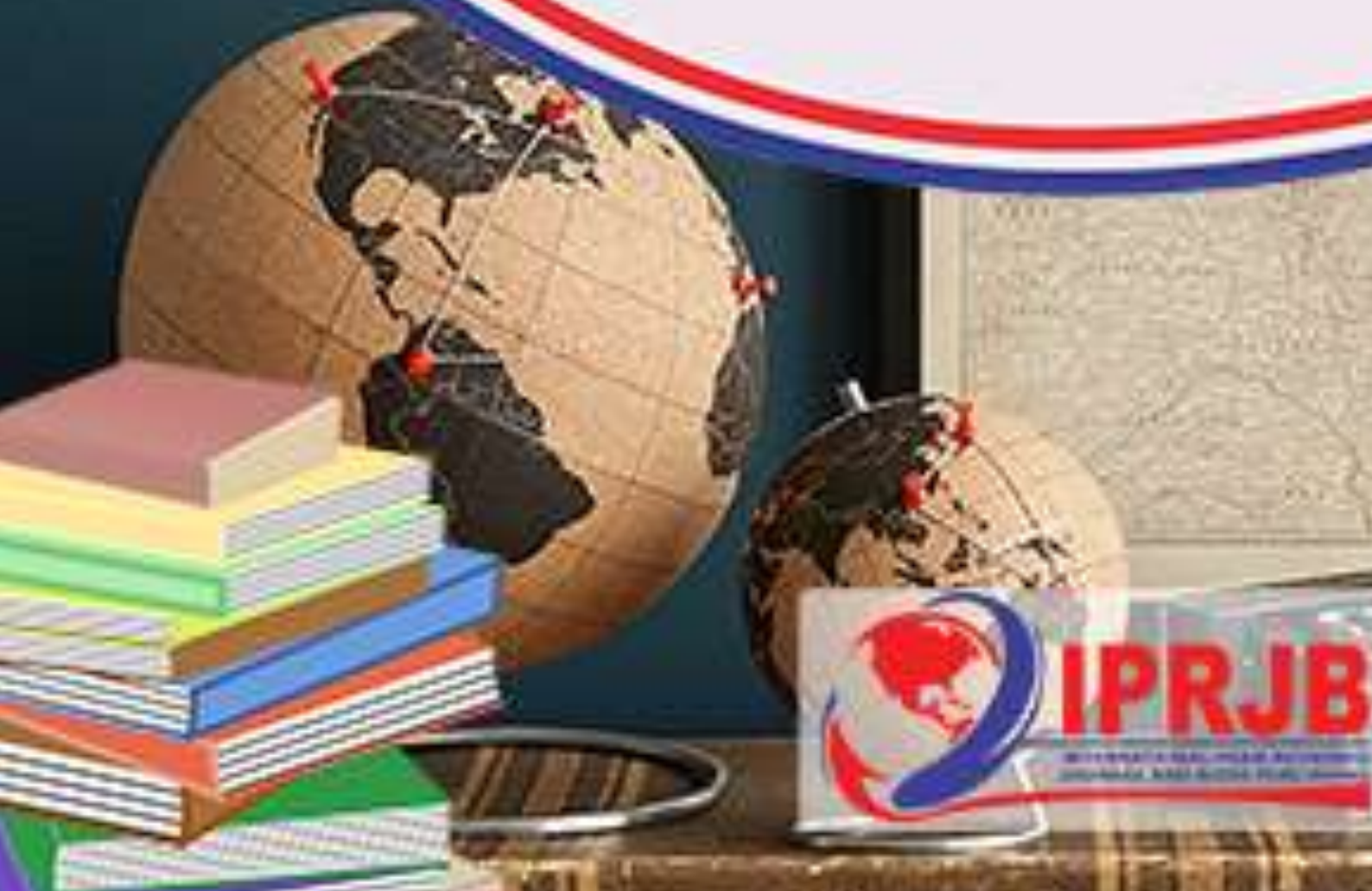

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University Knowledge Transfer and Its Associated Challenges for Sustainable Impact: Case of the University of Rwanda

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Abstract

Purpose: The study sought to identify the obstacles that university-based hubs confront in attaining long-term effects.

Methodology: Given the subjective character of the topic under investigation, the study took a qualitative approach and was guided by the Triple Helix Model. The University of Rwanda was used as a case study, with five respondents questioned.

Findings: The study discovered that, while certain gains have been recorded, there are still many problems that are impeding the realization of the aims of building ihubs. Internal shortcomings included poor communication between departments, incompatible university administrative structures, insufficient finance, and a lack of labs and other critical technology. External weaknesses, on the other hand, revolved around the informal character of the university-industry connections. These flaws have resulted in what is known as single confinement.

Unique Contribution to Theory, Practice and Policy: The study makes several recommendations for ihubs to have a long-term impact including streamlining the University of Rwanda's management, increasing university funding, improving interdepartmental communication at the university, and formalizing links between the university and the industrial sector.

Keywords: *Innovation Hubs, Knowledge Transfer, Spinoff, Innovation Ecosystem*

INTRODUCTION

Innovation hubs (iHubs) are being established across the globe as spaces and places where innovative ideas are nurtured and applied to solve emerging societal problems and market needs (CHERUNYA & AHLBORG, 2020). Global research is becoming more concentrated and the competitive heterogeneity in research innovation among different regions has increased. Many countries realize innovation investment is critical to increase economic growth. The investment, development, and adoption of new technologies continue to spread out from the Silicon Valley epicentre to tech hubs around the world (KPMG, 2017). According Global Innovation Hubs Index 2022, cities across Europe and the United States are in the lead with their unique innovation culture followed closely by Asian cities especially Chinese and Indian cities (CIDEG, 2023).

The spread of iHubs is not limited to developed countries but also in the developing countries. Africa today has over 600 active hubs and the chances for the numbers to rise are high. While Africa is punching below its weight in the international race to develop technology, the continent has the potential to become a start-up superpower in the tech sector. Africa is a pioneering space for commercial innovation and the most entrepreneurial continent (Bayuo et el, 2022). Rwanda which has just recovered from a terrible war and genocide against Tutsi aspires to become the leading ICT Hub in Africa. It intends to achieve this vision by establishing conducive innovation ecosystem with competitive start-ups which supply high quality and high value ICT-products and services for the continent and for the global markets.

According to the Global Innovation Index (2018), Rwanda ranks 7th country in Africa and 99th globally (MINICT, 2023). Kigali the capital of Rwanda has one of thehighest ratios of Entrepreneurial Support Organizations (ESOs) per inhabitant globally with seven ihubs (Benjamin Meier et el, 2020). The spread is hardly surprising given the many advantages associated with hubs such as creating and fostering entrepreneurial communities by bringing together key stakeholders and encouraging collaboration (Obeysekare et el, 2017).

While hubs have largely been established and promoted by innovators and entrepreneurs independently, there is growing interest by public and academic institutions. These institutions are increasingly acknowledging the value of providing support directly to entrepreneurs and innovators by nurturing and protecting their ideas, and by providing safe spaces to fail (CHERUNYA & AHLBORG, 2020). For Instance, in a review of university embedded hubs across Africa Ahead, 2023 found that most iHubs had several goals which included; improving innovations, transfer of technologies and university spin-offs (Ahead, 2023).

One of the mechanisms by which universities currently seek to promote innovation in iHubs is through Knowledge transfers. Knowledge transfer (KT) is a term used to encompass a very broad range of activities to support mutually beneficial collaborations between universities, businesses and the public sector. It's all about the transfer of tangible and intellectual property, expertise, learning and skills between academia and the non-academic community (Minshall, 27 May 2009).

Knowledge transfer can also be defined as a process through which knowledge moves from the root to where knowledge is given and practiced (Nguyen and Burgess, 2014). The essence of innovation lies in knowledge, which is why open innovation opens the door to knowledge transfer with agents outside the organization. The ability to transform knowledge through sharing, also lead to one level of innovation or another. It is therefore necessary to have

an effective knowledge management system that facilitates the absorption of knowledge arising from knowledge sharing within and among organizations (Alvarez-Meaza et el, 2020). Knowledge transfer betweenacademia and industry is an important driver of innovation and economic growth as it eases the commercialization of knowledge (E. de Wit-de Vries et al., 2019). This view is also shared by Jahn et el, when they noted that Universities, public institutions, and the transfer of knowledge to the private sector play a major role in the development of medical technologies. (Jahn et al, 2015).

Yet, empirical insights from Bol shows that managing outsourcing, innovation and knowledge transfer are one of the biggest challenges for businesses. Knowledge transfers do have their own challenges and barriers and this may influence its eventual impact on the innovation process (Bol, 2010).

As such the goal of this research is to understand the challenges associated with knowledge transfer within iHubs. Understanding this is important because, empirical research on iHubs in Africa remain focused on the rise of iHubs and the expected benefits. Yet little is known about their achievements and failures. It somehow assumed that once they are established, their success is guaranteed. Using Rwanda as a case study, this research asks two main questions;

(a) What are the challenges faced by university embedded ihubs in Rwanda?

(b) What strategies can these institutions undertake to overcome the challenges?

By exploring these questions, this study contributes two main key insights. First it unpacks the challenges associated with university knowledge transfer in Rwanda. Second it seeks to propose strategies to deal with identified challenges. To provide a theoretical foundation for this study, the next section explores existing research that captures the challenges around knowledge transfer within innovation processes.

Knowledge Transfer in Innovation Processes and Ihubs

Innovation has acquired strategic relevance in the quest to increase and sustain the economic growth of nations. Many governments from the developed and developing world see innovation as a strategy to increase their competitive advantage in the global stage. Therefore, nurturing innovation through policies and actions has become a priority in both the public and private sectors everywhere. Such policies and actions focus broadly on facilitating and regulating the transfer of knowledge and technology among the multiple actors in the innovation system – notably among universities, governmental agencies, and industry (Grimpe And Fier , 2010). The flow of knowledge and technology is relevant to the performance and evolution of innovation systems.

The relation between the two is of a mutually dependent nature, context dependent, and socially rooted. Thus, the increasing openness of contemporary innovation system might not exclusively depend on the prevalence of just one form of knowledge transfer, but on the system's capability to facilitate, sustain, and capitalize on any form of endogenous and exogenous collaboration (Jofre, 2011). In a fast moving business environment university-industry collaborations play a critical role in contributing to national economies and furthering a competitive advantage. Knowledge transfer from university to industry is supported by national governments as part of their innovation, national growth and competitiveness agenda. A university-industry landscape involves multiple stakeholders with multiple, and often contradicting, objectives and organizational mind-set and cultures (Schofield, 2013).

The process might however be hampered by knowledge stickiness and knowledge ambiguity. Therefore, it demands immediate attentions to find ways to mitigate the negative effect of knowledge stickiness and knowledge ambiguity on knowledge transfer since the higher levels of knowledge transfer will result in higher levels of innovation competitive advantage (Sheng et el, 2013).

Challenges of Knowledge Transfer in Ihubs

In their work on the subject, E. de Wit-de Vries et al found out that differences in goals and knowledge were found to be important barriers to knowledge transfer. These differences may result into ambiguity, difficulties in knowledge absorption and application. On the other hand the same study found out that trust, communication, and use of intermediaries can be enablers of knowledge transfer (E. de Wit-de Vries et al., 2019). Ritesh Chugh's work moved further to focus on Barriers and Enablers of Tacit Knowledge Transfer in Australian Universities (Chugh, 2018).

However, this work was done in an advanced economy and does little to understand the situation in developing countries. The same can be said of the work of Olmos-Penuela et el which focused on the processes underlying knowledge transfer (KT) in social sciences and humanities (Olmos- Penuela et el, 2014). Dolmans et el on the other hand concluded that boundary spanning is also very crucial and can have a great impact on knowledge transfer and commercialization of university developed technologies (Dolmans et el, 2022). Whereas having links between the university and the industry is important, there is question on what type of links. Links must be formal as informal links and collaborations may negatively affect knowledge transfer and innovation performance (Abdulai et el, 2019). To Ciapetti, there is no single factor that explainsthe success of ihub.

An institutional network, a triple helix at local level, should be in place to guarantee that all the types of knowledge capital that a university has (educational, human andsocial) can act in synergy with regional policies and business needs (CIAPETTI, 2009). Whereas these and other works gives a glimpse of the challenges faced university embedded hubs, the African experience particularly is missing and needs a deeper investigation. The work covering the African experience include that of Cherunya & Ahlborg which aimed at profiling best practices to inform establishment of an energy innovation hub at the University of Rwanda (CHERUNYA & AHLBORG, 2020). The work of Obeysekare et el also covered Rwanda focusing mainly on success measures that are appropriate for developing countries (Obeysekare et el, 2017). Benjamin Meier et el focused on entrepreneurial ecosystems where they noted entrepreneurs are at the centre of any ecosystem without whom, the ecosystem collapses (Benjamin Meier et el, 2020), To make a thorough investigation, the study used the Triple helix theory as explained in detail below.

METHODS

Conceptual Approach

The study was guided by the Triple helix approach as theorized by Etzkowitz and Ledersdorff. The theory assumes that there are interactions between University, industry and government. The university-industry-government relationship is assumed to be one of relatively equal, yet independent. In the interaction of the three, the universities provided the needed knowledge by the industries while the government provides the necessary regulation to facilitate socio-economic development. The framework further assumes

that interactions between government and universities depend on the government relationship with higher education. The government attitude towards the market determines its relationship with industry (Etzkowitz H. ,2008). The first dimension of the triple helix model is an internal transformation in each of the helices, such as the development of lateral ties among companies through strategic alliance or an assumption of an economic development mission by universities. Universities on the other hand have to enhance their relevance to technology transfer, firm-formation and regional renewal places to fit into the knowledge-based society (Cai & Amaral, 2021). Kimatu however cautions that innovation does not only depend on presence of a strong government, universities and industries but more so on how they mutually interact for strategic objectives. This strong interaction is usually lacking in developing countries leading to silo confinement (Kimatu, 2016). Following this theory, the study investigated the challenges faced by the University of Rwanda in enhancing its relevance to technological transfer through the university embedded hubs. From the above, it is clear that smooth transfer of knowledge needs proper and strong university-market-industry linkages, clear government policies to enhance transfer, supportive university policies and structures, and strong entrepreneurship culture at the university.

Participants

The study had a total of five participants drawn from the different campuses of University of Rwanda. Two of these were female while three were male. The researcher used a purposive judgmental sampling which according to Earl Babbie Johann, it is based on one's own judgment and the purpose of the study (Johann, 2001). The study was carried out research on a subset of Rwanda population from university of Rwanda which has established innovation and incubation hubs. The study's sample size was based on innovation hubs operating under the university system

The researcher has selected grid innovation and incubation hub at CST and the center for entrepreneurship and innovation as samples, technology transfer officer at the university level was interviewed to assess the challenges, and also interviewed the head of technology transfer at the college level to assess the challenges associated with the translation of research and incubation.

Three founders of startups from the college of science and technology were interviewed to assess the challenges they went through during their incubation period and post-incubation period. Female and male students were both included in the study.

Materials

Phenomenological interviews were adopted focusing on the University of Rwanda and its colleges. The researcher used the existing present contacts to identify the most relevant respondents. The research included a process of back and forth from the field to the existing literature as the data were collected. The study used a questionnaire which had three pages.

The data analysis was mostly focusing on the practical approach of the technology transfer office (TTO) or knowledge transfer office (KTO) in meeting their mandate, the discussion around their challenges involve a continuous literature review, it should be noted that it is not only informed data analysis but also emergent themes, sub-themes, and concepts which gave a researcher a sense of further sampling.

Procedure

Data was collected through face-to-face interviews and key focus group discussions based on a different subset of groups, and themes of discussion, the target respondents were admitted incubates and startups at the university hubs and employees responsible for knowledge transfer and commercialization of research output. All the respondents were asked and approved through a consent form to agree and become part of the study. Notes were taken in due course of the interview to capture the emotion of the moment. It was added to transcription later. We agreed with no audio taping, notes were taken and later expanded to capture the mood and meanings.

The research initially listened to two employees responsible for technology transfer or knowledge transfer officer, one at the university level- the center of entrepreneurship and innovation, and another one at the college level responsible for commercialization or innovation officer at the college of science and technology. All interviews conducted were of good quality and all interesting observations were taken note of. Two of them were very rich in narration and were coded sentence by sentence. After coding the first interview similar data in subsequent interviews was analyzed using the same code as the proceeding the interview but looking at different themes and adding more codes. The rest of the transcription using different codes and analysis of them shows that all the interviews had the backing of the filed work with notes taken only.

RESULTS

The study found that both the government and the University of Rwanda have tried to put some structures to assist the knowledge transfer but there is a lot that needs to be done if the objectives of establishing ihubs are to be realized.

The achievements include the following;

1. The University of Rwanda through UR-GIIH offers a number of mentorship supports such as how to pitch for funding, proposal writing, concepts development, planning for the project from early stages, presentation skills etc.
2. In addition to technical support, the university also provides, seed funding, startup capital, office facilities (internet computer, and working space). Seed funding is provided after student have done market validation which was found to be very important for the kick-off of the projects and prototyping.
3. The study found out that ICT equipment was available and students didn't face challenges to develop prototypes though this was limited to certain fields. For example while students dealing in animal feeds could do all the experiments at campus labs, students in the fields of electronics had to move places outside the campus.
4. The university also provides its students with exposure by connecting them to different institutions that increase their visibility
5. There is also strong link between the knowledge given at the university and the needs of the society and all student innovations had a bearing with what was taught to them in class. One of the respondents said 'during the learning process I came to realize there's less availability of animal feeds resulting into high animal prices. The idea came up because of a course I attended related to the challenge of animal feed in

Rwanda and that is how I responded with a possible solution and started to work on it through the support of an incubation hub at the university.'

Another respondent claimed that 'I translated my master's thesis research to an impactful solution related to clean energy and very affordable compared to grid energy, due to quality training in research at the master level helping transfer my knowledge into the technology of PV.

6. The networking events organized by the university also paid off with some students getting funding from other funding agencies though this was limited as it will be seen later.
7. The entrepreneurship culture is slowly developing as a result of a module on entrepreneurship through which students' mindset is changed.

Challenges

Despite the above achievements, the project still faces many challenges and these include the following;

There is a lack of communication between the department in a change of Giihubs and the different schools and colleges of the university. This communication gap means that many innovations may go unnoticed which in turn a big barrier as one the respondents claimed becomes.

'There are many challenges, I can mention a few, we don't have any innovations reported from colleges every quarter and year so far. Our department seems not well connected to colleges and schools, and few of them know if we exist. It's a big challenge and concern, I can't make any progress as TTO without schools, this is where students and faculty members doing research are based.'

The impact of the communication gap on the ihubs is again noticed by another respondent in the following;

I can't say we support incubation at the school and college levels because there is no working framework between the centre for innovation and entrepreneurship. The functionality of the centre is more isolated from the schools and colleges. When the centre was established, it has a general mandate to oversee the functions of innovations and incubation centres at the college level, from a policy perspective, however until today no working framework and link between the centre and colleges. I will conclude to say no we offer no support to university hubs and innovations departments at the college level.

In addition to communication gaps, there is a managerial problem which slows down the activities of knowledge transfer. According to one of the KTOs,

'We don't work with any college-level incubator programs or schools. The university structure and incubator programs operate under their respective school and colleges under the directorate of research and innovation. However, the career department seems to take care of some innovations from students through industrial placement, generally, the incubator programs don't follow anywhere within the current structure.'

The confusion in structures is further is further explained by another respondent in the following way;

'The centre for entrepreneurship and innovation does not function properly because it lacks proper management. Looking at how it was supposed to work initially, the policy is weak and doesn't mention how it should function, it lacks an operational manual, and the current policy doesn't mention anything related to the operating process and its link to incubator programs. There are also career departments at the college level which were established to carry out the specific task of career preparations and placement for an internship before students graduate with their bachelor's degree. By practice, they mix innovations, and incubations activities with career guidance, and university policy is silent on that, therefore wherever there's a working relationship, is only for the career department which seems to be more active than another department. Generally, I have no idea about the support of innovations by the industry.

The study found that the university is not connected to all local and regional ecosystems. This was particularly in Agriculture. According to one the respondents,

We don't have any connections to the regional and national innovation ecosystem due to a lack of leadership and managerial support at the center level, the entire system doesn't function. We continue asking the university management to appoint a director to carry out such initiatives.

Although the university provides ICT services such as the internet, these are not enough to cover all the needs and the available working space is also not enough.

The study also found the university lacked labs for certain fields especially advanced technologies lab for agriculture and electronics. For example, one student-respondent explained that

'Labs for experimentation-related animal feeds were not available. A technology lab for prototyping does not exist mostly for agriculture. On the other hand the technology required to support the prototyping was very expensive machinery, which was not available at CST and the GIIhub. A laser cutter was not available at the university hubs, which is a challenge because the university does not have such labs to support experiments, so it is a big challenge until you must go out of the university and the labs available are very expensive to get them in Rwanda.'

Another respondent also said that

'University labs related to electricity and electronics there are not available, and it is a big challenge for this thematic discipline, most electronics innovative solutions will not be tested or developed due to this challenge unless the university invests in them.'

The university also does not have a stable financial system for start-up capital or any financial legal framework to support start-ups before the graduation of the incubation phase. The finance contact person at the university, who deals with start-up financing and payment, doesn't have the required public procurement process suitable for the incubation hub financing procedure. He relies only on the existing instrument yet the instrument is not fit and does not respond to the needs of start-ups or incubates registered and supported by the university on time. Finance officers at university need to re-align the start-up capital, and seed for market validation with other payment procedures and requirements.

The study also found out that university lacks concrete plan for operations of the Giihub. The directorate that should have provide d direction had no director (by the time study was conducted) which compromises the functionality of the TTO/KTO achievements. Relatedly, there is also lack of a scientific person students can deal with directly during the ideation period. As students grow up their concepts, the lack of finance to generate their knowledge of research around the novelty of the financing process is another challenge and as well as research funding.

'Another challenge our directorate has no working plan to admit some innovative concepts or some initiative to support researchers from the early stages of research proposals to respond to emerging global challenges such as the recent C-19. We have only the Swedish development agency offered some grant funding to for supporting for researchers but never matured into an impact nor published any patents or created start-ups.'

The study also found out that university at a certain level is linked to the industry however this linkage it is very low and not very supportive when it comes to innovation process which requires some partnerships at a certain level of market validation.

'No policy guiding how universities can interact with industry. What do we do, we only sign an MoU with the industry based on a specific activity, for example, many industry partnerships exist to provide internships for our students. We don't have any specific or formal relationship with the industry and partnership. However, Proffers and other departments initiate relationships, including technology transfer, but I don't have any specific example at the centre level.'

Some students also lacked the business expertise which required industry guidance through partnerships with the incubator program at university.

The entrepreneurship culture does exist at a certain level and it was one of the reasons such start-ups came up, however it seemed to be largely individual efforts and mentorship as it was not uniformly spread. The study found out further that whereas university professors encouraged students to practice enterprising while at university, there is no policy and legal guidance at managerial level.

Another challenge was a long process during the incubation period, and also to get the start-up capital takes a very long process and time due to the government public procurement act which is not suitable for a business incubator program. One of the respondents explained that;

No, we don't have a budget. During 2020 we were asked to budget for center activities, and we included support for incubates to build their prototype, but the budget was not allocated. Since we don't have any demand or request from respective schools and colleges, maybe it is the reason the budget is not given.

Publishing patents is also a big challenge because the GIIH doesn't have patent drafters. In cases of sharing patent, the university lacks a clear policy on this. As a result, it depends on negotiations between the student and the academic supervisor as explained by one of the respondents below;

'As the centre of entrepreneurship and innovation we don't have any documentation related to the publication of a patent. If there are patents published by professors and their students, we are not informed, as I told you we don't have any link with faculty members as well as colleges.'

Strategies

1) Government should enact policy to uphold the university to include innovation with impact concepts into the learning outcomes of different modules they offer, and it should be part of the organized public talk for awareness purpose and invest in infrastructure which supports innovations process.
2) The university should also improve the mind-set of the departments within the university who provide support to younger innovators.
3) The government and the university should come up with motivation package/incentives to younger innovators so as to increase number of patent publication every year.
4) The current linkage is weak, and it needs to be improved. The university requires to link up with different industries with a purpose, signing an agreement with a clear set of relationships and a set of outcomes.
5) There's a need to restructure and define clearly where the incubator programs fit with the university structure.

Discussion

The investigation has clearly shown what the University of Rwanda has managed to do to ihubs. The findings on the challenges have in some areas confirmed what earlier studies had found.

Informal linkages which startup founders had raised were also found to be a big challenge to the university. These poor linkages resulted into some kind of solo confinement whereby the university could not link meaningfully with both the market and industry. What many earlier many earlier studies missed was the role of university management. Structures with poorly stated roles have posed a big challenge to ihubs resulting into the malfunction of both university structures and ihubs they are meant to serve. Lack of labs and insufficient internet networks, and IT infrastructure are areas probably taken for granted in developed countries but a big challenge in the developing world as the study has found out in the case of the University of Rwanda.

Conclusion

The study was intended to investigate challenges faced by university imbedded hubs. As the findings have shown, the university had both internal and external weaknesses. The internal weaknesses were mainly managerial and communication gaps while externally linkages were informal. These weaknesses resulted into what Kimatu referred to as solo confinement. To get out of this situation and enhance ihubs to achieve a sustainable impact, both the university of Rwanda and the government have to streamline management, fund the various university structures and improve communication both within the university and also between the university and the industrial sector.

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