

“UNIVERSITY BUSINESS INCUBATORS (UBIS) BASED PROJECTS IN COLLABORATION WITH THE ACADEMIA, REGIONAL GOVERNMENTS AND DIGITAL INNOVATION HUBS(A SPIN OFF FROM DBA RESEARCH 2022/23)”

Research Paper

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“Abstract”

This project in line with the European Union Digital Europe Programme investigates the role of University Business Incubators(UBIs) within their Regional Innovation System(RIS), Spatial Innovation Systems (SIS) and Supra Innovation Systems (e.g EU). While several forms of UBIs could exist based on their configurations, need, roles and specific capabilities they possess which enable them to perform their roles within their Entrepreneurial Ecosystems, there is a dire need to understand how these UBIs forms such as Networked UBI, UBI Alliances, Innovation Hubs, Special Tech focussed UBIs such as Biotech Based UBIs, AgroTech or Smart Focused UBIs and traditional UBIs differ in their capabilities, entrepreneurial ecosystem dimensions, attributes, structures, actors and social networks overtime.

This study specifically investigates Networked UBIs, UBIs and other higher education based innovation hubs configurations within different RIS modes (i.e municipal, old industrial and peripheral), the divergent entrepreneurial ecosystem attributes and dimensions they possess, how it is enhanced with their specific capabilities (substantive and dynamic) overtime and how it affects their legitimation, normative expressions and their socio-human structure.

The study will be based on a mixed method research (combination of quantitative and qualitative techniques) because UBI' configuration capabilities concept requires an investigatory, exploratory and numerical validation approach. Guided by the application of multi-level analysis and governance coupled with Dynamic Capabilities Framework, an adapted Strong Structuration Theory and Dynamic Social Networks Analysis, this study will conduct a time series based model and later develop an integrated Software as a Service(SaaS) for UBI capabilities order (resources, operations, strategies and dynamic capabilities), performance management, scenario synthesis, visualization and Innovation system configuration.

Keywords: Regional Innovation System(RIS), Entrepreneurial Ecosystem(EE), University Business Incubator(Incubation), Networked Business Incubators, Strong Structuration Theory(SST)

1 Introduction

This project describes the Networked University Business Incubators(NTWUBIs) a consortium or network of traditional University Business Incubators(UBIs), Innovation Hubs and Network of Universities Innovation Alliances within a region and interconnected regions and also specially focused Universities Business Incubators(UBIs). The project will investigate specific Network UBIs, High-Tech Based UBIs (or specially focused UBIs) their capabilities, how they differ from traditional UBIs, how they foster and enhance entrepreneurial activities within their Regional Innovation System(RIS) and how they have taken the more advance role of knowledge facilitator within their

Regional innovation and entrepreneurial ecosystem and how several conditions and factors impact the socio human structures.

This project is in line with the European Union Digital Innovation Hubs Programs and initiation drive towards the enhancement of Innovation within Regional Ecosystems with partnerships with actors and stakeholders within the clusters and Regional ecosystem such as Universities, UBIs, Accelerators, SMEs and Venture Capital Firms.

This project will investigate specific alliances within the EDIHs(European Union Digital Innovation Hubs) with different UBI configurations.

Networked University Business Incubation and Network of Universities Innovation Hubs have been the bedrock or core innovation mode in developed economies such as Europe and the United States. Countries like UK, The Netherlands, Germany and Finland use Networked University incubation for amassing intense innovative knowledge and outcomes through a robust and well integrated regional innovation systems in different regional types (metropolis, peripheral etc.). Disruptive high-tech businesses, bio-medicine and other sector focused innovation have been developed within such innovation spaces that involves several universities alliances and clusters of firms with technology transfer offices and other actors within the region.

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Networked Incubators like SETSquare (Universities of Bath, Bristol, Exeter, Southampton) (UK), Open Alliance (Artic Region- Denmark, Finland and Norway), Daegu Tech Park (South Korea), the Alliance (Montpellier, University of Barcelona, ELDA Hungary, Trinity University, Ireland and Utrecht, with other German Universities) are examples of networked UBIs,Alliances and innovation hubs existing in Europe which over the years have remained among the top UBIs in the world due to their impact on both economical and regional development. While single UBI have its benefits, the cumulative benefits of Networked UBIs and the co-creation and co-evolution capabilities of the alliance formed cannot be undermined and how their capabilities change overtime based on the accompanying impact i.e political, social, governance, economic, needs to be investigated(Lawson and Lorenz, 1999; MacKinnon, Cumbers and Chapman, 2002).

Although studies have shown that specific regions require tailored or customized approach towards their RIS integration,as their competencies,dynamic resources and capabilities differs and there are few scholarly literatures that aids the understanding of typical UBI structures,evolution of their dynamic networks(Taiwo, 2022) and how they develop social capital over-time based on their interaction with the local RIS,other RISs and NIS(National Innovation System).

Based on a mixed method approach that combines both qualitative and quantitative studies, this project builds on existing theories such as knowledge spillover,an adapted version of the Strong Structuration theory(SST), Dynamic Capabilities Framework, Dynamic Social Network Analysis, Multi-Level Analysis and Governance (MLA and MLG) and regional growth theory to understand Networked UBIs configurations and structures, triggers within their regions that fosters the establishments of these Networked Incubators and hubs, the patterns and themes that could ensue based on integrated studies of several Network UBI studies, social mechanisms that facilitate

knowledge development and diffusion within these Networked UBIs and the region and the overall impact on the RIS. The several forms of knowledge bases (analytic, synthetic and symbolic) and knowledge types (tactical and codified) (Cohen and Levinthal, 1990; Cooke, 2001a; Asheim and Coenen, 2005a) between these Networked UBIs and the Regional Ecosystem requires further investigation.

This study intends to contribute to the existing body of knowledge on Networked UBIs and Innovation Hubs and how Universities in innovative economies co-create, establish and institute policies that facilitate Network UBIs establishment, Universities Innovation Hubs and Alliances creation in producing innovative outcomes within and across regions.

It is also pertinent to understand that while developed economies use Networked UBIs as mechanisms to facilitate regional development, little is known about such developments in some other countries in the EU and other emerging economies such as in SSA (Sub Sahara Africa). This study could also serve as a guide to other regional development agencies, academia and other stakeholders outside the EU.

It is pertinent to note that there is no one size fit it all formula within typical regional cluster agglomeration and several regional typologies that exist also differ in regional needs, resources and demands at different points within their life cycle (MacKinnon, Cumbers and Chapman, 2002; Rasmussen and Borch, 2010; Soetanto and Jack, 2016; Ng *et al.*, 2019).

The understanding of the development of specific UBI capabilities that enhances entrepreneurial activities within regional cluster and the absorption and use of the differential entrepreneurial activities ecosystem attributes (e.g cultural, material, social, legal, policies and financial) changes overtime (Spigel, 2017; Malecki, 2018). In addition to this, the dynamisms between the actors, institutional and legitimate networks and the impact on the socio-human structures, configurations and evolution of these UBIs overtime also require further investigation (Cooke, 2001b; Zahra, Sapienza and Davidsson, 2006a).

The concept of Business Incubation (BI) as well as UBI and their embedded Regional Clusters have undergone evolution in the last five decades. Studies have shown the evolution, generations and archetypes of BIs (Allen and McCluskey, 1991a; Aernoudt, 2004; Becker and Gassmann, 2006) and different entrepreneurial universities typologies based on their dimensions and attributes (Bronstein and Reihlen, 2014) and value proposition (Bruneel *et al.*, 2012). However a gap still exists in the investigation of typical UBIs configurations with their capabilities (dynamic and substantive) and their relationships with performance based on a multi-dimensional approach and statistical modelling. It has also been suggested that a holistic approach towards the study of the dynamisms in capabilities gives a more realistic and broader view of the concept in different regional perspectives (Inan and Bititci, 2015; Heaton, Siegel and Teece, 2019; Heaton, Lewin and Teece, 2020; Taiwo, 2022).

While this project is about understanding different RISs and their inter-relationships with Networked UBIs due to the fact that RISs and DIHs are established within different regions under different entrepreneurial advantages and disadvantages, cultures, social interactions and structures and few literatures also exist on benefits of these subsystems within the RISs to regions. There is need to also understand the patterns, configurations, structures, capabilities of each specific Networked UBIs and Innovation Hubs based on taxonomy within different regional and country context (MacKinnon, Cumbers and Chapman, 2002; Cooke, 2003; Audretsch and Belitski, 2017).

Due to the research objectives and purpose and based on a pragmatic worldview, this project will be conducted using the mixed method research. The mixed method research which lies between the quantitative and qualitative continuum enhances more added benefits and relevance compared to single based research methodologies. Mixed method research techniques can be further used to develop, expand, triangulate or justify either of the well-known research techniques in a phase based or concurrent design.

Mixed Method Research also encourages multi-phased segments and strands within a single research based on time and integration orientation (Onwuegbuzie and Collins, 2007; Cameron, 2009, 2013; Cameron and Molina-Azorin, 2010; CRESWELL and CLARK, no date) e.g Qualitative technique can

be used in the first phase of a research then followed by quantitative to further develop, justify, contradict (as the case may be) the earlier qualitative results and vice-versa which gives rise to a sequential mixed method approach i.e explanatory and exploratory).

This research will combine several forms of the mixed method research techniques based on the need and fit of the research (Ivankova and Creswell, 2009; Creswell and Clark, 2017). The qualitative research techniques to be used will include: thematic analysis and open ended interviews, while the quantitative techniques in the project will include: clustering analysis, time series modelling with forecasting and backcasting. Mixed method approach will also be used for the socio networks analysis (Froehlich, Rehm and Rienties, 2020; Froehlich, Van Waes and Schäfer, 2020).

From the theoretical stance, this project study will be guided by the use of an adapted version of Strong Structuration Theory (SST) (Jack and Kholeif, 2007; Greenhalgh and Stones, 2010; Stones, 2017), multi-level analyses and governance (Cooke, 2001a; Baraldi and Havenvid, 2016), regional urban growth theory, dynamic social network theory (Scott, 2012; Froehlich, Van Waes and Schäfer, 2020) and knowledge diffusion and spill over theories (Cooke, Uranga and Etxebarria, 1997; Asheim and Coenen, 2005a), the Dynamic Capabilities Framework (Zahra, Sapienza and Davidsson, 2006b; Inan and Bititci, 2015; Breznik, Lahovnik and Dimovski, 2019) and the Regional Entrepreneurial Ecosystem (REE) (Cooke, 2001a; Doloreux and Parto, 2005; Spigel, 2017).

This project will contribute to the scholarly literatures of Networked UBIs, UBI configurations and their regional ecosystems firstly by aggregating literatures, articles, that discusses the concepts, pedagogy, knowledge diffusion within Networked UBI, regional entrepreneurial ecosystems studies as a sub-system of RIS using a qualitative approach via thematic analysis, the aim of this section of the study is to understand the configuration and patterns within existing Networked UBIs and traditional UBIs. This study also aims to understand how traditional UBIs capabilities, socio-human structures and networks differ from Networked UBIs within and beyond the same REE and a comparison of different Networked UBIs overtime across DIHs, RISs and supra innovation systems.

Secondly, this study will also investigate specially focussed UBIs' (such as Biotech, Agrotech and Smart Based UBIs) capabilities, socio-structures and underlying social networks dynamisms within their RISs, SISs and DIHs (Digital Innovation Hubs). Based on an aggregation of existing literatures and Biotech Based University Business Incubators (UBBI), these study will understand the different mode of UBBI clusters in several continents and regions to understand related patterns, themes, Biotech value chains and socio-human and legitimation structures and their entrepreneurial ecosystem. These include: the Boston 128 structure with MIT, Stanford and Harvard, United Kingdom clusters (Cambridge, University of Liverpool, Bradford, Imperial and Wales), Canada Mega Biotech clusters with Universities in the cities of Toronto and Montreal, the Scandinavian (Sweden, Denmark and Finland – KI, Uppsala Med Valley), the German major Bio-Regions (Munich, Heidelberg, NRW), the Swiss connected clusters (Bio Valley, Bio Alps-Basel, Zürich, Bern, Genf, Freiburg) together with the French city of Strasburg and Toulouse. In Asia Japan's Biomass and Biotech UBBI clusters (e.g Kyoto, Kobe), India's Biomass clusters, South American UBBI clusters (Brazil-Rio De Janeiro, Minas Gerais, Sao Paulo and Mexico), Israel, Austria (Tyrol, Wien) and South Africa (West Gauteng) (Cooke, 2001b, 2013; Trippel and Tödtling, 2007; Breznitz, O'Shea and Allen, 2008; Breznitz, 2013; Wakabayashi and Takai, 2016).

An understanding of instituted and established UBBI modes, successes, structures and challenges and adaptation to external and internal factors will facilitate the enhancement of UBBI based entrepreneurial activities in other regions with less or different infra and superstructures. The next sections describe the methodology and the blocks of research.

2 Methodology

The primary research method for this study is a combination of both qualitative and quantitative methods (i.e. the mixed method). Due to the multi-phased approach of the research and the different

segments of investigative, explorative enquiries and validative statistical modeling, mixed method designs such as sequential exploratory, sequential explanatory, concurrent and multi-phased methods could be applied at different phases.

The adoption of mixed method techniques adequately fits the research questions and the purpose of the research. The mixed method aids in the combination of both qualitative and quantitative benefits to further develop, expand or triangulate data or findings from the earlier phase (Johnson and Onwuegbuzie, 2004; Cameron, 2009; Cameron and Molina-Azorin, 2010; Onwuegbuzie, 2019).

Mixed method sampling schemes such as identical and nested will be applied while purposive sampling design will be used (Tashakkori, Teddlie and Teddlie, 1998; Onwuegbuzie and Collins, 2007; Tashakkori and Creswell, 2007; Tashakkori and Teddlie, 2010).

In line with this, this study will use a multi-strand mixed method research design (combining Sequential Exploratory and Explanatory techniques in which qualitative coding of sampled Networked UBIs in the EU region based on the EDIHs and in different RIS types will be conducted to find patterns, themes and dimensions and the varying substantive and dynamic capabilities and how they relate to their performances overtime combined with open-ended interviews. Thereafter quantitative modelling techniques will be further used to develop or validate the qualitative findings.

This study will firstly analyse and review Networked UBIs and DIHs literatures based on case studies using thematic analysis followed by descriptive statistics (cluster, co-occurrence, correlation statistics). The social network of relationships will also be analyzed using the Dynamic Social Network Analysis.

The second block of the study is focused on UBIs Entrepreneurial Ecosystem (EE) their dimensions and attributes. This study will be based on a sequential exploratory mixed method. UBIs' regional ecosystem will be understudied within different EDIHs and Regional types (peripheral, municipal and old industrial) to differentiate and classify the varying Entrepreneurial Ecosystem attributes and dimensions and the UBIs capabilities, how UBIs entrepreneurial activities create value within the different ecosystem based on these attributes and dimensions and how they change overtime with the UBIs internal capabilities, the Regional Ecosystem Lifecycle and their impact on the socio human agents and structures within their ecosystem using the SST, DCF and Dynamic Social Network Analysis. This study will investigate how these structures are impacted and affected overtime based on the 'temporality' as suggested in SST. In conducting the mini-research project, the following research questions are developed. These UBIs recurring patterns and their set theoretic configurations based on causal complexities as they transit into different forms or 'gestalts' due to the orchestration and transformation of their assets, resources, operational routines, strategic mechanisms into higher order capabilities (dynamic) and also how their institutional structures, normative expressions and also changes overtime to form these configurations.

For the third block of this project, based on a mixed method research design, this study will also investigate the related specific capabilities, socio human structures, value chain and configurations of special focused UBIs such as high tech based University Business Incubators i.e. University Based Biotech Incubators (UBBIs). Several UBBIs studies and clusters within EDIHs Regions, EU and other continents will be reviewed and integrated to understand how their capabilities differ from traditional UBIs, which themes and patterns exist within regions and supra regions, how policies and external factors affect their structures overtime and their outcomes. This will include an integrated study of various UBBi clusters across different continents, thematic analyses and quantitative modeling.

In the fourth block, the configurations of UBIs in relation to outcomes will be determined using combination of techniques for comparison such as integrative review, taxonomy development and Qualitative Comparative Analysis (QCA).

The fifth block will involve the development of a Software as a Service Platform (SaaS) and a mobile based app that integrates all studies and could be used for the design, measurement, analyses and control of several UBIs' configurations performance and capabilities order.

For all stages of studies, time series modelling will be conducted to understand how the respective capabilities, Regional Entrepreneurial Ecosystem attributes and dimensions relate to value creation, UBI performance and how they enhance entrepreneurial activities overtime.

3 Literature Review

While UBIs are instituted within their region to firstly facilitate the incubation of ideas within the academic community and external entrepreneurs, some UBIs play advanced and multiple roles within their region which include acting as innovation facilitator and knowledge explorer.

It is pertinent to understand how specific UBIs advance in these roles and the specific capabilities they possess that facilitate the specific roles played. The essential supportive dimensions and elements they absorb from their regional ecosystem to achieve this and how they facilitate entrepreneurial activities within the region and also create value in different regional contexts required further investigation. In addition to this, how the UBIs' capabilities also change overtime with the regional ecosystem life cycle will be investigated in conjunction with the institutional and socio structural effects and changes during the Regional Entrepreneurial Ecosystem Lifecycle.

3.1 Regional entrepreneurial ecosystem

A Regional Entrepreneurial ecosystem(REE) is made up of elements,actors (individuals, organizations and agencies) and institutions which continually interact and integrate to create value to foster sustainable development and economic growth within the region. REE support institutions like the Universities and UBIs with enabling infrastructure and policies that enhance their core objectives of research, commercialization, knowledge creation and diffusion and entrepreneurial activities such as business incubation. The consensus space within the Triple and Quadruple Helixes provide the platform where the actors within the REE strategize and align on policies and innovation and entrepreneurship culture that enhances the right entrepreneurship climate within the REE. However, scholars have suggested that there is 'no one cap fits all' REE type. Each EE has specific unique elements and dimensions that makes it sustainable overtime. Also UBIs are located in different regions which have favorable and unfavorable entrepreneurship regions and adaptability of their internal capabilities and the Regional EE is vital and should be contextually researched. While capabilities that facilitate the organizational business process and strategy transformation are continuously re-configured and re-integrated during the organizational capability life cycle, it is important to understand how UBIs facilitate their internal Substantive and Dynamic Capabilities to undergo re-integration and transformation overtime with the EE dimensions, elements and networks(Teece, 2014, 2016).

Within the EE network, there are formal and informal linkages used during capabilities and knowledge exchanges. While these transformation and re-integration of the institutional hubs like UBIs are evolving so also are their different linkages within their network facilitated by several actors and agencies that include influencers, brokers, intermediaries' entrepreneurial connectors, and resource providers. Based on past literature review, it is important to understand the different types of Institutional networks(UBIs) that exist within the EE and how the EE lifecycle and these linkages evolve overtime. While scholars have also identified institutional networks types such as: informational, exchange and legitimate networks, a research gap still exist to understand the different network type that exist in several UBIs' EE(Audretsch and Belitski, 2017; Brown and Mason, 2017).

These changes and transformation of EE elements with the UBIs internal capabilities typifies a change in the UBI structure embedded within the REE. The impact of these transformation on UBI internal structure overtime requires more investigation. Based on a combined Strong Structuration Theory(SST), Actor Network Theory, Personal Construct Theory(PCT) and Institutional theory, this study will investigate the quadripartite structure of the UBI Entrepreneurial Ecosystem (EE) and how

their actors ‘cognitively’ problematize and finally mobilize other actors in the network to adapt to these changes overtime and how this has led to a successful outcome or failure vis-à-vis tension, alignment or breakdown on the overall structure.

3.2 UBI entrepreneurial ecosystem

UBIs are embedded within region entrepreneurial ecosystem(EE) to foster knowledge generation, diffusion and stimulate entrepreneurship culture and climate. UBIs aid in attracting entrepreneurial actors and also facilitate Entrepreneurial connection within the regional EE.

An Entrepreneurial Ecosystem can be defined as an interconnected, interrelated and agglomeration of elements and dimensions such as actors(individuals, organization, clusters), processes and infrastructures within a region where resources are exchanged, value created and sustainable regional development enhanced(Brown and Mason, 2017; Spigel, 2017). An Entrepreneurship Ecosystem is made up of components, dimensions or attributes and these can be classified into social, financial, Infrastructure, legal, political, social, economic, commercial, actors, resources, Entrepreneurial actors (influencers, brokers and dealmakers) and connectors, resource providers and entrepreneurial orientation. These elements and dimensions exist in different degrees within typical Entrepreneurial Ecosystem and the interaction and interdependencies of these element enable EE to be sustainable and the dynamic evolution of the EE’s dimensions needs to be further investigated.

Universities are the most referenced institution hubs within an EE and the Universities’ EE include several mechanisms within the regional Innovation space as suggested by the Triple and Quadruple Helixes(Malecki, 2018).

In addition to this, the EE is made up of networks and institutions. The typical network include informational,exchange and legitimation networks which defines rules,guidelines and norms. These networks facilitate information and resource sharing and exchange and also define rules,guidelines, norms and Entrepreneurship culture within an Entrepreneurship Ecosystem (EE)(Alvedalen and Boschma, 2017). The institutional culture within the EE as suggested above also buttresses earlier Structuration theory postulation which defines the internal structure of a social-actor and agency, normative expressions, interpretative schemes and the internal structures (conjectures and habitus)(Jack and Kholeif, 2007; Greenhalgh and Stones, 2010; Coad, Jack and Kholeif, 2016). However more studies are required to investigate EE’s institutional structures such as UBIs overtime(Taiwo, 2022).

3.3 Networked incubators

The Triple and Quadruple helixes aid the understanding of interactions of different actors within a regional ecosystem (Government, Academia,Industry and End Users)(Etzkowitz, 2002; Etzkowitz and Klofsten, 2005a). The manner in which these roles are played out within different regions differs as several forms of innovation consensus space platforms as suggested in the Triple Helix model are used. Due to this, varying innovation consensus modes such as UBIs, Network UBIs, Accelerators, Digital Technology centers,Innovation Parks and High-Tech Based Innovation Hubs have been created in Regions.

As an example, Networked UBIs are established within a RIS or NIS to accelerate regional entrepreneurial activities and combination of entrepreneurial strengths, knowledge and experience and to aggregate the benefits and strengths of a single traditional UBI(Bøllingtoft and Ulhøi, 2005; Fukugawa, 2013; Kitagawa and Robertson, 2015). How their structure and mechanisms differ across RISs requires investigative and theoretical groundings therefore a gap still remains in the study of Networked UBIs(Perdomo Charry, Arias Pérez and Lozada Barahona, 2014). Networked UBIs are the innovation bedrock of some regions in developed countries. Typical examples include the SETSquare UK Network which is a consortium of 6 UBIs (Exeter, Birmingham, Southampton, Bath,Cardiff and

Bristol). While each UBI has its singular benefit, a combination and centralized network of these UBIs resulted in the speedy or accelerated entrepreneurial activities within the ecosystem thereby creating fast paced regional growth and economic development. The outcome of such was the nomination of SETSquare as the best UBI in the world for consecutive years(Meyer, 2019). The combinative effects of human, knowledge, financial, social resources and capabilities enabled the advancement of such regions and hubs(Kitagawa and Robertson, 2015).

Although regions differ in their forms of resources, infrastructures, superstructures, capabilities and linkages available within their RIS, NIS and SISs (Spatial Innovation System) and the levels of Innovation milieu within the continuum of knowledge available, such SISs linkages are formed between regions in different countries, within continents and other continents based on the need to overcome the local regional innovation challenges. Such regions amidst lock-in-effects (especially in old industrial RISs) in their territorial embeddedness engage in establishing these linkages for internationalization and new markets entries while still connected to their local RISs.

In such Innovation Systems(ISs), knowledge creation and diffusion are firmly based on an intensive University research, robust product development programmes and spin-offs within their Networked University incubators, strategic internalization partners and venture aids and continental backed projects and policies.

Such vivid examples are Karolinska Institute(KI) in Sweden (a foremost Bio-Medical University with a robust networked incubator and partnerships), Artic Alliance(OIA) is an innovation alliance between regions in Finland, Norway and Denmark and the Alliance Group (which consist of five major partnered University network: University of Barcelona, ELDA Hungary, Montpellier France, Trinity University Ireland, Technical University Utrecht Netherlands and a Germany University).

KI (Karolinska Institute) as an example has established an integrated network of incubation and business development process within its region in Sweden and in other Scandinavian regions. KI has been known to create exponential bio-medicine based products within their incubators and science parks all integrated with University Aarhus in Denmark and universities in Finland and also supported by numerous venture capital organizations e.g. VINNOVA, KI development agencies(KIDB). KI is also listed on the Swedish Stock(Baraldi, Ingemansson and Launberg, 2014; Baraldi and Havenvid, 2016). Such extended regional strategies defy the original Saxenian and RIS typologies as the attractiveness for knowledge (exogenous and endogenous) are different from the metropolitan RISs due to their nature of knowledge generation and the adaptation processes in overcoming their regional challenges.

The case of the Artic Alliance created between Oulu, Lulea and Tromso (Finland, Sweden and Norway) also describes another Innovation system network with integrated University networked incubators that was created not only based on regional economic growth but also as an EU supported program in aiding inter-regional entrepreneurship activities in climatic unfavourable regions in the Scandinavia or Artic regions of Finland, Denmark and Norway. These alliances, networks and hubs buttress the suggestion that “no one size fits all” i.e. different regions with their networked UBIs within RIS and NIS adopt different innovation systems mode e.g. peripheral RISs (or regions in unfavourable entrepreneurship). In lieu of this, it is also pertinent to investigate the structures and patterns of networked UBIs in other regions of the world with different economy system (i.e. factor and production based economies) in different specialized and focused sectors such as Agriculture, Smart specializations, Bio-tech, High-Tech Network UBIs).

3.4 Biotech based university incubators

As a vivid example, BioTech or BioScience UBIs are specialized type of university based incubators with specific focus on biotech, biopharma or biomedicine based spinoffs using techniques such as protein recombination and DNA.

Regional governments together with Universities in developed countries invest substantial amount of funds and resources in establishing biotech clusters to enhance innovation, medtech transfers in Life Sciences and Healthcare sectors of the economy. Several examples of such establishment in Europe and North America include: Karolinska Institute, Sweden, MIT, Stanford, Harvard, Boston Massachusetts Biotech Clusters, Toronto and Montreal University and their Bio clusters. This project examines regional and national biotech clusters and biotech based UBIs with focus on the different patterns and structures they form regionally and nationally and how they differ from traditional UBIs.

These special or focused UBIs include high tech based UBIs: Smart Tech UBIs, Space and Satellite based, Agro Based UBIs and Biotech based UBIs. Specific strategy and mechanisms are needed to enhance the successful outcomes of these UBIs compared to traditional UBIs. How they develop their capabilities and the human actors and structures within their ecosystem requires in-depth investigation as no two BIs are the same and the strategy, mechanisms needed to manage them differs (Rasmussen and Borch, 2010; Miner *et al.*, 2012; Obaji, Olugu and Obiekwe, 2015; David-West, Umukoro and Onuoha, 2018; Ng *et al.*, 2019).

From studies, different Biotech clusters and incubators exist around the world based on their regional and national innovation policies and systems, however their structures are different due to the dynamism within their region and the mode of knowledge diffusion and spillover.

In addition to this, RISs also differ in terms of infrastructures and superstructures (Cooke, 2002, 2008) and RIS types (MacKinnon, Cumbers and Chapman, 2002; Asheim and Coenen, 2005b). Heterogeneity also exist within the regional dynamisms in terms of labour mobility required to facilitate tech based intense research (which is highly required in biotech), knowledge generation and diffusion and the financial power or venture funds available within the Biotech clusters (Cooke, 2004).

While agglomeration of clusters is facilitated based on the regional input factors according to Porters' Diamond model of clusters' agglomeration (Niosi and Bas, 2003; Cooke, 2008) i.e. the existing infrastructure in the region, supporting development and infrastructure, an intense research centre and academic support such as a well-known University grounded in biopharma and biosciences research with several patents to their credits and a region that facilitates competition and rivalry to enhance value delivery, these biotech clusters differ based on the accumulation of these cluster factors. Multifactors also aid the evolution and development of these biotech incubators and hubs which depends on available regional attributes.

Generally taking a deep dive into some successful UBI based biotech regions such as in the UK (Cambridge, Bradford in association with Universities such as Cambridge University, Bradford University and Imperial College London), United States (Massachusetts-Boston, Stanford, MIT Harvard), Sweden (Stockholm, Karolinska Institute, Uppsala with Uppsala Science University), Basel, Zürich and Geneva (Switzerland) with the BioAlps and BioValley with an excellent partner network via BioPartner and Canada (Toronto, Montréal) shows that these UBIs have been successful in spinning off several biotech firms both from Universities, research centres, regional and public incubators. However other regions in the same country face challenges in facilitating the same success.

In Canada, the major biotech clusters are situated in Montreal and Toronto and are mainly from two models: the first model involves co-operation involving biotech firms, Universities and Venture capital firms in nurturing and spinning off biotech firms from the University in Toronto and also licensing research patents. The second mode is where large organizations often called Megacenters or multinational corporations align and collaborate with private research centers on product development (Niosi and Bas, 2003; Cooke, 2004).

In EU, Munich and Heidelberg winners of the German Bio-region competition operate a different mode of biotech cluster financing with much dependency on regional sponsorship (Cooke, 2001b), however in Austria (Vienna, Styria and Tyrol) there are some challenges due to lack of the infrastructure and cluster formation as compared to what is seen in Sweden or the US and Germany. This is mainly due to the lack of intense research experts and the funding required. In Tyrol and Styria

for instance, biotech activities have been mainly on laboratory equipment development, while major biotech firms' spinoffs have occurred in Vienna and also an ongoing transformation in the regional innovation system (RIS) and labour mobility have ensued (Tripl and Tödtling, 2007).

In Japan (Kyoto, Osaka, Kobe) regions, an alliance with Kyoto University have developed a funding base with private organizations and cumulative efforts with Universities research centres. Industrial and knowledge clusters are also created across major regions in Japan to foster biotech collaboration, spinoffs and knowledge generation and diffusion (Wakabayashi and Takai, 2016).

While these regions all have different modes of University Based Biotech Incubators or Biotech clusters with Universities acting as agents of knowledge creation or development and diffusion, there are slow progresses with respect to other regions in the world such as South Africa in the Western Gauteng Region saddled with funding challenges (Pillay and Uctu, 2013) Israel (Jerusalem University) with slow progress in Biotech spinoffs compared to advancement in ICT (information and Communications Technology) and major concentration on only a line of production in the value chain such as R&D (research and development) (Breznitz, O'Shea and Allen, 2008; Breznitz, 2013).

Globally regions like Boston Massachusetts, Cambridge (UK), Zürich and Basel (Switzerland) Uppsala (Sweden), Germany (Munich and Heidelberg), are front runners in biotech spinoffs and research. The German Biotech regions (Münich and Heidelberg) in conjunction with Universities and institutes such as MaxPlanck Institute have successfully developed agglomeration of bio-tech clusters and University and Regional Based incubators that are well established over the years and have spined off several firms with high revenues in yearly turnover, the same story cannot be said about other Universities biotech based incubators and clusters both in some of the mentioned countries above but in different regions (Cooke, 2008; Cooke *et al.*, 2011).

Although different forms of biotech incubators exist and can be classified according to the actors within their ecosystems and the linkages they form with Universities, it is relevant to understand the specific structures and changes that occurred overtime with some University based Biotech incubators and clusters and the specialized capabilities these UBIs possess. It would also be novel to understand how they differ from traditional UBIs and how other regions within the same country can adapt or adopt their structures to the successful ones. In lieu of these facts, this study aims at investigating the different patterns and structures of Biotech UBIs that exist in different world economy types (innovative, production and factor based economies).

3.5 Theoretical concepts

UBIs exist within Universities' local ecosystems and the broader Regional and Spatial Entrepreneurial Ecosystem. Within these ecosystems, UBIs interrelate and exercise their entrepreneurial activities towards value creation via co-existing, co-evolution and co-production with actors (entrepreneurs, individuals, brokers, dealmakers and cluster of firms) and several network types.

UBIs inter-relationship and co-existence develops a structure of human agents with several actors. Scholars have suggested that studies of UBI must be investigated based on context and regional levels as different dynamics, strategies, mechanisms are needed due to differing favourable and unfavourable entrepreneurial conditions and locations (McAdam, Miller and McAdam, 2016; David-West, Umukoro and Onuoha, 2018). In this regard, it is pertinent to understand the typical UBI structures that exist in literatures and selected cases.

The Structuration theory earlier postulated by Giddens stipulated the recursive nature of socio-human relationship within a structure from an ontology in general perspective. While there has been criticism to Giddens' theory due to its abstract nature, SST (Strong Structuration Theory) built on earlier Giddens' Structuration Theory aid scholars in understanding the typical socio human structure by depicting the three levels in which the recursive relationships can be more understood (Jack and Kholeif, 2007; den Hond *et al.*, 2012; Coad, Jack and Kholeif, 2016). SST added the meso level to the abstract and ontic levels. SST also defines the position practice, contextual and focussed agents within

what was called the quadripartite framework with the internal,external,actants and outcome components(Harris *et al.*, 2016; Makrygiannakis and Jack, 2018).

Based on the SST, a methodological bracketing can be employed to understand the context and conduct of actors within a socio-human structure i.e why do they do what they do and how they carry out such activities based on their cognitive,transposable skills and culture.SST also aids to understand the internal and the effect or impact of the external conditions and how agents respond to the impact of these conditions depending on the level of causation(Harris *et al.*, 2016).

In this regard, UBIs are influenced and impacted by conditions: internal or external which either aid or debar their entrepreneurial activities and there is dire need to continually ‘orchestrate their assets’ to continually provide value both for the University and regional ecosystem.

Based on the literature summary above, different UBIs forms in varying regions and ecosystem will produce varying outcomes and since several forms of UBIs could exist within same or different RIS and SIS, it is important to understand the configurations of UBIs and their related outcomes.

3.6 Set theoretic configuration approach

With the advent of the Triple Helix and policies such as the Bayh Doyle Act in the United States,several incubators have been created globally over the years and they have evolved via several generations of evolution(Etzkowitz, 2004; Etzkowitz and Klofsten, 2005b). In general,scholars have classified the evolution of business incubators from inception(Allen and McCluskey, 1991b; Grimaldi and Grandi, 2005) with UBI identified as a typology.

However,several UBIs have been established over the years within regions based on specific mission,objectives,actors and strategies required to fulfil the stakeholders’ goals and in line with this,there is the tendency for these UBIs to evolve into different configurations,patterns,dimensions and archetypes based on the order of the capabilities they posses and how they have orchestrated their assets overtime according to the capabilities as the highest and mega order(Zahra, Sapienza and Davidsson, 2006b; Inan and Bititci, 2015).

Based on archetype anaylsis and configuration theory,there is the tendency for structures(such as UBIs) to form gestalts or constellations which are groups with the same dimensions and elements sharing common characteristics overtime and applying this concept to UBIs can aid scholars to understand how UBIs have evolved overtime into different gestalts,patterns and configurations due to the capabilities(substantive and dynamic) they possess,their strategies,mechanisms and assets that facilitate these structural dynamisms.

Configuration theory aids the understanding of how organizational efficiency exists due to the combination of strategies and structures which causes changes internally within the organization structure. This is often referred to as magnitude or sets of patterns or organizational forms. It is pertinent to note that the application of configuration theory must be guided by the number of domains for assessment which can be single or multiple,issue of causality i.e reverse of mutuality and the temporality or stability of the organization in question overtime. Care should also be taken to distinguish configuration from typology (which occurs due to conceptual or theoretical development) and taxonomy development which is based on empirical evidences from data collections(Dess, Newport and Rasheed, 1993; Lim, Acito and Rusetski, 2006; Bronstein and Reihlen, 2014).

Although archetypes of academic entrepreneurship exist(Bronstein and Reihlen, 2014) with several typologies of business incubation as stated above, however a gap exists in business incubation literatures in understanding the transition,configurations and archetypes of UBIs changes overtime with their capabilities. It has also been suggested that a combinative methodology of qualitative studies grounded in data or thematic analysis with quantitative study that shows the clusters of attributes, configurations and not just correlations and relationships of variables and constructs (as do multivariate analysis) but also a dynamic time series analysis could be used to further examine the

concept of organizational configuration(Dess, Newport and Rasheed, 1993). This study intends to fill this gap by adopting a mixed method research design (sequential exploratory).

In line with this, this study will be guided by the set theoretic configuration theory using Qualitative Comparative Analysis(QCA), archetype analysis, integrative review (also for classification, taxonomy), dynamic capabilities framework and SST (Strong Structuration Theory).

Set Theoretic Configuration Theory is based on causal complexity and its adjoining fundamentals of equifinality, asymmetry and conjunctions. It suggests the use of conditions instead of independent variables (in quantitative based techniques) and outcomes instead of dependent variables. Set theoretical theory fosters the path development in research as several conditions could be combined to form an outcome and some conditions might be necessary and or not sufficient in producing an outcome. The Set theoretical approach could be used for configuration analyses via QCA. Qualitative Comparative Analysis(QCA) combines case based techniques and variable(conditions) i.e quantitative based techniques in determining the outcomes of configurations that gives rise to an outcome. QCA is based on crisp or fuzzy data sets using truth tables and Boolean Algebra in determining the sets of configurations and outcome.

3.7 UBI software as a service platform

The analyses and major findings within the project will be integrated on a cloud based platform. This will be provided as a SaaS for UBIs,RISs and DIHs. An Initial IT strategy and Business model will be formulated to understand the market and customer trends and demand. The IT Strategy development will include the market and customer analyses, IT open group architectural framework and Data Information and Security based on EU and DIHs polices. The initial minimum viable product(MVP) will be designed and developed together with the software developers to test the waters and reduce initial starting cost thereafter a full-blown production and implementation based on demand and market strategy will be implemented.

4 Conclusion

The long term goal of the EU based research is to investigate and understand the specific capabilities (substantive and dynamic) of Networked Incubators, special focused (Biotech and Agro Tech Based UBIs) in comparism with traditional UBIs.

The aim of this project is to investigate Networked UBIs,different UBI configurations in specific regional context based on the combination of sampling schemes and strategies in different RISs and SISs on how they adapt to dynamic changes within their region overtime and how their capabilities and structures adapt to these changes. The result of this study will be valuable to the DIHs in Europe, Regional Innovation Systems actors and stakeholders, UBIs policy makers and cities based regional development agencies,innovation parks and technology centers.

5 Project management and Funding

Based on the research methodology outlined, the research project will be divided into phases. Each phase will be a duration of 1 to 2 months (depending on selected cases) and budget as this project is based on a personal initiative apart from the author's doctoral research. These stages will be implemented as described in the introduction. Project work packages,deliverables,milestones,critical path and project reporting and methodologies are also defined in other documents. The project will implement best practice PMO(project management organization) for the monitoring and control of project activities. Table 1 shows a breakdown of the work packages.The required patenting and copyrights will be addressed with the stakeholders.

5.1 Table

Project Work Packages	Status	Stakeholders
1. Networked UBIs (WP1)		Head DBA,SSBM,A.Taiwo,Mentors, Regional Co-ordinators,EU UBIs,DIHs
2. UBIs REE and Structures		Head DBA SSBM,A.Taiwo,Mentors, Regional Co-ordinators, EU UBIs,DIHs,
3. Specialized UBIs(Biotech) (WP3)		Head DBA SSBM,A.Taiwo,Mentors, Regional Co-ordinators, EU UBIs,DIHs,
4. UBIs Configuration with QCA (WP4)		Head DBA SSBM,A.Taiwo,Mentors, DIHs, Regional Co-ordinators, EU UBIs
5. UBIs SaaS Platform (WP5)		Software Developers(DE and CH), A.Taiwo (Author) and Product owner, Advisor(SW),SSBM,Author,Universities Professors.

Table 1. Project Management Work Packages.

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