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Understanding University Community Engagement in a rural context. A Mixed Study

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Dissertation for academic degree of
Doctor in Educational Sciences
2023
"Great things are done by a series of small things brought together." - Vincent Van Gogh
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Embarking on a PhD journey is like sailing on an uncharted sea. As I reflect on my voyage through the world of academia, I am reminded of the saying: it takes a village to raise a child. It took an extraordinary network of individuals to guide, support, and inspire me. My pursuit of a Ph.D. began as a humble aspiration, a desire to delve deeper into the realm of knowledge. The trajectory has been filled with exceptional happiness, many exciting experiences, and beautiful memories. I want to express my sincere gratitude to the individuals and organizations whose support and encouragement have been instrumental in completing my doctoral journey.

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Abstract

This doctoral dissertation aims to understand university Community Engagement (CE) in a rural context in Uganda and to test a CE model and the processes of engaging various stakeholders in CE. The first study systematically reviews the literature regarding characteristics, theories, models, and critical elements that foster successful CE outcomes. From the findings, the conceptualisation of university CE underscores the importance of reciprocity, shared benefits and engagement that focuses on the needs of stakeholders. The second study explored how engaged university stakeholders perceived CE regarding benefits, opportunities, challenges, and their needs for CE. Data were collected by way of a survey. Respondents were categorised as academic staff (n=53), students (n=194), and dairy farmers (n=203). One-way ANOVA findings showed that the three categories of stakeholders perceived CE differently and had multiple needs. Findings underscored the importance of empathy and responsive communication in bridging the gap between these diverse university stakeholder voices.

Therefore, the third study demonstrates a co-creation process where different university stakeholders were engaged in developing a dairy app for CE. The study followed the stages of the design thinking model: ideation to generate content for the app's initial requirements, prototyping a usable app and testing the functionality and content of the app with end users. This study's findings showed that stakeholders' active participation in the app development process yielded valuable insights, resulting in a tool that addresses practical needs and reflects the essence of shared ownership. Having developed a technology tool for CE, the fourth study assessed factors that could influence rural farmers' readiness and intention to use the dairy app. The aspiration Intention to use the application was assessed with nine constructs. A survey was used to gather data from 466 respondents: dairy farmers from five districts. A Partial Least Squares- structural equation modelling analysis technique was applied to test the research model using Smart PLS (v3.3.3). The findings strongly supported all the anticipated relationships predicted in our research model. The study findings signal a promising future for successfully implementing and using technology tools in university CE initiatives. For instance, the significance of awareness and perceived usefulness of the Rwenzori dairy suggests that the app successfully communicates its value to users.

The last study focused on developing and testing a model of input dimensions influencing university CE processes and outcomes at the university and community levels. Our model comprises institutional, personal community and professional dimensions as input elements that could influence the CE process and outcomes at institutional and community levels. We tested the CE model with a sample of 126 academics and 216 community partners from the Rwenzori region of Uganda. The study used a structural equation modelling technique to assess the relationship in the model. The results demonstrated the significance of institutional, community, and professional/occupational dimensions to the engagement participation process.

The research is significant as it validates both theoretical and practical dimensions of CE in a rural context in Uganda, hence contributing to new knowledge from a developing country viewpoint. Besides, this research contributes to the CE debate by developing a model that can serve as a strategic roadmap for guiding the universities' efforts to create meaningful, sustainable, and reciprocal relationships with their communities.
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Chapter 1

1. General Introduction

This dissertation examines community engagement (CE) from the perspective of higher education institutions (HEIs) or universities. CE has increasingly evolved into a holistic strategy through which HEIs connect their academic expertise with the needs of their communities, improve student learning and scholarship, and foster mutually beneficial connections with their communities (Boyer, 1990; Clifford and Petrescu, 2012; Mtawa et al., 2016). Fulfilling the CE mission is seen as a practical and tangible part of HEIs to enhance community development and participation and solve local and global challenges (Musinguzi et al., 2016). For instance, the COVID-19 pandemic presented various obstacles that necessitated engagement efforts between HEIs and communities to respond to and reduce the virus's impact appropriately. As such, governments, policymakers, accreditation agencies, scholars and researchers increasingly challenge contemporary universities to pay maximum attention to CE missions (Brunton et al., 2017; Jongbloed et al., 2008a; Murphy and McGrath, 2018).

Historically, in different society context, HEIs reached their communities or stakeholders within an expert model of knowledge delivery (Scull & Cuthill, 2010; Shephard et al., 2017). University CE efforts focused on generating highly specialised and technical knowledge within disciplines, often resulting in research and teaching with minimal or no significance to community challenges (Gupton et al., 2014). Institutional involvement in activities beyond teaching and research was often limited to providing services to the community (Moore & Ward, 2010; Mugabi, 2015; Musinguzi et al., 2016). During the second part of the 20th century, Ernest Boyer emphasised the importance of expanding the traditional definition of scholarship to include CE (Boyer, 1990). He advocated a broader view of scholarship encompassing not only research and publications but also CE through teaching, service, and the application of knowledge.

One CE domain includes using university knowledge to fulfil societal challenges and aspirations. Ernest Boyer underlined that CE entails collaboration between academics and community members to form mutually beneficial partnerships and exchange information for the community's benefit (Boyer, 1990). According to Bridger and Alter (2006), appropriate CE is meant to be conducted in partnership and reciprocity, aiming at institutional development and contributing to communities' sustainable social, economic, and environmental cultural...
prosperity. To recognise and encourage universities' CE programs, the Carnegie Foundation for education improvement training initiated a classification system (Welch & Saltmarsh, 2013). According to their system, CE comprises partnerships between HEIs and communities to exchange valuable resources and knowledge. The process enables HEIs and their communities to develop viable relationships that foster and shape success in both directions (Bhagwan, 2018).

Due to increasing community challenges and changing societal expectations, universities have increasingly adopted the CE mission (Gupton et al., 2014; Koekkoek et al., 2021). Literature shows HEIs have established CE programs, initiatives, and partnerships to address numerous community challenges (Chile & Black, 2015; Morrell et al., 2015). To maximise the universities’ capability and promote CE, governments introduced policies to allow collaboration, information sharing and community-centric research for social and economic growth in Africa (Mugabi, 2015). Therefore, a comprehensive understanding of CE conceptualisation, stakeholder perceptions, processes, approaches to executing engagement initiatives, and contextual models that guide university CE is required. For instance, understanding the perceptions and needs would be valuable for designing and guiding future CE interventions.

Additionally, CE emphasises the importance of identifying stakeholder needs and exchanging knowledge and resources to address these needs. More importantly, in knowledge exchange processes, users should have the opportunity to share their insights and preferences when developing tools that affect them. Once CE tools are developed, target users should be ready to use these tools. Thus, testing the readiness and intention to use such tools provides critical feedback on overall readiness for adopting and using technology tools. Moreover, developing and testing a CE model allows for identifying best practices and areas and contributing to the broader field of CE research.

2. General research gap

Like any other HEIs, CE is an essential component of Mountains of the Moon University's mission in Uganda. Since its inception in 2005, the university has had a rich mission-driven commitment to involve the university with its local community (Dhaene et al., 2018). The university is found in the Rwenzori area of Uganda. The region is characterised by a rural landscape comprising small villages, relying on agricultural activities as a major source of
income and a predominantly rural population (UIA et al., 2020). Since its establishment, the university has focused on collaborating and serving its community, contributing to local development, and addressing challenges faced in the region. For instance, the university prioritised CE initiatives with local farmers on research projects addressing agricultural challenges and enhancing best agricultural practices (Johan De Tavernier, 2020). A specific example was the university's establishment of a dairy development centre to reinforce dairy farming practices in the Rwenzori locality. Engaging with farmers is envisaged as an opportunity for the university to leverage this expertise and apply it to the community's agricultural challenges and improve the well-being of rural communities. Other CE initiatives spearheaded by five members of the Faculty of Education included training programs for local primary school teachers and principals to improve their teaching methods, subject knowledge, school management, and classroom management skills. The business and Management Science faculty also offered entrepreneurship training programs to community members and aspiring community entrepreneurs.

Despite the numerous CE activities initiated by specific faculties or departments, the CE's overall visibility and impact were not apparent. A report by (Dhaene Europe and Paul Kibwika (University of Makerere 2018) revealed that meaningful CE at MMU is lacking and CE efforts have had minimal impact on the rural community. A fundamental limitation to successful CE is that the institution lacked a clear conceptualization of CE. Secondly, stakeholders’ perceptions and needs for CE are unknown. In addition, approaches that actively involve stakeholders are rarely explored, and the university lacks a clear model to govern the CE process. Without a clearly defined approach, it could be difficult for universities and communities to establish compelling, visible, and sustainable engagement initiatives. Moreover, conveying and showcasing the value and outcomes of engagement efforts to the university and the community becomes difficult without a structured approach or model. This dissertation focuses on university CE, with a specific focus on how literature conceptualises CE, perceptions and needs of engaged stakeholders, practically involving stakeholders in a co-creation process to develop a CE tool, testing their intention to use the tool, and finally, developing and testing a model of dimensions that can guide practical university CE.

3. Theoretical background

This doctoral study is embedded in the knowledge exchange theory to understand the idea of university CE. Knowledge exchange refers to procedures that produce, exchange, and use
information in various ways based on the context, goal, and participants (Fazey et al., 2013; Hagen, 2008). Initially, the knowledge exchange theory pinpoints the fundamental role of knowledge as a facilitator of relationships (Fitzgerald et al., 2012; Loi et al., 2015). Secondly, the term ‘exchange’ emphasizes the transactional and reciprocal dimensions of relationships (Hagen, 2008). The theory stresses the bidirectional exchange of knowledge, expertise, and experiences between university and community members, acknowledging that both groups can provide valuable insights (Mbah, 2019; Mtawa et al., 2016). According to the knowledge exchange theory, university CE should develop beneficial knowledge that addresses community needs and aspirations (Weerts, 2005). Addressing community needs can be facilitated through co-creation activities, matching university teaching and research activities to community challenges and allowing active connections amid the community and the university to address the challenges and deliver meaningful outcomes through CE projects. The knowledge exchange theory assumes that during the engagement, there is a sharing or exchange of knowledge between the two parties (Hagen, 2008; Hart & Northmore, 2011; Smoluk, 2018). Knowledge exchange signifies institutions and their communities collaborating in research and co-learning activities, developing knowledge that benefits academia, and solving real community needs (Mtawa et al., 2016).

This research also used Javen and Wenger’s Communities of Practice (CoP) theory. This theory is closely linked to the knowledge exchange theory. However, CoP stresses the sense of belonging and shared experiences among members. The theory underscores the significance of social interaction and collaborative learning within a shared human experience, fostering knowledge exchange among its members (Wenger, 1998). The theory suggests active participation in joint activities and information-sharing among members (Hart et al., 2014; Reilly et al., 2012). According to CoP theory, members foster mutual relations that enable them to exchange knowledge through creative workshops, internet forums, web apps, or discussions (Wenger, 1998). As members collaborate in CoP, mutual benefits such as boosting the academic mission and enhancing community development are obtained (Arthur et al., 2016). From the CoP view, HEIs may meet the distinct stakeholders’ needs and jointly search for solutions. According to Chile and Black (2015), university interactions in CoPs are expected to bring positive partnerships and address stakeholders’ distinctive needs.

In this research, we developed a dairy application for university engagement with dairy farmers. Therefore, the dissertation partly used a proposed technology acceptance model (TAM) to evaluate rural farmers’ readiness and intent to use a dairy app. According to the
concept, when individuals are introduced to new technology, various elements impact their decision to utilise it. In the case of this dissertation, we anticipate that interaction between universities and communities could happen using technology and, specifically, a tool for dairy farmers (the Rwenzori dairy app). However, there was limited evidence of whether rural farmers are ready and intend to use the dairy app. For decades, technology-based interventions have consistently validated measures derived from the Technology Acceptance Model (TAM) (Davis et al., 1989). Therefore, an extended TAM was preferred to establish rural farmers’ readiness and intent to use the dairy app. In precise terms, these theories offer different perspectives to understand and address CE and its aspects in HEIs.

4. The conceptual framework

Based on the exceeding theoretical viewpoints, the conceptual framework for summarising the essential notions in this PhD dissertation is depicted in Figure 1. The conceptual framework comprises five dimensions that broadly support promoting practical university CE in rural areas. In this dissertation, the term university and HEIs are used interchangeably to imply a centre of research and scholarship where faculty members and students engage in scholarly activities, including teaching, learning, research, and creative endeavours. Such institutions possess a wealth of knowledge, expertise and research that brings fundamental changes to the community by creating spaces for interaction (Sara and Jones, 2017). Community engagement activities advance knowledge, innovation, and societal developments (Brown-Luthango, 2013; Mbah, 2019). Thus, universities are considered valuable assets that have the potential to improve communities through the CE mission.

The term community has several definitions in the literature. For instance, a community may imply a collection of individuals with shared characteristics, interests, or geographic proximity who interact with one another (Bernardo et al., 2014; Bridger and Alter, 2006; Cherrington et al., 2019; Coetzee, 2012; Delugan et al., 2014). In this dissertation, "community" refers to the local collective group of individuals, organisations, or institutions in a rural area where the university CE strives to cooperate to address their specific challenges, contribute to their growth, and support and promote university CE objectives.

The conceptual framework commences with a critical assessment of how literature conceptualizes the CE phenomenon in HEIs. This evaluation delves into a comprehensive examination of theories, models, and key elements that underpin the nurturing of community
engagement. Within the rich tapestry of scholarly discourse, diverse theoretical paradigms are explored. Concurrently, an in-depth examination of the essential elements that shape effective CE is explored.

The literature review stressed the importance of university focus on the stakeholders’ perceptions and needs to nurture successful CE (Frank & Sieh, 2016; Strom, 2011; Tarus et al., 2017). Thus, the second dimension of our conceptual framework focuses on the stakeholders' perceptions and needs for CE (Sheila et al., 2021). Stakeholders' perceptions are crucial in shaping attitudes, motivations, and expectations towards engagement attempts (Ogunsanya and Govender, 2019; Shannon and Wang, 2010). Understanding how the community perceives CE enables the university to tailor engagement strategies to their needs and aspirations; building genuine partnerships allows for a more comprehensive and practical CE approach that fosters trust and shared responsibility and ultimately leads to more meaningful and impactful CE initiatives (O’Brien, 2009). In this dissertation, stakeholders' perceptions imply the faculty members, dairy farmers and students’ thoughts or perspectives regarding university CE's benefits, challenges, and opportunities.

In addition, the literature demonstrates the need to actively involve stakeholders in the joint development of solutions to address their challenges and needs (Filieri, 2013; Kumar et al. (2016). The third dimension of our conceptual framework is a practical approach to the active engagement of different university stakeholders in developing solutions. In literature, co-creation is a popular engagement strategy suggested to enhance end users' participation in developing solutions (Al-kumaim et al., 2021; Baelden and Van Audenhove, 2015; Herselman et al., 2010; Voorberg et al., 2015). By engaging rural communities in the collaborative development of solutions, universities can ensure interventions are contextually relevant, culturally sensitive and have a higher chance of success (Kenny and Regan 2021; Mansson et al. 2020). Moreover, stakeholders are empowered to take ownership of their development processes and promote sustainable change that addresses their aspirations (Zavratnik et al., 2018).

In the fourth dimension of the conceptual framework, farmers' readiness and intention to use a co-created tool are modelled based on a broadened Technology Acceptance Model (TAM). This model is based on evidence that individual decisions to adopt any technology are based on elements such as attitude (Davis et al., 1989; Thar et al., 2021). In this dissertation, readiness and intention refer to university and rural farmers' preparedness and intent to adopt the co-
created Rwenzori dairy app for specified purposes. Assessing readiness and intent to use apps helps identify potential roadblocks, challenges, and areas for improvement in app adoption and usage (Elahi et al., 2021). It also enables targeted interventions, customisation, and user-centric design to ensure the apps' effectiveness, adoption, and impact on the intended users or community (Elahi et al., 2022).

The last dimension of the conceptual framework develops and examines a model of input dimensions that influence the university CE process and outcomes. The model is developed through published studies and experience from the prior empirical studies in this dissertation. The model provides an expanded articulation of institutional, professional, personal, and community dimensions that influence the CE process and university outcomes at the university and community levels. The university CE process is perceived as the university's ability to integrate CE into activities that bind academics and community partners (Shabalala & Ngcwangu, 2021; Wanjiru & Xiaoguang, 2021).

Figure 1: Overall structure of the research
5. Research questions

From the theoretical and empirical point of view, this doctoral dissertation addresses distinct research questions from the structure depicted in Figure 1. The dissertation's overarching research question is how university CE is understood in a rural context. Five specific research questions were devised to elicit answers to the primary research issue.

Research question 1: How have existing studies conceptualised community engagement mission for higher education institutions since 1990?

The literature review reports studies from 1998 to 2019 on university-community engagement. The chapter gives an overview of theories, models, and key features guiding university CE. The initial research subject question yielded insights that prompted more investigation, which greatly benefited the completion of this doctoral dissertation.

Research question 2: What are the HEIs stakeholders' perceptions and needs for CE?

This chapter consists of empirical evidence of university stakeholders' perceptions and needs intended for CE. Examining HEIs stakeholders' needs and perceptions could considerably add to understanding how engaged stakeholders in Uganda perceive their roles in the engagement process or what needs to be done to enhance the CE in HEIs. This research question was addressed in chapter 3 of this doctoral dissertation.

Research question 3: What practical approaches can be used to involve university stakeholders in developing tools to address the CE challenges?

The fourth chapter focused on using the co-creation approach to develop a dairy app as an engagement platform that could benefit the university and the dairy farmers. The chapter describes faculty, software developers, and dairy farmers' contributions to the application's design and development. The chapter demonstrates how collaborative input, shared decision-making, and multiple stakeholders' active participation resulted in a contextual dairy application. The experience from this chapter demonstrates the benefits of engaging end-users in developing tools. However, developing the tool does not necessarily imply the intention to use it. This necessitated an investigation into this phenomenon.
Research question 4: What factors influence rural farmers' readiness and intention to use a dairy application for collaboration with a HEI in Uganda?

This chapter assessed dairy farmers' readiness and intention to use the dairy app to understand if users are likely to interact with and continue to use the app for engagement with the university. By assessing the readiness and intent to use the app, the chapter gives valuable insights into user motivations and what the institution should focus on to scale up the CE engagement tool.

Research question 5: What input dimensions influence the university community engagement process and outcomes?

This chapter develops and tests a conceptual model of input dimensions influencing university CE processes and outcomes. Developing and testing a contextual university CE model could provide a framework that guides effective and impactful engagement initiatives. The model is meant to be a valuable resource for universities, community partners, and other stakeholders who want to foster meaningful and sustainable mutual collaborations.
Table 1: Outline of research objectives and corresponding research questions

<table>
<thead>
<tr>
<th>Research objective</th>
<th>Research questions</th>
</tr>
</thead>
</table>
| OB1: Provide a comprehensive overview of conceptualisation and models of CE in HEIs | RQ1: What are the characteristics of community engagement studies in HEIs?  
   RQ2: What theoretical perspectives underpin the community engagement of HEIs in the selected articles?  
   RQ3: What are the existing models of community engagement in the selected articles?  
   RQ4: What elements are described in the identified articles fostering effective university CE? |
| OB2: Evaluate stakeholders’ perceptions and needs for CE | RQ1: What are the stakeholders’ perceptions of CE with HEIs?  
   RQ2: What are the HEIs stakeholders' needs for practical CE? |
| OB3: Engage stakeholders in co-creating an engagement tool. | RQ: What approaches and processes can be used to involve university stakeholders in co-creating a dairy application tool for CE? |
| OB4: Examine rural farmers' readiness and intention to use a co-created tool | RQ1: Do awareness and normative influence positively affect rural farmers’ readiness to collaborate through the co-created dairy application?  
   RQ2: Does readiness positively affect the dairy app’s perceived usefulness and ease of use?  
   RQ3: In what manner does self-efficacy influence the perceived ease of use of the dairy app?  
   RQ4: Does perceived ease of use positively affect the perceived usefulness of the dairy application?  
   RQ5: In what manner does perceived ease of use influence hedonic and utilitarian attitudes to use the dairy application?  
   RQ6: How does perceived usefulness influence hedonic and utilitarian attitudes toward the dairy application?  
   RQ7: Does self-efficacy, hedonic and utilitarian attitude influence the intention to use the dairy application? |
| OB5: Developing and testing the CE model | RQ1: What input dimensions influence the university CE process and outcomes based on existing literature?  
   RQ2: What is the effect of the proposed model dimensions on the university-community engagement process and outcomes? |
6. Research methods

The doctoral research employed mixed methodology to collect and analyse data per the stated objectives.

6.1 Data Collection and Sources

In this dissertation, qualitative and quantitative data were used. Each measurement's details are provided in its chapter. However, a broad overview of the study methodology is provided below.

Secondary and primary data were gathered in response to the study questions. The first paper-based chapter (chapter 2) involved a systematic review of 106 studies on university-community engagement to identify theories, models, and crucial features of successful community engagement. PRISMA, a data-collecting method, was utilised to gather information for the systematic review question.

The third chapter assessed the university stakeholders' perceptions and requirements for CE. A survey of four hundred and fifty stakeholders classified as students, faculty members of Mountains of the Moon University and dairy farmers was used. The analysis involved using One-way ANOVA to ascertain how engaged stakeholders perceived CE.

Chapter Four describes the design of the Rwenzori dairy app with end-users' input. The chapter applied the design thinking model's final three stages (ideation, prototyping, and testing) in a qualitative co-creation process to develop the application. We purposively sampled three categories of participants, including dairy farmers, faculty members from the agriculture department, and a specialised software design and development team to engage in the co-creation of the dairy application.

Chapter Five applied a modified technology acceptance model to evaluate farmers' readiness and intent to use a co-created app as an engagement tool with the university. Intention to use the dairy app was examined with nine indicators: normative influence awareness, readiness, self-efficacy, perceived usefulness, perceived ease of use, utilitarian and hedonic attitude. Data were obtained from a survey of four hundred and sixty-six respondents in the Rwenzori region.
in Uganda. A Partial Least Squares- structural equation modelling assessment technique was utilised to estimate the effect of the model indicators on the intention to adopt the dairy app.

The previous study involved developing a conceptual model of input dimensions influencing the university community engagement process and outcomes. The developed model was empirically examined by a survey with a sample of 126 academics and 216 community partners from the Rwenzori region of Uganda. Statistical analysis for the chapter involved using structural equation modelling techniques to assess the relationship in the model.

6.2 Overview of Data and data analysis methods

The overview of the methodology, research data and data analysis methods applied in this doctoral study is shown in Table 2.
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Study</th>
<th>Sample</th>
<th>Data type</th>
<th>Data collection method</th>
<th>Measurements</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 2</td>
<td>Literature Review on University CE</td>
<td>106 studies</td>
<td>Secondary</td>
<td>PRISMA</td>
<td>Theories, models, and key elements for CE</td>
<td>Descriptive and narrative synthesis</td>
</tr>
<tr>
<td>Chapter 3</td>
<td>Stakeholders' Perceptions and needs for CE</td>
<td>450 stakeholders (3 groups)</td>
<td>Primary</td>
<td>Survey questionnaire</td>
<td>University stakeholders’ perceptions: (benefits, opportunities, and challenges) and needs for CE</td>
<td>ANOVA</td>
</tr>
<tr>
<td>Chapter 4</td>
<td>Co-creation of the dairy app for CE</td>
<td>139 stakeholders (3 groups)</td>
<td>Primary</td>
<td>Design thinking co-creation stages (ideation, prototyping, and testing)</td>
<td>Contextual content for the dairy app</td>
<td>Screening feedback from workshops and living lab sessions</td>
</tr>
<tr>
<td>Chapter 5</td>
<td>Rural Farmers' Readiness and Intent to Use the dairy app</td>
<td>466 dairy farmers</td>
<td>Primary</td>
<td>Survey questionnaire</td>
<td>Awareness, Normative influence, readiness, self-efficacy, perceived usefulness, perceived ease of use, attitude and the intention to use the co-created dairy application</td>
<td>A Partial Least Squares-structural equation modelling</td>
</tr>
<tr>
<td>Chapter 6</td>
<td>A model of input dimensions that influence the university CE engagement process and outcomes</td>
<td>342 stakeholders (2 groups)</td>
<td>Primary</td>
<td>Survey questionnaire</td>
<td>Institutional, Professional, personal and community dimensions</td>
<td>The structural equation modelling technique</td>
</tr>
</tbody>
</table>
7. Outline of the dissertation

This PhD dissertation has been organised into seven chapters, as depicted in Figure 1.2. The first chapter (general introduction) presents the state of the art, general research gap, theoretical and conceptual background, research objectives and methodologies applied to address the research objectives.

Chapter 1 described the objectives, research questions, conceptual framework, and research methods. The primary goal of this chapter is to provide the reader with an overview of the rationale for the present study, as well as a general background and justification for the following chapters.

Chapter 2 thoroughly evaluates the literature to determine the most critical studies on universities or HEIs and the CE mission. This chapter focused on the theories, models, and critical futures enabling practical university CE. Results from the review helped design the following chapter by providing variables that could measure the stakeholders' perception regarding CE.

Chapter 3 gives an empirical overview of university stakeholders' perceptions and needs for CE. The chapter generated knowledge on how engaged stakeholders perceived university CE regarding benefits, opportunities, and challenges. Chapter 3 is published in the Heliyon journal (see Sheila et al. 2021).

Chapter 4 demonstrates a co-creation approach to engage university stakeholders in developing a dairy application for university engagement with dairy farmers. The process followed the final three stages of the design thinking model (ideation, prototyping, and testing). This chapter was presented at the EDULEARN21 conference. (See Nanyanzi et al. 2021).

Chapter 5 was designed to assess rural dairy farmers' readiness and intention to use the co-created dairy app. This chapter empirically investigates constructs affecting the intention to use a dairy app for CE. Findings from this chapter are published in the Social Science and Humanities Open journal (See Nanyanzi et al., 2022).

Chapter 6 explains the development and testing of a conceptual model of input dimension that
influences the university CE process and outcomes at institutional and community levels. Chapter 7, the final chapter, summarises the research results and highlights the main contributions of this doctoral dissertation.

Figure 2: Outline of the doctoral dissertation
8. Reference


Chapter 2
Conceptualisation and Models of Community Engagement in Higher Education Institutions: A Review

Abstract
This literature evaluation was inspired by the global drive for HEIs, the CE mission to attain more profound societal conversion and address community challenges. However, the most compelling literature conceptualises the community engagement mission differently, challenging key role players. A mutual insight into what community engagement entails could offer an invaluable starting point for effectively adopting this mission. This study investigates extant literature concerning university community engagement to identify theories, models, and crucial features of successful community engagement from 1998-2019. Our systematic search with syntax and keywords search approach from three databases yielded 1851 articles. One hundred and six peer-reviewed journal articles met the inclusion criteria. We then analysed these studies to ascertain the existing theories, models, and key features that can guide community engagement. The place-based theory was the dominant theory used to explain the community engagement phenomenon. In line with models, the university-community partnership model was more pronounced. Fifteen elements influencing the effectiveness of university-community engagement efforts emerged from the synthesised studies. The results inform a systematic approach to developing models that support mutually beneficial community engagement. Future research should focus on stakeholders' perspectives and needs for community engagement.
1. Introduction

This review examines several journal articles on the theories, models, and crucial features that can support the university community engagement mission. The CE mission is often regarded as a leading paradigm for HEIs to demonstrate relevance and address diverse community social, economic, educational, and cultural requirements (Clifford and Petrescu, 2012; van Schalkwyk and de Lange, 2018; Ward and Hazelkorn, 2012). A substantial body of literature acknowledges CE as a transformative tool for HEIs to address challenges affecting communities (Paleari et al., 2014; Preece, 2013). As community assets, HEIs are understood as critical role players in enabling communities to map out development pathways (Paleari et al., 2014; Preece, 2013). As community assets, HEIs are understood as critical role players in enabling communities to map out development pathways (Paleari et al., 2014; Preece, 2013). Given the documented benefits of CE, numerous studies have progressively asserted that HEIs could aid the development of communities and nations when the CE mission is prioritised (Goddard et al., 2016; Shukran et al., 2019). For institutions and partners to engage efficiently, there is an urgent need to understand the fundamental theories, models, and elements that can guide CE practice.

Primarily, the term CE was presented by Ernest Boyer in 1990 after acknowledging that the pre-existing procedures, such as experimental education, community outreach, service learning, community education, and community service, had shortcomings (Ward and Hazelkorn, 2012). For instance, these traditional CE approaches were stringent to unidirectional interventions, implying one party giving to the other while the other becomes a passive recipient (Aurora et al., 2014; Carolyn, 2005). Academics used CE as a tool to extract information from communities for academic purposes Ward and Hazelkorn (2012). Researchers such as Coetzee (2013) and Cherrington et al., (2019) suggest that contemporary HEIs must move to a different level and character of engagement to create and promote community social transformation.

According to the literature, CE is meant to be a practice aiming at developing relationships with community stakeholders (Brown et al., 2016). The institution's expertise in teaching and research areas is intended to address community-related concerns (Coetzee, 2013; Lebeau and Cochrane, 2015a, 2015b; Piirainen et al., 2016). Equally, community members are acknowledged as sources and generators of critical knowledge and co-producers of knowledge that meet their needs (Clark, 2015; Fitzgerald et al., 2016; Groark and McCall, 2018). Equally
important is the community members’ active involvement in all phases of the engagement process (Brown-Luthango, 2013).

Effective CE facilitates inward and outward knowledge flow among faculty, students and the community (Quillinnan et al., 2018). During engagement, various activities, such as applied research, development, innovation, and social engagement with the surrounding community, can be applied (Arthur et al., 2016; Piirainen et al., 2016). The process offers various prospects for institutional members to discover how their research could apply to critical community problems (Dempsey, 2010; Olutokunbo et al., 2018). In this regard, CE reflects the institution’s purpose to strengthen ties and create synergies with the non-academic world (Frank and Sieh, 2016; Hall, 2009; Thakrar, 2018). University members are meant to reciprocally collaborate with other groups of individuals to generate and share knowledge, increase understanding, and address common challenges (Aurora et al., 2014; Fitzgerald et al., 2016; Gorski, 2016). In precise terms, CE focuses on reciprocal, knowledge-driven relationships between the institution and her community (Bender, 2008; Bloomgarden, 2013; Carolyn, 2005; Kruss, 2012; Mbah, 2018).

Despite its inspiring nature, the clarity about theories, models and key elements of CE that guide and support its practical implementation is still unclear to role players (Starke et al., 2017). Previous studies such as Franz et al., (2012) and Hikins and Cherwitz, (2010) found that CE is weakly developed at the institutional level. In addition, Weerts and Sandmann, (2010) and Tarus et al. (2017) progressively underscore the difficulty in defining what constitutes CE. More recently, Johnson, (2020) argued that CE remains challenging due to a lack of substantive conceptualisation. A challenge to note from the literature is that the conceptual scope of CE seems to be presented with deviating propositions. For instance, the terms community and engagement are interpreted with varied definitions. Additionally, CE is identified with other terms or ventures like, public engagement (Cho, 2017b; Plakans et al., 2016), social engagement, scholarship of engagement, or community-engaged Scholarship (Abbott and Tiffen, 2019; Brien, 2009; Delugan et al., 2014; Mbah, 2018; McNall et al., 2008), third mission (Arthur et al., 2016; Krčmářová, 2011; Loi and Di Guardo, 2015). The discrepancy in terminologies used in reference to CE creates a difficulty in its key features.

Whereas many would acknowledge that CE is crucial and that efforts to advance this mission in HEIs have been made in recent years, it is still broadly acknowledged that CE is still weakly implemented, especially in the African university context (Nkoana and Dichaba, 2017).
Creating meaningful engagement requires a model and an understanding of the elements that can support engagement interventions (Weerts, 2005). At this point, the motivation for assessing the conceptualisation of CE in HEIs requires consideration. This study examined the existing theories, models and fundamental features that facilitate CE in a systematic approach. Therefore, the leading research question guiding this chapter is:

How have existing studies conceptualised community engagement mission for higher education institutions since 1990?

Following the above research question, this study makes three contributions: First, we present descriptive statistics on how CE has been recognised over time, key participants, theories used, and general models considered to support it. Second, we better understand the key elements that enable CE in HEIs. Third, a comprehensive systematic review makes present academic CE knowledge more visible and replicable. It serves as a foundation for future studies and guiding principles for developing and optimising CE in HEIs.

Throughout the systematic review, we follow as possible the widely used Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA), which ensures transparent and complete reporting –The subsequent sections for this chapter are organised as follows, the second section illustrates the research strategy which is used to extra data and data analysis methods, the third section elaborates the findings relating to the research questions. The discussion and conclusions are explained in the last sections, which shape the future research agenda.

2. Methods

The methodology adopted to conduct the systematic reviews consisted of the following five steps, as suggested by (Tranfield et al. 2003) and Higgins and Green (2008). The initial stage is to plan, followed by identifying or searching for papers. The third phase involves selecting the studies that are qualified for inclusion. Step four entails extraction and synthesis, while step five entails reporting the synthesis findings. The following paragraphs elaborate on their practical application in this review.
2.1 Specific Research Questions

Community engagement is a broad idea that encompasses a diverse range of research disciplines. To demarcate boundaries for this study, the authors defined the main research question to guide this review. We navigated the review with the following specific research questions:

1. What are the characteristics of community engagement studies in higher education institutions?
2. What theoretical perspectives underpin higher education institutions' community engagement in the selected articles?
3. What are the existing community engagement models in the selected articles?
4. What elements are described in the identified articles fostering effective university CE?

2.2 Searching/Paper identification.

Criteria for selecting studies for this review.

Types of studies
Both conceptual and empirical studies were included. Since CE in HEIs has evolved over time, this review sought to comprehend the conceptualisation and application of this concept.

Participants
The studies that involved all internal university stakeholders, and community partners were included. It is crucial to emphasise that the motivation for this study was what happens when internal institutional stakeholders collaborate with the community members.

Phenomenon of interest
Studies that reported on the definition, theories, and models of CE or how CE is implemented by HEIs were selected for synthesising.
2.3 Search methods

The researchers formulated a comprehensive search strategy with stringent inclusion and exclusion criteria. Key terms were selected from (Dempsey, 2010; Northmore and Hart, 2011; Sandmann, 2008). Using Boolean connectors, authors searched for community OR similar AND Engagement OR similar AND ‘higher education institution’. These key terms were used to create search strings applied to secondary academic data sources. The final search syntax was compiled to search for the Scopus and ISI Web of Knowledge databases and collect articles published in selected peer-reviewed journals, employing keywords such as, (“Community engagement” OR “Engagement” OR “Third mission” OR “Public engagement AND (“Higher education institutions OR “Universities”) OR Engaged University” OR Community-university engagement” OR University-community engagement” OR “University-community partnerships” OR Engaged Scholarship, OR Scholarship of engagement, OR “University-third mission” AND NOT (“community service OR “civic engagement”).

The electronic databases, including Web of Science, were searched in June 2019 to provide multidisciplinary references, Scopus was searched in September 2019 to provide references from social sciences, and google scholar was searched in January 2020 to provide additional references. In addition to the electronic databases, cross-referencing was used to extract - studies suitable for the inclusion and exclusion criteria discussed below.

The preliminary search string yielded diverse papers covering a wide range of topics. All the search results were imported into citation management software, Endnote, and duplicates were removed. Titles were scanned, excluding articles with irrelevant titles based on inclusion and exclusion conditions. After reviewing the abstracts and keywords of the remaining papers, the full texts were retrieved. After that, the full retrieved articles were assessed to establish their merit for inclusion, as explained in Table 3 below.
Table 3: Conditions for article inclusion and Exclusion

<table>
<thead>
<tr>
<th>Inclusion criteria</th>
<th>Justification for inclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic</td>
<td>Research articles should focus on CE in HEIs or Universities to narrow the research questions and report pertinent findings. The presence of other concepts which seem concepts or phenomena that appear to be related to CE, such as civic engagement, public participation or community service, were acknowledged. However, incorporating these ideas would greatly increase the number of studies and cause a loss of focus.</td>
</tr>
<tr>
<td>Year of publication</td>
<td>Articles published between 1998 to 2019 are included because scholarly work on community engagement in high education institutions evolved in 1990</td>
</tr>
<tr>
<td>Study design</td>
<td>Both conceptual and empirical studies are eligible. Since the term CE in HEIs has evolved, this review aims to understand this concept's conceptual and empirical design.</td>
</tr>
<tr>
<td>Type of participants</td>
<td>The participants in the CE process should nominally be internal university stakeholders and community stakeholders or groups. It is crucial to stress that the motivation for the review is to find out what happens when the academic institution interacts with community stakeholders.</td>
</tr>
<tr>
<td>Language</td>
<td>Barely English-published articles were synthesised and reported in the systematic review. English is the most used language in the academic scientific community worldwide.</td>
</tr>
<tr>
<td>Publication status</td>
<td>Scholarly research articles published in peer-reviewed journals are considered good quality.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exclusion criteria</th>
<th>Reasons for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpublished article</td>
<td>To guarantee quality and uniformity, all articles included were peer-reviewed journals. Therefore, conference proceedings and working articles were excluded.</td>
</tr>
<tr>
<td>Non-education institutions</td>
<td>Articles investigating CE in other institutions, such as public health and medicine, the military or the private sector are excluded. This review did not consider concepts that do not fully represent a comprehensive view of CE or those that offer one aspect (like community services (Moore, 2010).</td>
</tr>
</tbody>
</table>

Following the above criteria, 1851 articles were identified as relevant to the study's objectives—figure 3.
2.4. Data extraction

Data extraction was performed using a pre-tested data extraction spreadsheet developed by three reviewers guided by the purpose of the review. These worked independently, and in cases of discrepancies in the extracted data, the original articles from which those discrepancies arose were revisited. Such discrepancies were resolved by discussion to arrive at a consensus. The extracted information included eight items that focused on essential publication characteristics such as the study location, author, year of publication, study type, participants, study design, study focus, theories and models reported guiding CE and elements associated with university CE success. The identified elements were grouped into themes that support CE in HEIs.
2.5 Data analysis

Several approaches are used to synthesise data in reviews. For example, if empirical data was obtained in the same manner to answer comparable research questions, a meta-analysis may improve the conclusions' dependability. (Churchill and Peter, 1984). However, the diverse data based on this review is less liable to this sort of synthesis. (Denyer and Tranfield, 2009). Therefore, we used a descriptive synthesis approach to test what works for this study, following (Rousseau et al., 2008) suggestion. All eligible studies were synthesised, and key data from each article was included in the spreadsheet. The subsequent section provides quantitative and qualitative descriptions of studies included in our review. This type of analysis is useful in synthesising qualitative and quantitative evidence from different research studies (Lucas et al., 2007).

3. Reporting Results

First, we provide a report of our first research question demonstrating key characteristics of the synthesised articles.

Study characteristics and selection
The selection criteria limited the publication date; barely publications from 1998 to 2019 were synthesised. Searches generated (n =1851) and (n =1487) articles after removing duplicates. However, a sample (n = 106) of articles met our inclusion criteria. Considering the years of publication, findings reflected a gradual increase in the number of peer-reviewed publications regarding CE. A decline in research focus on CE was reflected in 2007, 2011, 2014, and 2017. However, in general terms, the results from Figure 4 can be explained as an acceptance of CE acknowledgement in the scientific community as the number of publications increased from (n = 1) to (n =12) in a year.
Secondly, we focused on the study type published and found that most of these studies were conceptual compared to empirical studies. This indicates that theoretical methods prevail when studying CE in HEIs. The empirical studies were often case studies and applied qualitative research designs, for instance, using interviews in data collection. Table 4 indicates the distribution of the study types.

<table>
<thead>
<tr>
<th>Studies</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual</td>
<td>58</td>
<td>54.7%</td>
</tr>
<tr>
<td>Empirical</td>
<td>47</td>
<td>44.3%</td>
</tr>
<tr>
<td>Mixed</td>
<td>1</td>
<td>.9%</td>
</tr>
<tr>
<td>Total</td>
<td>106</td>
<td>100.0</td>
</tr>
</tbody>
</table>

In terms of study location, the majority of studies were carried out in developed countries, as indicated in the table. As shown in Table 5, the USA dominated studies (56.6%), followed by South Africa (15.1%) and the United Kingdom (4.9%). The findings in Table 5 show that although research regarding university CE is increasing globally, the notion is not so much reflected in the literature of developing or low-developed countries like Uganda. This partly confirms that the CE concept is not yet clearly acknowledged and might have received minimal attention within HEIs in developing-countries’ literature.
This study also collected data about the key participants in university CE. As shown in Table 6, studies presented CE participants in different categories. The most frequent category were faculty members (30.5%), community partners/stakeholders/groups (24.2%), university students (18.9%), campus or university leaders (13.7%), and engagement professionals/officers (4.2%). Other participants identified were community leaders (3.2%), government policymakers (2.1%), support staff (2.1%), and on-campus community stakeholders (1.1%). The type of participants involved in the CE were not reported in every article. The result implies that CE majorly relies on faculty members.

<table>
<thead>
<tr>
<th>Location</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>60</td>
<td>56.6%</td>
</tr>
<tr>
<td>South Africa</td>
<td>16</td>
<td>15.1%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>5</td>
<td>4.7%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>4</td>
<td>3.8%</td>
</tr>
<tr>
<td>New Zealand</td>
<td>3</td>
<td>2.8%</td>
</tr>
<tr>
<td>Australia</td>
<td>2</td>
<td>1.9%</td>
</tr>
<tr>
<td>Ireland</td>
<td>2</td>
<td>1.9%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>2</td>
<td>1.9%</td>
</tr>
<tr>
<td>Norway</td>
<td>2</td>
<td>1.9%</td>
</tr>
<tr>
<td>British Columbia</td>
<td>1</td>
<td>.9%</td>
</tr>
<tr>
<td>Canada</td>
<td>1</td>
<td>.9%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>1</td>
<td>.9%</td>
</tr>
<tr>
<td>Denmark</td>
<td>1</td>
<td>.9%</td>
</tr>
<tr>
<td>Finland</td>
<td>1</td>
<td>.9%</td>
</tr>
<tr>
<td>India</td>
<td>1</td>
<td>.9%</td>
</tr>
<tr>
<td>Italy</td>
<td>1</td>
<td>.9%</td>
</tr>
<tr>
<td>Kenya</td>
<td>1</td>
<td>.9%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1</td>
<td>.9%</td>
</tr>
<tr>
<td>South Korea</td>
<td>1</td>
<td>.9%</td>
</tr>
<tr>
<td>Total</td>
<td>106</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 5: Number of studies per country
### Table 6: Participants in the engagement

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty members</td>
<td>29</td>
<td>30.5%</td>
</tr>
<tr>
<td>Community partners/stakeholders/groups</td>
<td>23</td>
<td>24.2%</td>
</tr>
<tr>
<td>Students</td>
<td>18</td>
<td>18.9%</td>
</tr>
<tr>
<td>University/Campus Leaders</td>
<td>13</td>
<td>13.7%</td>
</tr>
<tr>
<td>Engagement professionals/officers</td>
<td>4</td>
<td>4.2%</td>
</tr>
<tr>
<td>Community leaders</td>
<td>3</td>
<td>3.2%</td>
</tr>
<tr>
<td>Government policymakers,</td>
<td>2</td>
<td>2.1%</td>
</tr>
<tr>
<td>University Support staff</td>
<td>2</td>
<td>2.1%</td>
</tr>
<tr>
<td>Community on-campus stakeholders,</td>
<td>1</td>
<td>1.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>95</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

**Community engagement theories in the selected article**

To address research question two in this chapter, we first identified the meaning of community and engagement. From the selected studies, we realised that the terms community and engagement had been used to imply many different things.

We explored the key meanings of these two terms. First, studies looked at "community" from a place-based perspective. They defined it as a physically or geographically bounded area where people interact in various organisations and express shared interests through various actions and activities. (Bernardo et al., 2014; Bridger and Alter, 2006; Cherrington et al., 2019; Coetzee, 2012; Delugan et al., 2014; Jongbloed et al., 2008; Weerts, 2005). The second definition of a community was one in which it was seen as a collection of individuals with an immediate, direct interest in a particular area (Bender, 2008; Bhagwan, 2018; Frank and Sieh, 2016; Onwuemele, 2018). Additionally, when referring to stakeholders, organisations, or groups of people who share specific characteristics that the institution must address, the term "community" is often used (Jongbloed et al., 2008) or stakeholders from the neighbourhood (Groark and McCall, 2018). Also, the term community is used in reference to a particular group of individuals or a community of practice who share a common understanding of the group perspectives, are united in action, support each other (Reilly et al., 2012), and foster reciprocal relationships. The authors of this study concur that the aspect of individuals was a common theme among these definitions suggested. In the manner in which (Cherrington et al., 2019) urged for successful CE, the authors suggest that Institutions should define the community as individuals to engage, the purpose of engagement, activities in the engagement, and how participants are linked. The next step was to examine how the selected studies characterise the term engagement.
To assess the description of the term "engagement," we concentrated on the interactions between the university or HEI and the community in question. The term engagement appeared to imply varied participation from unidirectional to bidirectional perspectives. Some studies characterised engagement as a one-way communication or a form of outreach from the institution to the community (Chile and Black, 2015; Demb and Wade, 2012; Kruss, 2012; Murphy and McGrath, 2018; Onwuemele, 2018; Ramachandra and Mansor, 2014). Furthermore, this form of engagement views community participants as spectators and passive recipients of HEIs services. To university students, engagement implies providing community experience or expertise (Bruning et al., 2006).

We identified as the second form of participation that emphasises a proactive two-way process between the institution and the community (Bal et al., 2013; Bhagwan, 2018; Brackmann, 2015; Demb and Wade, 2012; Prioleau, 2004; Prioleau, 2016; Ramachandra and Mansor, 2014). This engagement advocates for the involvement of the community in mutual dialogue and setting up an atmosphere that goes toward community empowerment (Cherrington et al., 2019; Murphy and McGrath, 2018; Thakrar, 2018; Weerts, 2005). Engagement avails opportunities for faculty to enhance research, creativity, teaching, and learning activities (Cook and Nation, 2016a; Fitzgerald et al., 2012; Frank and Sieh, 2016)(Aronson and Webster, 2006; Pearl, 2014) and disseminating research results (Prioleau, 2004).

Partners accordingly have a complete voice in identifying challenges and needs that can be addressed through community-grounded participatory research or service-learning pedagogy (McNall et al., 2008; Sandmann, 2008). This engagement further entails promoting democratic values and social responsibility and bringing together stakeholders to achieve common goals (Carolyn, 2005; McNall et al., 2008; Noel and Earwicker, 2015; Paton et al., 2014). In particular, studies emphasise the importance of reciprocal relationships based on trust, connectivity, and shared understanding (Abrams et al., 2006; Strom, 2011; Wilson, 2013).

As indicated in Table 7, we found that the majority of the studies (80.1%) did not specify the theory guiding CE. The remaining articles used a range of theories to explain the phenomena of CE. The first widely applied theory found (7.5%) of articles is the place-based theory. This theory provides a method for describing and assessing the university’s position along a place-building continuum (van Schalkwyk and de Lange, 2018). CE is viewed as a component of what institutions do in place and in relation to other place-based organisations. Through engagements, an institution impact community that lives in the spaces outside the institution. The theory explains how an institution values a place in terms of nature, social relations,
material environment, ethics, and economic relations. The place-based theory advocates for a participatory research design that allows students, faculty, community partners, staff, and administrators to dialogue to create development trajectories. Participating in place-building initiatives enables place keepers to gain insight into the role and reflects an institutional commitment to CE.

We found that (5.6%) of articles used the knowledge flow theory, knowledge exchange or knowledge spillovers. These studies underline the importance of knowledge as a fundamental element that could facilitate relationships (Fitzgerald et al., 2012; Krčmářová, 2011; Loi et al., 2015; Mtawa et al., 2016; Smoluk, 2018a). It considers how knowledge is produced, where it is being produced and how it is distributed. Articles presented this theory with two deviating positions. The first is to produce knowledge and allow it to flow. In this approach, HEIs are presented with the role of creating knowledge to be shared with users (stakeholders) who are its consumers. The second strategy was knowledge exchange, emphasising values such as mutual benefit. In this approach, institutional community partners are more than knowledge produced by the institutions; they are also partners in knowledge creation, dissemination, and implementation (Weerts, 2005). Meaningful CE entails institutions and their communities sharing knowledge and expertise through collaborative research, co-creation and interdisciplinary activities that benefit academia while addressing real community problems. When applied to CE, the knowledge gathered could result in positive perceptions and increased capacity to build informed decisions.

As depicted in Table 2, we found two articles (2.8%) supported the social interaction theory. The theory suggests that individuals’ behaviours are determined by the collective pressure they encounter. Based on this theory, CE becomes when HEIs take social responsibility to address community problems (Bridger & Alter, 2006; Byrne, 2016). The social interaction theory is somehow linked to the communities of practice theory Farnsworth et al., (2016). In CoP, individuals aspire to cooperate in ways that allow them to freely share their skills and knowledge in novel ways that foster the development of new perspectives and solving problems (Hart et al., 2014). The most critical features describing social interaction and practice communities are mutual engagement and joint initiatives.

The stakeholder theory was used in (1.9%) studies to explain the CE phenomenon in HEIs. According to these studies, CE is built on stakeholders or individuals or groups of individuals interested in engagement success or constrained by engagement innovations. The theory holds
that stakeholders possess critical knowledge and provide valuable input during the engagement. Accordingly, HEIs are meant to establish consistent interaction with stakeholders who can affect or be affected by institutional CE activities. The other five articles explained CE using theories, for instance, the boundary spanning theory (Weerts and Sandmann 2010), the public good theory (Brackmann 2015), rhetoric perspectivism (Hikins and Cherwitz 2010) and the theory of public relations (Bruning et al., 2006).

Table 7: Theories applied in the synthesised studies.

<table>
<thead>
<tr>
<th>Theory</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>No theory</td>
<td>85</td>
<td>80.1%</td>
<td>See appendix</td>
</tr>
<tr>
<td>Social interaction theory</td>
<td>3</td>
<td>2.8%</td>
<td>Bridger and Alter (2006), Chile and Black (2015), Byrne (2016)</td>
</tr>
<tr>
<td>Stakeholder theory</td>
<td>2</td>
<td>1.9%</td>
<td>Jongbloed et al (2008), Ramachandra and Mansor, (2014)</td>
</tr>
<tr>
<td>Boundary spanning theory</td>
<td>1</td>
<td>.9%</td>
<td>Weerts, and Sandmann (2010)</td>
</tr>
<tr>
<td>Public good theory</td>
<td>1</td>
<td>.9%</td>
<td>Brackmann (2015)</td>
</tr>
<tr>
<td>Punctuated equilibrium theory</td>
<td>1</td>
<td>.9%</td>
<td>Sandmann, (2008)</td>
</tr>
<tr>
<td>Rhetorical perspectivism theory</td>
<td>1</td>
<td>.9%</td>
<td>Hikins and Cherwitz. (2010)</td>
</tr>
<tr>
<td>Theory of public relations</td>
<td>1</td>
<td>.9%</td>
<td>Bruning et al., (2006)</td>
</tr>
<tr>
<td>Total</td>
<td>106</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>

Models of community engagement

The third objective of our chapter was to identify the existing models that describe the interaction between the HEIs and the community. As shown in Table 8 (45.2%) of the studies were not based on any theory or could not specify the theory informing CE in HEIs. However, we identified three basic models from the studies.
As shown in Table 8, the partnerships model was the most prevalent CE model portrayed in (33.0%) of studies. Researchers such as Franklin, (2009), Garber et al., (2010) Hart et al., (2014) and (Elizabeth Morrell et al., 2015) used this model to demonstrate how HEIs legitimately create corporations with communities that are governed by egalitarian, knowledge- and experience-respecting values. According to the model, each partner uses participation and task sharing to contribute to education and community building. The model highlights four core traditions. One is that HEIs do not exist to solve societal issues but rather to work with community partners to tackle problems through significant interventions. Second, the community challenges are a shared responsibility between the community and the institution. Third, institutional internal stakeholders’ outreach and research activities should represent mutually beneficial partnerships. The fourth is that through partnerships and teamwork, individuals can improve their productivity and efficiency (Ó Tuama, 2019).

The partnership model generally supports combining institutional faculty members' knowledge and expertise with that of community members and students, as well as ensuring that all partners have a voice in problem identification, intervention design, and research. An example of the partnership model that we found in the synthesised literature was the participatory action research approach (Cook and Nation, 2016a; Demb and Wade, 2012; Elizabeth, 2015; Scull and Cuthill, 2010; Winkler, 2013; Wood and Zuber-Skerrit, 2013). Participatory action research is based on values of co-creation, joint learning, and action to bring about change. Mehta and Weinstein, (2015) gave a real-world illustration of this strategy in their engagement ecosystem model by demonstrating how knowledgeable consultants assist faculty members in integrating worthwhile projects into courses to establish engagement ecosystems (faculty, students courses, and community networks).

The second model we found in selected studies was the engaged scholarship model, also known as the public scholarship model. This model was highlighted in (20.7%) of studies. Researchers describe this model as reliant on academic and research collaborations between HEIs and the community. This model regards HEIs as a community of scholars responsible for contributing unique skills and knowledge to the community during the engagement. This model's key characteristics are academics facilitating learning, knowledge discovery, and appropriate actions to address community challenges. Furthermore, engaged scholars seek to produce and communicate creative work that advances the discipline and benefits communities through discovering, developing, or disseminating knowledge that may alter community conditions and
learning behaviour. In precise terms, conducting CE within the engaged scholarship model would imply that faculty members strive to conduct research that benefits the community.

The traditional engagement model was the final and, arguably, least popular model (0.9%). Typically, the traditional model portrays CE as a university task of knowledge and information transfer to the community. The significant contributions that HEIs make to knowledge creation, dissemination, and technological transfer to communities are reorganised by this model. Other characteristics of this model include its emphasis on providing students with brief interactions with the outside world as a means of experiential learning. University faculty members frequently act unilaterally and authoritatively during interactions with community partners (Jinkins & Cecil, 2015). This model operates with limited or no input from community stakeholders during the engagement, and the university hardly meets their expectations. The paternalistic approach HEIs take in this model is comparable to the service or outreach models. One of the main shortcomings of this model is that university CE initiatives often benefit only the university.
Table 8: Basic community engagement Models

<table>
<thead>
<tr>
<th>Models</th>
<th>Frequency</th>
<th>%ge</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>No model specified</td>
<td>48</td>
<td>45.2%</td>
<td>See appendix</td>
</tr>
<tr>
<td>Traditional model</td>
<td>1</td>
<td>.9%</td>
<td>Bender, (2008)</td>
</tr>
<tr>
<td>Total</td>
<td>106</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Elements for Nurturing CE Practice in HEIs

Our last objective of the review was to understand better elements that could facilitate the development and sustain effective CE. The identified elements were coded and grouped into subthemes and themes. Table 3 presents subthemes, fifteen themes that were identified.
Theme 1: Enabling Institutional Structure
The first theme we identified was the institutional structure that fundamentally shapes CE and supports or hinders an individual's or group's ability to do so. Thirty articles (30%) reported items on this theme. This theme comprised factors such as the institutional philosophy for CE. The institutional philosophy for CE reflects the shared beliefs, values and norms that inform or characterise partnerships—enabling the structure to be built on the university's vision, mission, values, and guiding principles. Particular values, such as institutional commitment to CE, mutual respect, integrity, trust, accountability, shared benefits, and treating community partners as knowledgeable and valuable stakeholders, were highlighted. According to the studies, CE requires several qualities that should be reflected in the institutional structure.

Theme 2: Establish community engagement framework and guidelines.
The articles have shown that successful CE relies on frameworks and practical guidelines for assessing CE work. The framework enables institutions to identify opportunities and develop strategies for structurally engaging their stakeholders. The authors emphasised the importance of an institutional CE framework to define and measure specific CE standards and guides for all partners (Rojas et al., 2012).

Theme 3: Planning for community engagement
According to studies, institutions must plan for CE to inform stakeholders about the goal of engagement and secure their support for the initiatives.

Theme 4: Motivation of community engagement participants
According to studies such as (Franz et al., 2012), faculty engagement efforts must be recognised and valued by the institution’s principal advancement structure, tenure promotions, and reward structures. Researchers confirmed that rewards are critical to improving engagement participation and increasing engagement outcomes.

Theme 5: Funding for community engagement
In addition, the articles emphasise the importance of funding to encourage participation in CE. According to these articles, universities must provide adequate funding and support for CE. They also pointed to the importance of financial incentives for community members, improving participation and leading to more successful outcomes (Tryon & Madden, 2019).

Theme 6: Leadership support for community engagement
Another persistent theme throughout the literature has been the critical role-played institutional leadership. Pooled literature, including recent studies by van Schalkwyk & de Lange 2018 (Farmer et al., 2019) Yamamura and Koth, (2019) emphasised that institutional leader is fundamental for demonstrating institutional commitment and effectiveness to CE. These show That Institutional leaders legitimate and establish structures for supporting CE. They also demonstrate that institutional leadership is fundamental to shaping an institutional culture that supports faculty participation in CE (Bernardo et al., 2012).

Theme 7: Engagement focused on community needs.
Researchers reported that CE requires institutions to be responsive to community needs to ensure their relevance in society to be contextually appropriate and should consider the needs and expectations of target users. For instance, exploring research that is applied to critical community challenges. Authors such as Dempsey (2010) and Olutokunbo et al. (2018) proposed that establishing good synergy between the institution and the external community should precede the institution's development of any engagement program. They proposed that addressing community needs can be enhanced by aligning teaching and research with the community’s challenges or needs, focusing on academic agenda and being receptive to community needs to ensure social relevancy.

Theme 8: Approach to responding to community needs.
Many studies discussed approaches through which universities could respond to community needs. For instance, articles demonstrated the necessity of co-creation and active participation of CE actors in creating, designing, building, and implementing innovations (Frank & Sieh, 2016) and (Mbah & Mbah, 2018). These studies support that involving partners in co-creation enables ownership of the engagement intervention and increases the possibility of staying engaged throughout and after the process. Co-learning, Co-action, or Co-creation are presented as new ideas that can support learning and develop the relationship between students, faculty, and community actors (Kearney et a., 2013). Furthermore, the institutions’ strength can be enhanced by emphasising co-creation and knowledge sharing between parties (Mbah, 2019). Other studies emphasise the benefits of actively participating faculty, community partners and students during the engagement. Participatory action research, dialogue and establishing a community of practice for knowledge mobilisation are also highlighted as catalysts for enhancing university-community engagement. Studies also encourage academics to undertake formal and informal engagements with the community and interdisciplinary community partnerships for mutual benefits.
Theme 9: The teaching-research-community service nexus

In 20 articles, it became clear that to improve CE, it is crucial that university teaching and research activities are organised and carried out in relation to community members. For instance, articles proposed integrating various academic activities into CE, focusing on entrepreneurial activities, and applying technology in CE. In addition, they propose the development of new curricula, strategies and tools that will enable partners to learn from, build on and advance new research practices focused on community needs—with this approach, faculty act as facilitators of the learning process, encouraging students to collaborate with community members rather than imparting knowledge or theory to students (Brown et al. 2016).

Theme 10: Individual factors

At the individual level, multiple personal and professional elements reported to influence university CE including social identity and sense of ownership over CE outcomes, ethnicity, gender, personal values, epistemology, previous experience, personal motivation to be actively engaged, perceived benefits and a desire for meaningful partnership (Wade and Demb, 2009). Professional dimensions include tenure status, faculty rank, length of time in academia, and professional orientation toward engaged research, engaged teaching, and community partnerships (Demb and Wade, 2012; Wade and Demb, 2009).

Theme 11: Document and disseminate engagement results.

The included articles encourage universities to communicate the engagement results to the community. Articles demonstrated that dissemination of CE outcomes is critical to facilitate the uptake and adoption of interventions to improve the university’s community welfare and brand image (Farmer-Hanson et al., 2019).

Theme 12: Establish authentic partnerships.

Articles focused on identifying the community for building authentic partnerships. These studies show that successful university CE highly depends on forming genuine partnerships (Ogunsanya & Govender, 2019). They emphasise that universities must work with community organisations, build inter-organisational support, leverage community structures, and ensure community awareness of partnerships. They add that it is fundamental for institutions to establish and understand the negative pressures generated by community partners, stay away from local politics and focus on local community development.
Theme 13: Institutional philosophy focused on community engagement.
Studies also demonstrated that institutional philosophy influences successful CE. Principal components of an institutional philosophy are vision, mission, and values such as mutual respect, continuous support, trust commitment and accountability (Furco, 2010); guiding principles, which strengthen institutional identity, are crucial so that stakeholders value the CE activities.

Theme 14: Community engagement capacity development
For CE to become a core part of the institution, actors must have competencies advancing this mission. Thus, articles highlight that institutions establish capacity and professional development in CE. Capacity development, in this case, refers to opportunities to empower all engaged members to create skills and competencies that empower them to create and share knowledge for personal, institutional, and welfare improvement. This can be achieved through capacity-building workshops for academics and community stakeholders (Delugan et al., 2014). They suggest that effective CE may be achieved when faculty receive training on integrating CE work into the workload (Van Schyndel et al., 2019).

Theme 15: Ensuring mutual outcomes.
Studies emphasised the need for CE to focus on mutual and tangible outcomes. The potential engagement outcomes for academics and the community are opportunities for sharing knowledge and information, networking, personal benefits, and self-efficacy to solving community challenges. Mutero and Govender (2019) highlighted that CE could support engaged stakeholders’ social capital and enhance positive externalities through reciprocity. CE is also linked to improved institutional brand image and stakeholder relationships (Weerts, 2019).
<table>
<thead>
<tr>
<th>Source</th>
<th>Subtheme</th>
<th>Theme</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Establish CE frameworks and guidelines</td>
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<tr>
<td></td>
<td></td>
<td>Policy support</td>
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<tr>
<td></td>
<td></td>
<td>Build frameworks to guide CE practices. A framework for measuring the third mission based on three dimensions: enterprising (to improve HEIs financial shortage), innovations (to create time and site for development path) and social role (to strengthen social cohesion and cultivating a democratic culture. Build framework for community-based action research to guide institutional CE projects. Prepare practical guidelines for CE. Pressure in the third mission is associated with lack of frameworks, Connect university policy to economic development. Institutions need to set up CE measures. Leadership and policy support, Create enabling environment. Development of support structure. Emphasised institutionalisation of CE Institutionalise CE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reflect on ways how CE is framed and promoted. Able to make strategic plans.</td>
</tr>
</tbody>
</table>

Table 9: Elements for nurturing CE practice in HEIs
Revise plans and actions to ensure that CE is prioritised.
Prepare proper engagement plans.
Alignment between research and CE

<table>
<thead>
<tr>
<th>Authors</th>
<th>Details</th>
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<tbody>
<tr>
<td>Authors</td>
<td>Article Details</td>
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</tbody>
</table>
Equal participation of community partners
Co-created boundary objects facilitate cohesive interdisciplinary-community partnerships that result into reciprocal and mutual benefit.
Co-learning, or Co-action, or Co-creation are presented as new ideas that can support learning and development of the relationship between students, faculty, and community actors.
Emphasise democratic participation and social justice.
Democratising knowledge through co-creation
Community involvement, Information exchange, support, and sustain small groups.
Utilise interdisciplinary research, especially co-production of knowledge.
Emphasise working with local community stakeholders,
Promote collaborative research involving students, faculty, and community.
Participation of various stakeholders
Encourage academics to undertake both formal and informal engagements with other stakeholders.
Sharing diverse expertise in engagement among faculty Dialogue,
Share resources
Catalogue Community resources
Active dialogue between universities, industry, and community Balanced leadership to compliment skills.
Emphasise dialogue and active participation in CE. Foster dialogue and healthy relationships Cultivate high quality partnerships through dialogue. Dialogue and build positive Partnerships. Sharing university resources with the community
Improve the curriculum content. Pedagogical synergies Curriculum emphasising CE. Change in learning, behaviour, and conditions. Develop community engaged curriculum. Emphasise engaged scholarship. Integrate different academic activities into scholarship. Prioritise scholarship of engagement Integrate different academic activities into scholarship. Integrate different academic activities into scholarship. Reshape the curriculum to allow students involvement in the community.

(Quet et al., 2019)

Emphases community-based teaching and research

Course based CE offers opportunities for transfer knowledge to the community and meet their social needs.

Focus on entrepreneurial activities.

Create community engaged programs.

Set up curriculum that impact students’ engagement including foundation, critical partnerships, community-engaged scholarships, approaches, evaluation, communication, and successful engagement careers.

Align teaching and research with society needs.

Curricular, and research focused on the community.

Establish sustainable programs that address stakeholder needs.

Apply technology in CE.

Emphasise community engaged teaching (Learning from within and outside the university).


Individual and environmental.

Faculty orientation toward researching teaching and community partnerships.

Personal factors

Professional dimensions

Personal commitment

Personal limitations, (Interest experience with CE limit faculty to integrate engaged scholarship.

Understand students’ motives before they are involved in CE.

Reflect on their social identity.

Career track (nature of appointment, specialisation).


Need for empirical research on CE.

Dissemination of new knowledge.

Disseminate relevant information.

Encourage knowledge exchange to promote the public, staff, and students’ engagement.

Works across disciplinary silos and disseminate findings.

Embrace innovation.

Document CE to communicate the whole scope of actions with all partners.

Document CE practices in any institution


Establish strong partnerships,

Build partnerships with the community.

Look for opportunities for partnership,

Convene stakeholders,

Share power with partners,

Build political and inter-organisational support for strong partnership.

Utilise community structures.
<table>
<thead>
<tr>
<th>Authors</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>and Cochrane, (2015)</td>
<td>Partnerships and interventions as learning-action networks,</td>
</tr>
<tr>
<td>Fitzgerald et al. (2016),</td>
<td></td>
</tr>
<tr>
<td>Plakans et al. (2016),</td>
<td>Community awareness and partnership</td>
</tr>
<tr>
<td>Tarus et al. (2017), Van and de Lange, (2018)</td>
<td>Partner with community organisations</td>
</tr>
<tr>
<td></td>
<td>Authentic partnerships</td>
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<tr>
<td></td>
<td>Bidirectional and balanced partnerships,</td>
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<tr>
<td></td>
<td>Structuring partnerships, joint planning, capacity</td>
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<tr>
<td></td>
<td>building and consultation</td>
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<td></td>
<td>Authenticate partnerships</td>
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<tr>
<td></td>
<td>Desist from the politics of the place Focus on local CE.</td>
</tr>
<tr>
<td></td>
<td>Understand the negative pressure created by partners</td>
</tr>
<tr>
<td></td>
<td>Faculty support</td>
</tr>
<tr>
<td></td>
<td>Students support</td>
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<tr>
<td></td>
<td>Institutional support for CE</td>
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<tr>
<td></td>
<td>Institutional commitment to CE</td>
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<tr>
<td></td>
<td>Commitment from community members</td>
</tr>
<tr>
<td></td>
<td>Continuous support</td>
</tr>
<tr>
<td></td>
<td>Mutual respect and collaboration</td>
</tr>
<tr>
<td></td>
<td>commitment</td>
</tr>
<tr>
<td></td>
<td>Integrity, trust, respect, accountability, and share are important engagement values.</td>
</tr>
<tr>
<td></td>
<td>Building trust</td>
</tr>
<tr>
<td></td>
<td>Share benefits</td>
</tr>
<tr>
<td></td>
<td>Treat community partners as knowledgeable and valuable stakeholders</td>
</tr>
<tr>
<td></td>
<td>Passionate and committed to CE.</td>
</tr>
<tr>
<td></td>
<td>Able to cultivate and maintain relationships.</td>
</tr>
<tr>
<td></td>
<td>Allocate time for partnerships with communities.</td>
</tr>
</tbody>
</table>
4. Discussion
This review was conducted to obtain comprehensive insights into the conceptualisation of CE in HEIs. In particular, the review focused on theories, models and the most significant elements that guide CE in HEIs.

From the study characteristics, the review depicts a growing interest in CE studies, evidenced by an increasing number of publications since inception, from one to twelve publications annually. At an extreme were publications from developed countries, particularly the United States, which had a superior number of publications over the selected years. This, to some extent, suggest that developing nations have lagged in prioritising CE and publishing literature regarding CE. Despite the increase in publications, most were conceptual studies; few studies...
reported empirical results regarding university CE. This suggests a need to enhance empirical research on the CE phenomenon. Multiple categories of participants in CE were mentioned. However, faculty were considered key participants in the CE process.

In addition, place-based theory was more pronounced in the selected studies. The theory has been presented as a powerful institutional engagement process for local partnerships, leading to more positive outcomes in their local communities (Yamamura & Koth, 2019). Adhering to place-based theory could ensure that college engagement activities and programs are responsive to community needs and, therefore, more effective.

We found three basic conceptual models describing the university and community interaction. The most prevalent model is the partnership CE model. In this model, elements such as partnership to solve community challenges, shared responsibility, shared benefits, and active participation of partners were presented as the key to impacting CE in HEIs. According to the model, each partner contributes to forming and building communities through participation and task sharing. Secondly is the engaged scholarship model, which is closely linked to the partnership model. However, the engaged scholarship model views universities as a community of scholars responsible for bringing unique skills and knowledge to the community during the engagement. In a way, the scholarship model emphasises the academic aspect, not reciprocity, a crucial CE feature. The selected studies also highlight the traditional one-way model that presents CE as a university task of knowledge and information transfer to the community. This model works with minimal input from community stakeholders during the engagement. The model focuses on delivering knowledge and service to the community. This model may have had several flaws that prompted scholars to develop models allowing mutual interaction.

The results also highlight fifteen elements that are fundamental to effective community engagement. We argued that recognising and considering these elements will likely contribute to effective CE.
5. Limitations

In our search for studies to include in this review, some key terms came up, such as: "university community service", were restricted. We may have missed some conceptual data as some scholars typically use the term "community service" to represent CE. Secondly, research studies on university CE are not only published in peer-reviewed journals, but some are also published in books or conference proceedings, and these studies are not included in the analysis either. Third, this review is limited to articles published in English-language journals. However, we do not consider that the additional studies would significantly change or improve our results.

6. Conclusion

This study provides a comprehensive overview of how the literature conceptualises CE in HEIs. Specifically, the study examined issues related to the characteristics of CE studies, theoretical perspectives, models, and critical elements for promoting adequate CE studies in HEIs. What emerged from the 106 articles reviewed was the dominance of using the place-based theory and partnership model for CE. We also identified elements that could facilitate effective CE in higher education from the selected studies, and we grouped these elements into fifteen themes.

A critical implication of this study's findings reveals CE elements that may enhance the quality of existing HEIs CE approaches and improve the effectiveness of university-community engagement efforts. Finally, the insights provided in this review may enable HEIs, CE practitioners and policymakers to develop and adapt CE models that are more likely to improve collaborations and enhance mutual outcomes.
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https://doi.org/10.1007/s10755-008-9086-8


van Schalkwyk, F., & de Lange, G. (2018). The engaged university and the specificity of


### Annex 1: Summary of key findings from the review

<table>
<thead>
<tr>
<th>Study location</th>
<th>Study type</th>
<th>Participants</th>
<th>Study design</th>
<th>Focus of the study</th>
<th>Core theories/models</th>
<th>Key elements to successful CE</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>Conceptual</td>
<td>N/A</td>
<td>Qualitative</td>
<td>Scholarship of engagement</td>
<td>-</td>
<td>Develop frameworks and guidelines for evaluation of engagement work, provide incentives and rewards for faculty excelling in engagement work.</td>
<td>Prioleau, (2004)</td>
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<tr>
<td>USA</td>
<td>Conceptual</td>
<td>-</td>
<td>Qualitative</td>
<td>Evolution of university’ third mission</td>
<td>-</td>
<td>Democratic and financial support to enable communities have access to diverse forms of knowledge</td>
<td>Carolyn D. Roper, M. A. H. (2005)</td>
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<tr>
<td>USA</td>
<td>Mixed</td>
<td>Campus and community leaders</td>
<td>Qualitative case study</td>
<td>Understanding challenges and opportunities for building UCP</td>
<td>UCP model. The knowledge flow theory.</td>
<td>Key challenges: Organisational structure, Communication barrier, Social and cultural barriers, Rewards and motivators to engagement.</td>
<td>Weerts (2005)</td>
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<tr>
<td>USA</td>
<td>Conceptual</td>
<td>Faculty Students Community</td>
<td>Case study</td>
<td>Facilitators of engagement</td>
<td>-</td>
<td>Vision and leadership support, Infrastructure reorganisation, Involvement of students, faculty, and community partners</td>
<td>Aronson and Webster. (2006)</td>
</tr>
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<td>USA</td>
<td>Conceptual</td>
<td>Faculty</td>
<td>Qualitative</td>
<td>Understanding and practice of CE</td>
<td>Public scholarship model. (Social interaction theory)</td>
<td>Creating enabling setting Develop skills in CE</td>
<td>Bridger and Alter, (2006)</td>
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<tr>
<td>USA</td>
<td>Empirical</td>
<td>Community stakeholders</td>
<td>Mixed</td>
<td>Perceptions and stakeholder attitudes to CE</td>
<td>Theory of public relations</td>
<td>Sharing university resources with the community Encourage community to attend university event</td>
<td>Bruning et al., (2006)</td>
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<tr>
<td>USA</td>
<td>Conceptual</td>
<td>University faculty, community partners</td>
<td>Qualitative case study</td>
<td>Engaged faculty members</td>
<td>Scholarship model</td>
<td>Support from university leadership, securing sustainable budgets, sharing diverse expertise in engagement among faculty, Improve the curriculum content, rewards faculty, and enhancing CE projects</td>
<td>Abrams et al., (2006)</td>
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<tr>
<td>USA</td>
<td>Empirical</td>
<td>Faculty members</td>
<td>Qualitative</td>
<td>Integrating teaching, research, and CE</td>
<td>Partnerships and institutionalisation of CE</td>
<td>Faculty orientation toward researching teaching and community partnership. Individual and environmental factors Support for CE Pedagogical synergies</td>
<td>Bloomingarden, and O’Meara, (2007)</td>
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<td>USA</td>
<td>Conceptual</td>
<td>N/A</td>
<td>Qualitative</td>
<td>Conceptual development of scholarship of engagement</td>
<td>Engaged Scholarship. (Punctuated equilibrium theory)</td>
<td>Need for empirical research on CE</td>
<td>Sandmann, L. R. (2008)</td>
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<td>Community partners (n=58)</td>
<td>Survey</td>
<td>Characteristics and benefits of effective UCP</td>
<td>Scholarship of CE model</td>
<td>Targeting community needs, Co-creation, Shared power.</td>
<td>McNall et al., (2008)</td>
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<td>Conceptual</td>
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<td>Conceptualising CE</td>
<td>Partnership and Traditional CE model</td>
<td>Policy support Curriculum emphasising CE Build frameworks to guide CE practices</td>
<td>Bender, (2008).</td>
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<td>Netherlands</td>
<td>Conceptual</td>
<td>N/A</td>
<td>Qualitative</td>
<td>Management links with university stakeholders</td>
<td>Stakeholders' theory</td>
<td>Involve stakeholders. Focus on research that is linked to stakeholder needs</td>
<td>Jongbloed et al (2008)</td>
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<tr>
<td>USA</td>
<td>Conceptual</td>
<td>N/A</td>
<td>Qualitative</td>
<td>Importance of ethical engagement</td>
<td>-</td>
<td>Set Clear vision and ethical purpose for engagement</td>
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<td>UK</td>
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<td>Establishing and sustaining partnerships</td>
<td>-</td>
<td>Create enabling platform (Help desk services)</td>
<td>Hart at al., (2009)</td>
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<tr>
<td>USA</td>
<td>Conceptual</td>
<td>N/A</td>
<td>Qualitative</td>
<td>Practice of engaged scholarship in HEIs</td>
<td>Engaged scholarship model.</td>
<td>Emphasise the discovery development, Dissemination of new knowledge, Change in learning, behaviour, and conditions</td>
<td>Franz, (2009)</td>
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<td>USA</td>
<td>Empirical</td>
<td>Chief engagement officers</td>
<td>Qualitative</td>
<td>University regional partnerships</td>
<td>Partnership model</td>
<td>Establish partnerships, Link structures to match the needs of the community. Value the relationships</td>
<td>Franklin, (2009)</td>
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<td>South Africa</td>
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<td>CE Challenges</td>
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<td>Need for a structure to promote mutual responsibility. Place and time</td>
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<td>Factors that influence faculty participation in CE:</td>
<td>Scholarship model</td>
<td>Institutional dimensions, Personal factors Professional dimensions</td>
<td>Wade, and Demb, A. (2009)</td>
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<td>CE as a public good Dimensions of CE</td>
<td>Scholarship model</td>
<td>Support community-based research Develop structures to support CE</td>
<td>Hall, (2009)</td>
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<td>N/A</td>
<td>Qualitative</td>
<td>Features of an engaged university</td>
<td>Partnership model</td>
<td>Authenticity (Use engagement to maximize university human capital. Genuineness (values and norms to guide partnerships are key characteristics to reflect a community-engaged university.</td>
<td>Furco (2010)</td>
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<td>USA</td>
<td>Conceptual</td>
<td>N/A</td>
<td>Case study</td>
<td>Engagement through partnerships</td>
<td>Partnership model</td>
<td>Identify community needs, Catalogue community resources. Note the institutional strength, Empower community members.</td>
<td>Garber et al.,(2010)</td>
</tr>
<tr>
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<td>Faculty members</td>
<td>Qualitative</td>
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<td>Scholarship model</td>
<td>Leadership for CE, Support for engaged scholarship, Institutional commitment to CE, sharing information. Set up structures for institutionalizing CE.</td>
<td>Moore, (2010)</td>
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<td>Creating pathways for university CE</td>
<td>Partnership model</td>
<td>Prioritizing CE, Developing strong facilitation skills, Build partnerships, Look for opportunities, Convene stakeholders, good leadership</td>
<td>Shannon and Wang, (2010)</td>
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<td>Rhetorical perspectivism theory.</td>
<td>Intellectual entrepreneurship should place all stakeholders in position to reflect and act complex issues in communities.</td>
<td>Hikins and Cherwitz. (2010)</td>
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<td>Challenges involved in CE.</td>
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<td>Dialogue, communication, power relationships, and Willingness to participate in CE are crucial factors in partnerships</td>
<td>Dempsey, (2010)</td>
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<td>Campus provost, engagement officers, directors, faculty, Mixed methods</td>
<td>Bridge between research universities and community partners</td>
<td>Boundary spanning theory</td>
<td>Focus on community-based problems. Build political and inter-organisational support. Build university capacity for CE. Emphasise knowledge creation.</td>
<td>Weerts, and Sandmann (2010)</td>
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<tr>
<td>Country</td>
<td>Type</td>
<td>Stakeholders</td>
<td>Method</td>
<td>Engagements</td>
<td>Challenges</td>
<td>Benefits</td>
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<td>Public, private sector stakeholders, Community leaders</td>
<td>Qualitative</td>
<td>Engaged outreach an innovative initiative to access higher education</td>
<td>Partnership model: Identify relevant stakeholders, Utilise community structures, Disseminate relevant information</td>
<td>Scull, and Cuthill (2010)</td>
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<td>University leaders, Faculty</td>
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<td>Role of university leaders and faculty in CE</td>
<td>Developing interpersonal skills, Partnerships and interventions as learning-action networks, Good information flow</td>
<td>Jr, M. S. (2011)</td>
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<td>University third mission</td>
<td>The knowledge flow theory</td>
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<td>A framework for measuring the third mission based on three dimensions: enterprise, innovations and social role</td>
<td>Krčmářová, (2011)</td>
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<td>Vision and engagement culture</td>
<td>Recognize Faculty engagement valued by the institution's principal advancement structure, tenure process, and rewards</td>
<td>Scull, and Cuthill (2010)</td>
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<tr>
<td>USA</td>
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<td>Qualitative</td>
<td>Universities build places through CE</td>
<td>Place-based theory</td>
<td>Scull, and Cuthill (2010)</td>
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<td>Importance of CE</td>
<td>Scholarship model (The knowledge flow theory)</td>
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<td>Faculty activities and attitude to outreach and engagement</td>
<td>Personal characteristics</td>
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<td>A framework for Measuring engaged academic activities</td>
<td>Engaged scholarship model</td>
<td>Scull, and Cuthill (2010)</td>
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<td>Sustainability of university community partnerships</td>
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<td>Embracing community engaged scholarship</td>
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<td>USA</td>
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<td>Faculty, students</td>
<td>Qualitative</td>
<td>Institutionalising CE</td>
<td>Engaged scholarship</td>
<td>Scull, and Cuthill (2010)</td>
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<td>Qualitative</td>
<td>Benefits and challenges of community engagement</td>
<td>Engaged scholarship (Participatory action research)</td>
<td>Scull, and Cuthill (2010)</td>
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<td>South Africa</td>
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<td>Qualitative</td>
<td>Benefits and challenges of community engagement</td>
<td>Engaged scholarship</td>
<td>Scull, and Cuthill (2010)</td>
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<tr>
<td>Country</td>
<td>Research Design</td>
<td>Participants/Participants</td>
<td>Study Type</td>
<td>Research Questions</td>
<td>Model/Methodology</td>
<td>Findings</td>
<td>References</td>
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<td>Case study</td>
<td>Faculty and student engagement through social work</td>
<td>Scholarship model</td>
<td>Address community needs through social work</td>
<td>Martin, and Pyles, (2013)</td>
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<td>Faculty, students</td>
<td>Case study</td>
<td>Steps to involve faculty and students in communities</td>
<td>Scholarship model</td>
<td>Reshape the curriculum to allow students involvement in the community, redefine scholarship, set up proper reward policy.</td>
<td>Kearney, et a., (2013)</td>
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<td>Leadership of CE in CE projects</td>
<td>Partnership model</td>
<td>Managing the flow of information for CE projects, Prepare practical guidelines for CE</td>
<td>Coetzee, (2013)</td>
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<td>Benefits of students' participation in CE</td>
<td>University community partnerships model</td>
<td>Sustainability in campus-community partnerships rely on Allocation of community resources, Collaborative planning, Communication of engagement outcomes</td>
<td>Selvaratnam, (2013)</td>
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<td>Relationship between principles of reciprocity in CE and sustainability</td>
<td>Partnership model</td>
<td>Establish multi-partners collaborations, interdisciplinary approaches, and networking with communities to create impact</td>
<td>Bloomgarden, (2013)</td>
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<td>Opportunities and challenges of Participatory action learning and research</td>
<td>Partnership model</td>
<td>Participatory action research, Communication Commitment from community members, Tension between institutional and community needs</td>
<td>Wood and Zuber-Skerrit, (2013)</td>
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<td>Nature and practice of CE and service learning in African HEIs</td>
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<td>Engaged scholarship model</td>
<td>Involve community partners as Co-producers of knowledge in all stages of engagement</td>
<td>Brown-Luthango, (2013)</td>
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<td>CE classification</td>
<td>Partnership model</td>
<td>Document CE to effectively communicate the full range of activities with all stakeholders.</td>
<td>Pearl, (2014)</td>
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<td>Knowledge exchange between university and community members</td>
<td>Partnership model</td>
<td>Establish a community of practice for knowledge mobilisation</td>
<td>Hart et al.,(2014)</td>
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<td>Leadership of CE in CE projects</td>
<td>Partnership model</td>
<td>Leadership is a key factor for effective university CE to facilitate change and respect for stakeholders involved</td>
<td>Aurora and Howard (2014).</td>
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<td>Guide for faculty development in CE</td>
<td>Scholarship model</td>
<td>Emphasise institutional support and Capacity building workshops for academic and community stakeholders</td>
<td>Delugan et al., (2014)</td>
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<td>Sustainability, and creating enabling platforms for CE</td>
<td>Partnership model (Stakeholder theory)</td>
<td>Need for partnerships, Continuous support, Participation of stakeholders, Consider stakeholders’ perceptions</td>
<td>Ramachandra and Mansor, (2014)</td>
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<td>Community stakeholders</td>
<td>Qualitative</td>
<td>Institutional practices depicting CE</td>
<td>Scholarship model of engagement,</td>
<td>Equal participation of community partners, and evidence of CE, Faculty scholarship, Students' community-based programs</td>
<td>Paton et al., (2014)</td>
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<td>New Zealand</td>
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<td>Students</td>
<td>Mixed methods</td>
<td>University CE programmes</td>
<td>Social interaction theory</td>
<td>Designing CE programs that meet the needs of different stakeholder categories</td>
<td>Chile and Black, (2015)</td>
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<td>Focus</td>
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<td>Italy</td>
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<td>NA</td>
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<td>Institutionalization of the third mission</td>
<td>Requires coherence (research and training mission) Explotion, openness, funding, and focus on entrepreneurial activities</td>
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<td>USA</td>
<td>Empirical</td>
<td>University directors, faculty members</td>
<td>Qualitative case studies</td>
<td>How universities collaborate with external organisations</td>
<td>Public good theory Reflect on ways how CE is framed and promoted</td>
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<td>USA</td>
<td>Empirical</td>
<td>Institutional stakeholders</td>
<td>Mixed methods</td>
<td>Documentation of CE practices</td>
<td>Clarify the concept of CE, with evidence of the practice and impacts. Document CE practices in any institution.</td>
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<td>UK</td>
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<td>N/A</td>
<td>Qualitative Case study</td>
<td>Engaged university and regional environment</td>
<td>Place -based theory Desist from the politics of the place Focus on local CE. Address community needs for economic development.</td>
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<td>India</td>
<td>Empirical</td>
<td>university community Partners</td>
<td>Exploratory case study</td>
<td>Practices to create centralised community engagement</td>
<td>Partnership model Maintain open and constant communication. Understand the negative pressure created by partners. Share resources Active engagement</td>
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<td>Faculty Research staff Students Community groups</td>
<td>Qualitative case study</td>
<td>University community partnerships through boundary objects</td>
<td>Partnership model Co-created boundary objects facilitate cohesive interdisciplinary-community partnerships that result into reciprocal and mutual benefits</td>
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<td>Graduate student Community partners</td>
<td>Case study</td>
<td>The CUP</td>
<td>Partnership model Create time for CE. Resources and funding Mutual respect and collaboration Culture and expectations</td>
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<td>Qualitative case study</td>
<td>Institutionalising CE</td>
<td>Organizational structures, support, commitment Engage key stakeholders</td>
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<td>Pressure in the third mission is associated with: Lack of frameworks, Funding and rewards, Incentive, and guiding structures.</td>
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<td>Mixed</td>
<td>Students’ CE activities</td>
<td>Co-learning, or Co-action, or Co-creation are presented as new ideas that can support learning and development of the relationship between students, faculty, and community actors.</td>
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<tr>
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<td>Integrating CE in undergraduate programs</td>
<td>Support for faculty to adopt CE in undergraduate programs. Connect university policy to economic development</td>
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<td>University CE strategies, challenges, and opportunities</td>
<td>Partnership model: Emphasise democratic participation and social justice. Target marginalized communities and populations.</td>
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<td>Engagement scholarship of partners.</td>
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<td>USA</td>
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<td>Faculty, students, and community members</td>
<td>Mixed methods</td>
<td>Socialisation and institutionalisation of CE: Democraticizing knowledge through co-creation partnerships.</td>
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<td>Students, community stakeholders</td>
<td>Case study</td>
<td>Community partnership model: Focusing on key stakeholders, sustainability through balanced economic, social, and environmental interest.</td>
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<td>Challenges hindering faculty from CE: Resources, (Financial and staff support) Career track (nature of appointment, specialization, rewards). Other duties (Teaching and research). Personal limitations, (Interest experience with CE limit faculty to integrate engaged scholarship.</td>
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<td>Actualisation of the university third mission</td>
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<td>South Africa</td>
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<td>-</td>
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<td>Community engagement Competence based programs that can meet students’ professional development needs: Set up curriculum that impact students’ engagement including foundation, critical partnerships, community-engaged scholarships, approaches, evaluation, communication, and successful engagement careers.</td>
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<td>South Korea</td>
<td>Empirical</td>
<td>Faculty, students</td>
<td>Exploratory</td>
<td>Students and faculty perceptions of university social engagement: Emphasised institutionalization of CE Authentic leadership in social engagement.</td>
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Cook and Nation, (2016)  
Byrne, (2016)  
Brown et al., (2016)  
Fitzgerald et al. (2016)  
Plakans et al., (2016)  
Brewster et al., (2016).  
Gorski, (2016)  
Piirainen et al., (2016)  
Mtawa et al., (2016)  
Appé et al., (2017)  
Dobernerck et al., (2017)  
Cho, (2017)  
Tarus et al., (2017)
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<th>Country</th>
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<th>Participants</th>
<th>Study Design</th>
<th>Perceptions of university internal stakeholders toward CE</th>
<th>CE Scholarships</th>
<th>Support professional development in Community-engaged scholarship</th>
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<td>University staff</td>
<td>Qualitative</td>
<td>Perceptions of university internal stakeholders toward CE</td>
<td>Scholarship</td>
<td>Support professional development in Community-engaged scholarship</td>
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<td>Campus leaders, Deans, coordinators, implementer, data technicians.</td>
<td>Qualitative</td>
<td>How CE is institutionalised and conceptualised</td>
<td>-</td>
<td>CE seems to be an ambiguous term with abstract guidelines and boundaries. Institutions need to set up CE measures</td>
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<td>Structural and historical challenges of CE partnerships</td>
<td>Engaged scholarship model</td>
<td>Enhance engaged scholarship. Communicate best practices to all collaborators</td>
<td>Bowers, (2017)</td>
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<td>USA</td>
<td>Empirical</td>
<td>Administrators, faculty, policy makers, community leaders, and business leaders</td>
<td>Qualitative</td>
<td>Role of university, benefits, challenges between CE mission and action</td>
<td>Place based theory</td>
<td>University pursue self-interest in engagements. Community resources benefit university research Funding Faculty tenure and rewards</td>
<td>Holley and Harris, (2017)</td>
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<td>Nigeria</td>
<td>Empirical</td>
<td>University professors</td>
<td>Qualitative</td>
<td>Carrier development of university professors</td>
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<td>Promote career and community development through CE.</td>
<td>Olutokunbo et al., (2018)</td>
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<td>Lessons</td>
<td>N/A</td>
<td>Case study</td>
<td>Partnership model</td>
<td>Balanced leadership to compliment skills, Funding for CE Projects related to community needs, Mutual respect</td>
<td>Groark and McCall (2018)</td>
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<td>Qualitative</td>
<td>Aspects supporting CE</td>
<td>Partnership model</td>
<td>Leadership and policy support, Organizational structure, Incentives and funding for CE, Local partnerships, Curricular, and research focused on the community</td>
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<td>University partners, staff</td>
<td>Qualitative</td>
<td>Cultivating partnership in Place-based engagement</td>
<td>Partnership model</td>
<td>Develop Competences for CE, Building trust. Facilitate students’ engagements, Faculty development and support. Co-develop</td>
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<td>Qualitative</td>
<td>University CE</td>
<td>Place making theory</td>
<td>Use CE as a principle through which universities would bring about social and economic transformation</td>
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<td>Qualitative</td>
<td>Social collaboration projects</td>
<td>-</td>
<td>Reorganise diversity of outcomes expected from partners in HEIs. Prepare proper engagement plans, Clarify their research agenda, rewards system</td>
<td>Murphy and McGrath, (2018)</td>
</tr>
<tr>
<td>Ireland</td>
<td>Empirical</td>
<td>Student, faculty, community stakeholders</td>
<td>Qualitative</td>
<td>Characteristics of effective CE partnerships</td>
<td>Partnership model</td>
<td>Share benefits, Authenticate partnerships, Establish sustainable programs that address stakeholder needs. Emphasise co-creation in CE</td>
<td>Quillinan et al., (2018)</td>
</tr>
<tr>
<td>UK</td>
<td>Empirical</td>
<td>Community stakeholders</td>
<td>Mixed methods</td>
<td>Sustainable development through CE</td>
<td>Partnership model</td>
<td>Emphasise Co-creation of knowledge with local community stakeholders, effective communication to minimize the gap between institutions and communities.</td>
<td>Mbah, (2018)</td>
</tr>
<tr>
<td>Country</td>
<td>Setting</td>
<td>Methodology</td>
<td>Participants</td>
<td>Research Design</td>
<td>Characteristics of Engagement</td>
<td>Knowledge Spillover</td>
<td>Partnership Model</td>
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<tr>
<td>USA</td>
<td>Conceptual</td>
<td>Qualitative</td>
<td>Characteristics of an engaged university</td>
<td>Knowledge spillover</td>
<td>Promote collaborative research involving students, faculty, and community.</td>
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<td>South Africa</td>
<td>Conceptual</td>
<td>Qualitative</td>
<td>Dialogical engagement</td>
<td>Place-based theory</td>
<td>Nurture and develop multiple systems of the community. Emphasise dialogue and active participation in CE. Power dynamics, Co-participation</td>
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<td>South Africa</td>
<td>Empirical</td>
<td>Qualitative</td>
<td>CE process and place making</td>
<td>Partnership model</td>
<td>Create enabling environment, focus on mutual and tangible benefits, ensure trust and a common goal, Foster healthy relationships, Focus on partners’ unique strength. Financial and material resources</td>
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<tr>
<td>USA</td>
<td>Conceptual</td>
<td>Qualitative</td>
<td>Positioning CE to support institutional sustainability</td>
<td>Social cognition theory</td>
<td>Securing financial support for engagement develop tools to show how engagement contributes to retention and student success. grant writing</td>
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<td>Malaysia</td>
<td>Empirical</td>
<td>Qualitative</td>
<td>Components of university CE</td>
<td>-</td>
<td>Involve the community at all levels, Academic and research activities, focus on bilateral engagements. Revise plans and actions to ensure that CE is prioritised</td>
<td>-</td>
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<td>USA</td>
<td>Empirical</td>
<td>Qualitative</td>
<td>Leadership role of CE</td>
<td>Place based Engagement</td>
<td>Develop professional competences in CE, Embed CE in the university structures, Practice, and staffing, Focus on place-based initiatives, build trust Treat community partners as knowledgeable and valuable</td>
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<td>USA</td>
<td>Conceptual</td>
<td>Qualitative</td>
<td>Professional development in CE</td>
<td>Partnership model</td>
<td>Competency for CE professionals Making changes within higher education, Institutionalise CE, facilitate engaged learning, Facilitate faculty development and support for CE. Cultivate high quality partnerships</td>
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<td>USA</td>
<td>Empirical</td>
<td>Qualitative</td>
<td>Competences for CE professionals</td>
<td>Partnership model</td>
<td>Competence model. Passionate and committed to CE, maintain relationships. Works across disciplinary silos Make strategic plans, Embrace innovation.</td>
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<td>South Africa</td>
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<td>Qualitative</td>
<td>Challenges and future trends of CE</td>
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<td>Build positive Partnerships, Apply technology in CE. Emphasise CE teaching</td>
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<td>Components of university CE</td>
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<td>Empirical</td>
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<td>Strategies engaged professional</td>
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<td>Understand students’ motives before they are involved in CE. Reflect on their social identity</td>
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<td>Ireland</td>
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<td>Approaches to CE</td>
<td>Partnership model</td>
<td>Be partners in shared needs. Practices co-creation</td>
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<td>Norway</td>
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<td>Qualitative</td>
<td>Internal university structure to shaper third mission activities</td>
<td>Engaged scholarship model. the entrepreneurial university</td>
<td>University engagement needs, Policies, Incentives for CE Create institutional Structures that allow CE, Good leadership. Encourage academics to undertake both formal and informal engagements with other stakeholders</td>
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Chapter 3
Assessing Higher Education Institutional Stakeholders’ Perceptions and Needs for Community Engagement: An Empirical study from Uganda

Abstract
Community Engagement (CE) is an accredited path for Higher Education Institutions (HEIs) to address development challenges facing communities. However, establishing practical CE approaches is difficult due to a lack of information on stakeholders’ perceptions and needs for CE. This chapter intends to fill this gap by examining engaged stakeholders’ perceptions and needs for CE. We surveyed 450 stakeholders, categorised as dairy farmers, students, and faculty members of a case study HEI in Africa. One-way ANOVA findings showed that the three categories perceived CE differently and had multiple needs. HEIs should create more CE opportunities to harness reciprocal engagement and address stakeholders’ needs, such as establishing structures, allocating time for engagement elements, financial support, and communication.¹

1. Introduction

When communities face several development challenges, community engagement (CE) has become a predominant mission (Cook and Nation, 2016b). The mission is implicitly reorganised as a path for higher education institutions (HEIs) to demonstrate pertinence to the communities’ complex social, economic, educational, and cultural needs (Clifford and Petrescu, 2012; van Schalkwyk and de Lange, 2018; Ward and Hazelkorn, 2012). For instance, Kruss (2012) and (Paleari et al. (2015) plausibly argue that CE is a remedial solution for HEIs to meet the needs, social expectations, and rising demand for knowledge by stakeholders and communities. Correspondingly, Fitzgerald et al. (2012) observe that, through CE, HEIs can play fundamental roles in empowering stakeholders and communities to outline pathways toward upward mobility. For this reason, governments and politicians since the mid-20th century encouraged HEIs to halt detaching themselves from outside entities, instead serve as critical instruments in tackling the challenges typically facing societies and local communities (Franklin, 2009; Goddard et al., 2016; Mugabi, 2015; Pinheiro and Langa, 2015). Research has shown that CE is a tremendous bridge between academic institutions, stakeholders, and the general community (Olowu, 2012).

Existing studies demonstrate incredible academic work theoretically explaining the CE concept and practice. In principle, CE emerged to address challenges in the traditional ivory tower approach to CE in HEIs (Mtawa et al., 2016; Shannon and Wang, 2010). The conventional approach focused on HEIs reaching out to communities or their stakeholders in an expert knowledge delivery model (Bruning et al., 2006; Jinkins and Cecil, 2015). This approach has witnessed a transformation of its long-standing ability as the creator of knowledge and human capital (Symaco and Tee, 2019) to a holistic and reciprocal approach(Goddard and Kempton, 2016). Compared to traditional outreach methods, CE requires much commitment to building enduring relationships between academic institutions and communities (Mehta et al., 2015; Shephard et al., 2017). Furthermore, studies highlight that the CE process requires institutional leadership support to create learning and research agendas considering the communities’ strengths and needs (Goddard and Kempton, 2016; Martin and Pyles, 2013).

In this regard, researchers characterised CE as a collaboration between HEIs and their larger communities for the mutually beneficial exchange of knowledge and resources in the context
of partnership and reciprocity (Bhagwan, 2018; Fitzgerald et al., 2016; Holley and Harris, 2018; Ramachandra and Mansor, 2014). Further, studies emphasise that CE aims to work with the community rather than for the community (Frank and Sieh, 2016; Korzun et al., 2014a). The central core process involves HEIs reciprocally engaging different internal and external stakeholders in sharing valuable resources. Creating, disseminating new knowledge, improving understanding, and involving partners in mutual dialogue is crucial in CE (Murphy and McGrath, 2018; Onwuemele, 2018). A research study (Phillipson et al., 2012) explains that CE is built on interactive approaches that involve end-users throughout the overlapping stages of engagement, jointly identifying community problems and solutions to those problems. The outcome of such partnerships is mutual benefits to all partners (Bhatnagar et al., 2020; Quillinan et al., 2018). Notably, partners have a critical role in the engagement process. Therefore, HEIs should increasingly avail opportunities and employ approaches that actively bring onboard their partners.

Javen and Wenger’s concept of Communities of Practice (CoP) can also enlighten this study. It illustrates the change from the traditional reproduction model and delivering expert knowledge to active reciprocal partnerships and collaborations with key stakeholders (Korzun et al., 2014b). In the current study, the authors advocate that the HEIs CE method can be rooted in the CoP concept. The concept emphasizes cooperative learning in a shared human behaviour domain (Hart et al., 2014). Knowledge exchange occurs spontaneously in CoPs as members communicate, share experiences, and solve problems cooperatively. Members engage in joint activities, support each other, and share information (Reilly et al., 2012). When CoPs are created, they foster reciprocal relationships that enable stakeholders learn from each other through innovative workshops, internet forums, web applications, or dialogue. Practitioners interface to illuminate potential problems, exchange ideas, construct tools, and create connections with peers. The process becomes a win-win situation where institutions can strengthen their academic mission, and communities can advance their social agenda (Arthur et al., 2016). From the CoP perspective, HEIs can take care of the specific needs of their stakeholders. Chile and Black (2015) demonstrated that interactions aid beneficial partnerships and address stakeholders’ specific needs.

Extant literature shows that collaborations yield multiple benefits to institutions and communities. Attree et al. (2011) points out that active bilateral engagements benefit participants by producing positive psychological consequences for their well-being. Similarly,
CE strengthens partnerships between the institution and the community (Quillinan et al., 2018). During the engagement, the time spent creates a strong bond between institutions and their outside partners (Morrell et al., 2015). Three studies suggest that CE facilitates HEIs to access fruitful research information (Furco, 2010; Mbah, 2016; Tarus et al., 2017). Similarly, research studies indicate that CE creates opportunities for HEIs to get closer to the community and brands the community’s institutional image (Franz et al., 2012; Goddard and Kempton, 2016; Selvaratnam, 2013). According to Bruning et al. (2006), CE fosters development and improves institutional public relations. This symbiotic relationship boosts human capital and economic and cultural development (Clifford and Petrescu, 2012). HEIs play the facilitator role in this case by attempting to release change, empower critical stakeholders to self-diagnose problems and create conditions that can lead to self-realization and transformation (Mugizi, 2018). However, Mbah (2019) explains that HEIs build beneficial engagements with their key stakeholders.

It is stated that HEIs develop their social niche through engagements with communities or programs geared towards engaging internal and external stakeholders (Bhatnagar et al., 2020). A research study (Benneworth and Jongbloed, 2010) pointed out that CE rests on institutions’ ability to constructively undertake practices that include vital stakeholders. Benneworth and Jongbloed further described a standard HEI stakeholder set, highlighting specific examples from various categories. Amongst these are the employees (administrative, faculty members, and support staff), clients such as students, and communities (special interest groups, community members). The current study considers three groups of stakeholders (students, faculty members, and dairy farmers from the community) as important stakeholders for the CE in the specific context of this study. These are selected based on several factors in the existing literature. Cho (2017), Frank and Sieh (2016), and Hart et al. (2009) observed that faculty members and students are absolute stakeholders with the greatest priority of the institution.

Similarly, Goddard and Kempton (2016) pointed out that students could be knowledge transfer agents and establish social relationships when allowed work placement in the community. According to Brisbin and Hunter (2003), establishing contacts for extensive student participation and collaborations with community partners is essential. Equally important, other studies show that CE relies on university faculty members’ backbone (Gorski, 2016; Kuttner et al., 2018). These perform administering, coordinating, supporting, and leading engagement activities. Adekalu et al. (2018) and Gorski (2016) suggested that institutional administrators
must create time and offer necessary support to engage faculty and students’ engagement. CE becomes effective when HEIs involve students, faculty, administrators, and other stakeholders in mutually beneficial activities (Smoluk, 2018). Also, the current study considers dairy farmers as external institutional stakeholders. Dairy farming’s potential to employ and provide income to community stakeholders has attracted researchers and policymakers from many countries (Protection and Speedy, 2011; Thornton, 2010). As such, HEIs involve dairy farmers in multiple engagements to support government policy and community development programs. Tiampati (2016) conducted research demonstrating initiatives where dairy farmers offered opportunities to engage with institutions to enrich their knowledge of animal husbandry.

Existing literature is clear about the importance of institutional focus on the stakeholders’ perceptions and needs during engagement activities (Frank and Sieh, 2016; Strom, 2011). However, there are no precise blueprints on stakeholders’ perceptions and needs for CE. Two studies show an unbalanced relationship where institutional community stakeholders’ perceptions are typically quiet (Sandy and Holland, 2006; Wattman et al., 2007). Moreover, one empirical study focused on faculty members’ and students’ CE perceptions (Cho, 2017). As such, multiple stakeholders' perceptions of CE require attention. The current study draws on empirical evidence of HEIs stakeholders’ perception and needs for CE using Mountains of the Moon University (MMU) in Uganda as a case. The university was established in 2005 with a niche to engage in quality research, teaching, and CE. The institution enrolls students from nearly all parts of the country. However, a significant number come from the encompassing Rwenzori rural farming community. Individual faculty members or departments have actualized a few CE ventures. For instance, some faculty members engaged in action research with community stakeholders. The focus is to generate knowledge to inform development actors in making informed decisions at the planning and policy levels. Students, too, are involved in internship training, research, and field placements. The mutual benefit is to produce competent students with practical skills to deal with community challenges.

Besides, with support from VLIR UOS, MMU set up a dairy development center to empower and strengthen dairy farming practices in the Rwenzori region. Through distinct engagements, dairy farmers participated in several participatory workshops to identify their training needs. Ten dairy farmers and five faculty members prioritised the needs and developed a training manual in dairy farming. They also translated the manual into the local language to suit all classes of dairy farmers. The manual focused on adopting modern farming practices, animal
nutrition, breeding and artificial insemination, and animal health. The institution later utilized the developed training manual to conduct several pieces of training to scale up its engagement with dairy farmers in the region. Interestingly, the study used a cohort approach to investigate dairy farmers’ perceptions and CE needs.

Against this background, the current study presents the engaged stakeholders’ perceptions and needs for CE. Assessing HEIs stakeholders’ CE perceptions and needs in the Ugandan context could significantly contribute to this topic’s dynamic global movement, study, and debate. Furthermore, understanding the perceptions and needs of institutional stakeholders is valuable for those designing future CE interventions. It aids the development of effective CE frameworks. Therefore, the main research questions for this research include: What are the stakeholders’ perceptions of CE with HEIs? And what are the stakeholders’ needs for the practice of CE with HEIs? From this background, section two presents the methodology, followed by research findings in section three. In section four, the discussion of the findings is presented, followed by concluding remarks and study limitations that shape the future of further research.

2. Research methodology

This study employed mixed research methods to investigate the research questions. We used a quantitative approach to investigate the institutional stakeholders’ perceptions of CE. Additionally, we employed a qualitative approach to investigate the stakeholders’ needs for CE. This research method’s strength is that the quantitative data collected can produce reliable outcomes (Steckler et al., 1992). In addition, the qualitative data can generate rich, detailed results that leave the study participants' perspectives intact (Steckler et al., 1992).

2.1 Data Collection and sampling technique

We used a survey with both closed and one open question to collect empirical data. After consulting relevant literature on past studies regarding HEIs or university engagement with communities or stakeholders, we developed the instrument with three key variables (Holley and Harris, 2018; Mbah, 2019; O’Meara and Jaeger, 2016; Selvaratnam, 2013). The current study measured institutional stakeholders’ perceptions of CE based on perceived benefits, opportunities, and challenges involved in the process (Zepke, 2013). By definition CE should
yield mutual benefits and to realise these benefits, there should be opportunities for engagement. Besides several challenges seem to hinder effective CE. Thus, each of these three key variables of stakeholders’ perceptions of CE were measured with eight items. Stakeholders’ perceptions are measured as illustrated in Table 10.

Table 10: Variables, items, and code used to measure stakeholders’ perceptions of CE.

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<th>Variable</th>
<th>Code</th>
<th>Items</th>
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<tr>
<td>BENEFITS</td>
<td>BEN</td>
<td>BEN1 Sharing knowledge</td>
<td>Quillinan et al., (2018), Onwuemele, (2018),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEN2 Sharing skills</td>
<td>Holley and Harris, (2018)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEN3 Sharing resources</td>
<td>Mbah, (2019), Selvaratnam, (2013)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEN4 Sharing information</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEN5 Offered real learning or teaching experience.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEN6 Cooperative learning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEN7 Addressed stakeholders’ expectations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BEN8</td>
<td></td>
</tr>
<tr>
<td>OPPORTUNITIES</td>
<td>OPP</td>
<td>OPP1 Opportunities for engagement</td>
<td>Selvaratnam, D. P. (2013), Morrell et al. (2015), (Mehta et al., 2015)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OPP2 Involve stakeholders.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>OPP3 Equal engagement opportunities</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>OPP4 Variety of engagement</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>OPP5 Share research findings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>OPP6 Information regarding engagement</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>OPP7 Consult about engagement.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>OPP8 Collaborate with different stakeholders</td>
<td></td>
</tr>
<tr>
<td>CHALLENGES</td>
<td>CHA</td>
<td>CHA1 Limited time for engagement</td>
<td>(Winkler, 2013), Gorski, (2016) Onwuemele, A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CHA2 Limited resources</td>
<td>(2018), O’Meara and Jaeger, 2016, Quillinan et al.,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CHA4 Little motivation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CHA5 Inadequate awareness</td>
<td>(2018), Morrell et al. (2015), (Holley and Harris, (2018)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CHA6 Inadequate support</td>
<td>(2016), (Holley and Harris, (2018)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CHA7 Inadequate flow of information</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CHA8 Other roles hinder CE</td>
<td></td>
</tr>
</tbody>
</table>

Note: Survey items for stakeholders’ perceptions of CE measured on a Likert scale ranging from 1=strongly disagree to 5=strongly agree.

Simple random and purposive sampling was employed to administer the survey that targeted stakeholders who participated in MMU CE activities. Simple random sampling was used to reduce the potential of human bias in the selection of respondents. Consequently, this sampling technique provided the population sample. The survey gathered (n=450) respondents in
September and October 2019. Respondents were categorized into three key stakeholder groups, namely: dairy farmers (n=203), Academic staff (n=53), students in the final year from the different schools at MMU, n=194). The survey covered three main sections: Section A elicited demographic data of respondents; Section B asked respondents to indicate their level of agreement on a one to five-point Likert scale that anchored from (1) Strongly disagree, (2) Disagree, (3) Neither agree nor disagree, (4) Agree, to (5) strongly agree with the statement that examined their perceptions of CE as illustrated in Table 3.1 above. Finally, Section C contained open-ended questions requesting respondents to outline their needs for practical CE. The rationale for having this type of questionnaire is that the input which triggers people’s response is controlled so the output can be reliably compared (Bliss, 2003).

2.2 Data analysis

First, we conducted a test for reliability to measure the unidirectionality of a set of items for BEN, OPP, and CHA. Each of the three variables was tested by eight items that yielded Cronbach alpha values that ranged from 0.65 to 0.91. These are acceptable values, according to Taber (2017). Secondly, descriptive statistics were conducted to determine the mean scores and the standard deviation for each item that measured BEN, OPP, and CHA of CE. Third, a one-way analysis of variance (ANOVA) was used to determine any statistical differences in CE perceptions among the group means. It was essential to run a one-way ANOVA to establish whether these three categories of stakeholders perceived CE differently. However, the ANOVA results could not estimate which specific pairs statistically differed from each other. A post hoc follow-up was conducted to determine which group means differ in perceptions of CE. SPSS version 22 was used to conduct all analyses and results used to inform the study findings.

Lastly, stakeholders’ needs for CE were analysed by a deductive approach to content analysis. Qualitative content analysis is defined as a method of classifying written or oral materials into identified categories of similar meaning (Elo et al., 2014). This step involved systematically categorising responses. Once categories were identified, data were analysed quantitatively to obtain the percentages for all responses. A qualitative description of the stakeholders’ needs was elaborated in the findings section to substantiate the different groups’ needs for CE.
2.3 Ethical approval

The institution required no ethical approval for this study. However, the authors acquired Informed consent from all participants at the start of this study.

3. Findings

3.1 Scale reliability

The reliability of the measurement scale for stakeholders’ perceptions of CE was assessed by calculating the Cronbach’s alpha values for the items that measured each variable and for the pooled sample. The results in Table 11 revealed acceptable Cronbach alpha values varying from 0.65 to 0.91. Hence none of the items was deleted.

Table 11: The reliability and validity of the measurement scale.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Code</th>
<th>Items</th>
<th>Dairy Farmers</th>
<th>Students</th>
<th>Faculty members</th>
<th>Pooled Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits</td>
<td>BEN</td>
<td>8</td>
<td>0.73</td>
<td>0.83</td>
<td>0.90</td>
<td>0.73</td>
</tr>
<tr>
<td>Opportunities</td>
<td>OPP</td>
<td>8</td>
<td>0.68</td>
<td>0.75</td>
<td>0.84</td>
<td>0.79</td>
</tr>
<tr>
<td>Challenges</td>
<td>CHA</td>
<td>8</td>
<td>0.65</td>
<td>0.90</td>
<td>0.91</td>
<td>0.76</td>
</tr>
</tbody>
</table>

Five-point Likert scale: 1= Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=strongly agree.

3.2 Descriptive results for stakeholders’ perceptions of community engagement

The descriptive statistics in Table 12 presents means and standard deviations for the three variables that measured stakeholders’ perceptions of CE. The sub-items measuring BEN scored relatively high means for the three categories. On average, dairy farmers scored mean=4.00(0.54), students mean = 3.86, (0.53), and faculty members 4.02 (0.51) as perceived BEN of CE. These findings imply that respondents highly agreed that CE is beneficial.

Besides, as indicated in Table 12, the sub-items for OPP were 3.69 (0.58) for dairy farmers, 3.36 (0.60) for students, and 3.52. (0.62) for faculty members. These findings show that the three categories of respondents were neutral about OPP for engagement.
Findings in Table 12 further show that the CHA’s sub-items scored the lowest mean values for dairy farmers, 2.74 (0.72). However, students and faculty members scored 4.21 (0.71) and 3.81 (0.90), respectively. These results imply that, on average, dairy farmers had a relatively low agreement that CE is a challenge. However, students and faculty reported relatively higher perceptions of challenges of CE.
Table 12: Stakeholders’ perceptions of community engagement (Means and standard deviations).

<table>
<thead>
<tr>
<th>Group category</th>
<th>Dairy farmers</th>
<th>Students</th>
<th>Faculty members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable BEN</td>
<td>Codes</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Sharing knowledge</td>
<td>BEN1</td>
<td>3.99</td>
<td>(0.87)</td>
</tr>
<tr>
<td>Sharing skills</td>
<td>BEN2</td>
<td>4.25</td>
<td>(0.71)</td>
</tr>
<tr>
<td>Sharing resources</td>
<td>BEN3</td>
<td>4.12</td>
<td>(0.65)</td>
</tr>
<tr>
<td>Sharing information</td>
<td>BEN4</td>
<td>3.96</td>
<td>(0.94)</td>
</tr>
<tr>
<td>Offered real learning or teaching experience</td>
<td>BEN5</td>
<td>3.93</td>
<td>(1.07)</td>
</tr>
<tr>
<td>Strengthening partnerships</td>
<td>BEN6</td>
<td>4.00</td>
<td>(0.87)</td>
</tr>
<tr>
<td>Cooperative learning</td>
<td>BEN7</td>
<td>4.06</td>
<td>(0.87)</td>
</tr>
<tr>
<td>Addressed stakeholders’ expectations</td>
<td>BEN8</td>
<td>3.72</td>
<td>(1.19)</td>
</tr>
<tr>
<td>Total mean benefits</td>
<td>BEN</td>
<td>4.00</td>
<td>(0.54)</td>
</tr>
<tr>
<td>Variable OPP</td>
<td>OPP1</td>
<td>3.73</td>
<td>(1.02)</td>
</tr>
<tr>
<td>Opportunities for engagement</td>
<td>OPP2</td>
<td>3.83</td>
<td>(1.05)</td>
</tr>
<tr>
<td>Involve stakeholders</td>
<td>OPP3</td>
<td>3.82</td>
<td>(1.01)</td>
</tr>
<tr>
<td>Equal engagement opportunities</td>
<td>OPP4</td>
<td>4.00</td>
<td>(0.94)</td>
</tr>
<tr>
<td>Variety of engagement</td>
<td>OPP5</td>
<td>3.98</td>
<td>(0.91)</td>
</tr>
<tr>
<td>Share research findings</td>
<td>OPP6</td>
<td>3.89</td>
<td>(1.09)</td>
</tr>
<tr>
<td>Information regarding engagement</td>
<td>OPP7</td>
<td>2.26</td>
<td>(1.33)</td>
</tr>
<tr>
<td>Consult about engagement</td>
<td>OPP8</td>
<td>4.04</td>
<td>(1.09)</td>
</tr>
<tr>
<td>Collaborate with different stakeholders</td>
<td>OPP</td>
<td>3.69</td>
<td>(0.58)</td>
</tr>
<tr>
<td>Total Opportunity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable CHA</td>
<td>CHA1</td>
<td>2.53</td>
<td>(1.37)</td>
</tr>
<tr>
<td>Limited time for engagement</td>
<td>CHA2</td>
<td>2.47</td>
<td>(1.31)</td>
</tr>
<tr>
<td>Limited resources</td>
<td>CHA3</td>
<td>2.49</td>
<td>(1.28)</td>
</tr>
<tr>
<td>Inappropriate engagement Approaches</td>
<td>CHA4</td>
<td>2.51</td>
<td>(1.30)</td>
</tr>
<tr>
<td>Little motivation</td>
<td>CHA5</td>
<td>2.29</td>
<td>(1.37)</td>
</tr>
<tr>
<td>Inadequate awareness</td>
<td>CHA6</td>
<td>3.07</td>
<td>(1.31)</td>
</tr>
<tr>
<td>Inadequate support</td>
<td>CHA7</td>
<td>3.17</td>
<td>(1.30)</td>
</tr>
<tr>
<td>Inadequate flow of information</td>
<td>CHA8</td>
<td>3.37</td>
<td>(1.35)</td>
</tr>
<tr>
<td>Other roles hinder CE</td>
<td>CHA9</td>
<td>2.74</td>
<td>(0.72)</td>
</tr>
<tr>
<td>Total Challenges</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Five-point Likert scale: 1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=strongly agree.
3.3 Pooled sample perceptions of community engagement among groups.

Table 13 ANOVA analysis of variance was conducted to determine whether there are statistically significant differences in CE perceptions among the groups. Findings show statistically significant differences among the group means. The variables BEN, OPP, and CHA generated F (4.01, P=.017) and F (15.63, p=.001), and F (197.98, p=.001), respectively. In general, findings imply significant differences in perceptions of CE among the three groups. However, these findings do not tell us which specific pairs statistically differ from each other, necessitating a post hoc follow-up.

Table 13: Pooled sample Mean values of stakeholders’ perceptions of community engagement.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean (SD)</th>
<th>F values</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEN</td>
<td>3.94 (.542)</td>
<td>4.10</td>
<td>.017</td>
</tr>
<tr>
<td>OPP</td>
<td>3.52 (.622)</td>
<td>15.63</td>
<td>.001</td>
</tr>
<tr>
<td>CHA</td>
<td>3.05 (.813)</td>
<td>197.98</td>
<td>.001</td>
</tr>
</tbody>
</table>

*Note: The mean difference is significant at the *P<0.05 level.

A post hoc follow-up was conducted to determine which group means differ from each other. To test the homogeneity of variance, the Welch’s F was used at an alpha level of 0.05. The robust test for equality of means for the three variables revealed a statistically significant effect, Welch’s p < .018 for BEN, p < .000 for OPP, and lastly, p< .000 for CHA. The post hoc comparisons using the Scheffe procedure was used due to the unequal sample sizes of the three categories of the group.

Findings in Table 14 revealed a statistically significant difference in BEN perceptions among dairy farmers and students M = .143, P < .030. Findings imply that the CE benefits were perceived by the two groups differently. However, no significant differences were detected in BEN between dairy farmers and faculty members and between faculty and students.

Concerning OPP for CE, findings in Table 14 show statistically significant differences among dairy farmers and students, M = .333, P < .000, and among dairy farmers and faculty members, M = .246. P < .030. These findings indicate there were no similarities in perceptions of OPP for CE among the two groups. However, the CE perceptions in terms of OPP were not statistically significant among students and faculty members.
Furthermore, the post hoc results in Table 14 showed differences in CE perceptions in CHA among the group categories. There were statistically significant differences among dairy farmers and student M =1.46, P < .000, dairy farmers, and faculty members M= 1.07, P< .000, and among faculty and students M. 0.30, P< 003. These findings indicate that the groups perceived CHA involved in CE differently.

Table 14: Post hoc results comparing stakeholders’ perceptions of community engagement.

<table>
<thead>
<tr>
<th>Scheffe test</th>
<th>Variables</th>
<th>BEN</th>
<th>OPP</th>
<th>CHA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean difference</td>
<td>P-value</td>
<td>Mean difference</td>
</tr>
<tr>
<td>Group category</td>
<td>Dairy farmers vs students</td>
<td>.143*</td>
<td>.030</td>
<td>.333**</td>
</tr>
<tr>
<td></td>
<td>Dairy farmers vs academic staff</td>
<td>.013</td>
<td>.988</td>
<td>.246*</td>
</tr>
<tr>
<td></td>
<td>Students vs academic staff</td>
<td>.157</td>
<td>.171</td>
<td>.086</td>
</tr>
</tbody>
</table>

Note: The mean difference is significant at *P < 0.05, and **P < 0.001

3.4 Stakeholders’ Needs for Community Engagement

The open-ended question in the survey required the respondents to identify their needs for CE. The qualitative responses were categorised to obtain the percentages. In general, findings in Table 15 show that the majority of the respondents identified the need to create time for CE, 50.4%, followed by frequent visits, flow-ups, and pieces of training 15.6%. Financial support for CE 11.6% and a contact office for CE 10.0% were also among the respondents’ identified needs. Besides, respondents reported the need to improve communication and information flow about CE initiatives 2.9% and interactive training and workshops 4.4%. In terms of group categories, most faculty members, 16.3%, and students 55.5%, consistently identified the need to create time for community engagement. In contrast, most dairy farmers 72.9%, reported the need for frequent visits and follow-up after engagement activities. These results show that the three group categories had different needs for CE.
Table 15: Descriptive results for stakeholders’ needs for community engagement.

<table>
<thead>
<tr>
<th>Categories of needs</th>
<th>Percentages of stakeholders’ Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dairy farmers</td>
</tr>
<tr>
<td>Create time for community CE.</td>
<td>28.2%</td>
</tr>
<tr>
<td>Contact office and structure for CE.</td>
<td>35.6%</td>
</tr>
<tr>
<td>Financial support for CE.</td>
<td>51.9%</td>
</tr>
<tr>
<td>Improvement in communication and information.</td>
<td>53.8%</td>
</tr>
<tr>
<td>Interactive workshops, courses, and radio programs.</td>
<td>68.8%</td>
</tr>
<tr>
<td>Frequent visits, follow-up, and trainings.</td>
<td>72.9%</td>
</tr>
<tr>
<td>Veterinary services and research on ticks.</td>
<td>5.1%</td>
</tr>
<tr>
<td>Subsidise price of drugs for animals and improvement in the price of milk.</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

*Source*: primary data from three groups of MMU stakeholders

3.5 Qualitative results for stakeholders’ needs for community engagement.

In the following section, we offer a qualitative description to substantiate the different group needs for CE.

**Students**

The students identified six needs for CE. These included creating time for CE, establishing a CE contact office, financial support for CE, improving communication, following up engagement activities and interactive workshops, and radio programs. The majority of students, 55.5%, reported that the institution allows them limited time for CE. In their responses, they highlighted that the university timetable does not indicate the time for CE. The following quotations are drawn from students’ responses.

*Lectures are conducted all through the semester following the university timetable. The one month at the end of the second semester is continuously implied for practical examinations. The university ought to permit us more time for down-to-earth CE lessons and exercises. We need a balance between coursework responsibilities and community activities. We need orientations about engagement responsibilities.*

*(Respondent 1 in a survey September 2019)*
These unique challenges can be addressed through mutual interactions among stakeholders. Among the student stakeholders, 51.1% of the students stressed the need for a contact office for community engagement. This office would help to sensitize and coordinate students’ engagement activities. In addition, the office would act as a link between the institution and the community stakeholders. Students mentioned that:

*The institution must have an office that supports and creates more CE opportunities for students.* (Respondent 2 in a survey September 2019)

Slightly more than a third of the students, 38.5%, cited the need to improve communication and information flow. These were followed by 32.7% who cited the need for financial support for practical CE. To increase students’ involvement in the CE, one of the respondents identified that:

*As students, we continuously get stuck amidst field practical activities because of limited finances. The university ought to adequately provide sufficient funds for CE activities.* (Respondent 3 in a survey October 2019)

**Faculty members**

Faculty members reported five needs for successful CE. These included making time for CE, establishing a CE contact office, financial support for CE, improving communication, interactive workshops, and radio programs. Among the faculty members, 16.3% of them reported the need for time for CE. They specified that an overwhelming teaching load could not permit effective CE as one participant stated:

*I handle five-course units for the pre-service department and four course-units for the in-service department per semester. Besides teaching, I set and check coursework, central tests, examinations. This load indeed constrains time for CE and even limits time for personal research. We require sufficient time for all activities of the university but not only teaching.* (Respondent 4 in a survey September 2019)

*Teaching two standard course units with many students hinders CE roles. Also, other commitments, for instance, supervising students’ research, attending occasional meetings, cannot presently permit CE to sprout.* (Respondent 5 in a survey October 2019)

Perhaps not surprisingly, given their strong sense of identity as faculty members, they consistently described a struggle between fulfilling the teaching and CE. They described the difficulty of fulfilling their teaching role without sacrificing personal time and income. These
opportunity costs, in turn, signified constraints to faculty members fulfilling the engagement mission. In this case, the respondent indicated that participation in CE depends on personal time and income. This finding demonstrates that the university faculty were struggling to fulfill the CE mission.

In addition, among the faculty members, 15.4% distinguished that inadequate financial resources hinder active participation in effective CE. Deprivation of specific budgets for faculty participation brands CE a frustrating task. In their responses, academic staff continually mentioned that:

We need the institution to honour faculty members that individually engage the community for the institution’s sake. We would have revived the outreach program in the School of Education, but we need financial support. The university seems to prioritise other activities but not CE. (Respondent 6 in a survey October 2019)

Furthermore, the feeling of abandonment of CE activities seemed particularly acute at this institution. The problem was catalysed because the institution lacks a CE structure, as identified by 13.3% of the faculty. One participant highlighted:

The human resource office conducts staff evaluations at every end of the year. One of the critical areas in this appraisal is CE. However, we do not know whether the academic registrar’s office or the human resource is responsible for CE activities during the academic term. We require a structure that can unanimously support CE activities. (Respondent 7 in a survey October 2019)

Dairy farmers

Dairy farmers identified eight needs for CE. These included frequent follow-up of engagement activities, adequate information flow, interactive workshops, and radio programs, and creating time for CE. They also identified the need for establishing a CE contact office, financial support, veterinary services, and research on ticks, subsidising animal drugs, and improving the milk price. The majority, 72.9%, stressed the need for frequent follow-up of CE activities. They expressed that the institution involved farmers in several pieces of training and workshops without follow-ups after training. Dairy farmers, in their responses, explained:

We had two workshops conducted by MMU staff four years back. Some farmers missed the opportunity to participate in these pieces of training due to inadequate information. During these workshops, farmers raised the problems of ticks attacking animals and low prices for milk. However, follow-up was not done, and the issues still exist. The
institution should provide a remedy to these problems. (Respondent 8 in a survey September 2019).

Besides, 68.8% of dairy farmers consistently identified the need for workshops, short courses, and radio programs. The following quotes are responses from three dairy farmers.

*We require the institution to enhance radio programs that address farmers' needs. Dairy farmers may facilitate some of these radio programs. We need to jointly design training programs that can benefit dairy farmers in our region.* (Respondent 9 in a survey September 2019).

*We operate dairy farms and have the experience to share with the institution. We need the institution to organize interactive workshops to generate ideas collectively to can solve the community problems.* (Respondent 10 in a survey October 2019).

*We need more workshops in areas of managing our dairy farming records and acceptable farming practices. We also need pieces of training in other fields but not only dairy farming.* (Respondent 11 in a survey October 2019).

Dairy farmers also mentioned the need for improvement in communication (53.8%), the need for financial support (51.9%), and creating time for CE (28.2%). Besides, 5.1% of the dairy farmers highlighted the need veterinary services. They noted that the drugs on the market could not treat animal diseases. Furthermore, 0.9% of the dairy farmers also mentioned the need to subsidise the price of animal drugs and improve milk prices, especially during wet seasons.

4. Discussion of the findings

This current study sought to understand the perceptions as well as the needs of HEIs stakeholders for CE. We based the research on the concept of CoP (Reilly et al., 2012) to understand the institutional stakeholders’ perceptions and needs for CE. Using survey data collected from 450 respondents of a case study HEI, the study revealed how institutional stakeholders perceived CE. Also, in an open-ended question, respondents highlighted their needs for effective CE. In the following paragraphs, we discuss the results from our study before offering conclusions.
The descriptive findings regarding CE’s BEN suggest a higher individual evaluation of MMU contributions to stakeholders’ engagement activities. This finding is consistent with previous research, showing that actively engaged participants perceive their involvement BENs (Attree et al., 2011; Sandy and Holland, 2006). Survey findings showed that participants neutrally perceived the OPP for CE, implying an unutilised potential to maximise CE. This finding is similar to one study, demonstrating the lack of engagement prospects resulting in participants’ failure to realise their collaboration with the institution (Mehta et al., 2015). It is suggested that OPP be enhanced for students and faculty to address community needs (Martin and Pyles, 2013). Similar research argues providing chances for student and academic staff hands-on experience is crucial for putting theory into practice (Jinkins and Cecil, 2015; Selvaratnam, 2013). The descriptive findings also showed that students and faculty members highly perceived CHA, whereas the dairy farmers disagreed that CE is an obstacle. In this regard, the dairy farmers may be willing to participate in MMU engagements, while impediments may hinder students and academic staff practical CE. These findings are similar to (Elizabeth Morrell et al., 2015), demonstrating that CHA inhibits effective participant involvement in engagement activities.

The findings above indicate different CE perceptions regarding BEN among students and dairy farmers. These findings are consistent with (Frank and Sieh, 2016), revealing that CE benefits participants differently. For instance, students benefit by gaining practical hands-on skills they would have missed through conventional teaching (Korzun et al., 2014a; Quillinan et al., 2018; Sandy and Holland, 2006). In contrast, dairy farmers benefit from obtaining knowledge and skills to manage dairy farming as a profitable income-generating activity. Another research study (Tarus et al. (2017) expressed a similar view that CE activities benefit farmers in acquiring record-keeping knowledge.

Similarly, dairy farmers gain knowledge in animal husbandry (Tiampati, 2016). The current research suggests that MMU should support mutually beneficial engagements with all stakeholders. For instance, enhancing the professional development of university faculty in CE, as Shephard et al. (2017) proposed when referring to Community-engaged scholarship to advance CE. Also, the findings suggest that HEIs emphases engagements that rotate towards the academic entity and CE.
Furthermore, responses of study participants revealed that the institution offers moderate OPP for CE. However, other research provides contradicting evidence showing that institutions offer great chances for engaging faculty, students, and community members (Selvaratnam, 2013). Participants in Selvaratnam’s study indicated that the course-based CE availed great chances for students’ engagement with local communities. In another study, Morrell et al. (2015) demonstrated practical OPPs for engaging stakeholders through action research projects. The current research suggests that the institutions must avail OPPs for their stakeholder engagement. Bhatnagar et al. (2020) recommended that CE be part of the institutional curriculum to increase students, faculty members, and community interaction OPPs. In a similar vein, Goddard et al. (2016) state that providing community engagement OPPs should form part of an engaged institution ensuring community partners’ full participation.

The study shows that there were differences in how participants perceived the CHA involved in CE. For instance, students tend to have limited time while university faculty are challenged because the institution does not consider CE as part of their workload. The study’s findings are entirely consistent with (Quillinan et al., 2018), who found out in their research “Lessons learned from community engagement initiatives within Irish higher education” that CE becomes challenging when it is not recognised as part of their workload. The findings are also similar to those of (Sandy and Holland, 2006), which found that although community partners are willing to devote time to educate university students, they often perceived the engagement CHAs. These hinderances are related to the academic calendar, logistics, workplace preparedness of students, and difficulty interacting directly with the faculty. The challenges involved for instance, limited time, little motivation, and other obligations hinder CE’s successful implementation. These results suggest that MMU should respond hinderances to stakeholders’ participation in CE initiatives. Moreover, Arthur at el., (2016) suggested that such CHAs can be addressed through establishing support structures and diversifying sources of funding for CE.

The three categories of institutional stakeholders identified multiple needs for effective CE, including creating time, contact office and structure, financial support, and CE elements’ follow-up. These findings align with Morrell et al.’s observation that CE activities suffer in most HEIs as the institutions are structured around graduation events and the academic term. The findings concur with previous research findings. Specifically concerning creating time for CE (Adekalu et al., 2018; Wattman et al., 2007), not rendering CE a voluntary activity
(Onwuemele, 2018), and allowing faculty and students to operate inflexible schedules to enhance practical CE (Wattman et al., 2007). According to Bhatnagar et al. (2020), CE should be part of the curriculum to enable students to develop innovation in addressing challenges in the communities. Goddard and Kempton (2016) also demonstrated the importance of embedding CE in research and teaching to involve all partners in co-production activities.

Participants of the study emphasised the need for contact office and CE structure, revealing a lack of leadership and management for CE. In their research, Brisbin and Hunter (2003) also reported the need for institutionalised contact between the community partners and the institution. They expressed that institutional partners need to be informed about how and what office to contact for CE activities. The findings are also consistent with Hart et al. (2009) and Franz et al. (2012), demonstrating the need for support structures, creating enabling platforms of point of contact for all university stakeholders who may wish to have access to CE information in that institution. Goddard and Kempton, (2016), in their study “The civic university,” stated that institutional leadership is critical to the engagement process. They suggested that realising practical CE active institutional leadership to work collaboratively with community partners.

The participants in this study emphasised the need for financial support to execute the CE elements. These results are in agreement with previous studies regarding institutional stakeholders’ needs for CE. Adekalu et al. (2018) conducted a study where participants indicated the need for funds to execute CE elements. Existing literature (Gorski, 2016; Mtawa et al., 2016) observed that inadequate financial support hinders academic staff and students from incorporating CE into their activities. These findings suggest that HEIs should prioritise, allocate resources, and provide rewards to participants in the engagement process (Furco, 2010; Kruss, 2012; Weerts, 2005). A research study (Cho, 2017) also support that institutions should provide incentives and rewards for faculty excelling in CE work.

In addition, participants identified the need for follow-up of the CE activities. Such a need concurs with (Holley and Harris, 2018) findings in their research “The Role of the Research University in City Development.” They found out that community members were frustrated by the lack of follow-up from university researchers. Similarly, an empirical study revealed institutional weakness in following up CE initiatives (Tarus et al., 2017). Consistent with previous research, Brisbin and Hunter (2003) demonstrated how inadequate follow-up,
infrequent contacts, and communication with university students and faculty frustrated community stakeholders. Whereas institutions engage communities in various activities, community stakeholders perceive them as academic institutions, engaging communities for information collection purposes. The empirical findings and literature suggest that HEIs should endeavour to follow-up their CE activities.

Nevertheless, the findings of this study question MMU’s commitment to fulfilling the CE mission. For instance, does the institution possess a clear university community leadership, structure, and a framework for actualizing CE? Taking this question into account justifies the development of a comprehensive strategy and a framework for CE. Creating strategies implies institutionalization and creating official structures to support CE. Such a framework would incorporate a “co-creation” model that embraces knowledge sharing through collaboration and participation, combining resources and capabilities between institutions and stakeholders. For instance, in various settings (workshops, classroom, community setting), students, faculty, and community stakeholders meet to co-create solutions to rising community challenges. Frank and Sieh (2016) and Quillinan et al. (2018) suggested that institutions should emphasise pedagogies of practical philosophical teaching and learning and support co-creation to benefit all stakeholders. More research suggested (Cook and Nation, 2016a; Mbah, 2019) suggested developing clear frameworks to guide CE initiatives. The absence of an engagement framework jeopardized building necessary bridges between the HEIs and the stakeholders. In precise terms, these findings suggest that the institution must refocus on efforts that facilitate beneficial engagement, acknowledge and work towards meeting the stakeholders’ needs.

There are some limitations of this study to note. First, the data analysed, and findings presented represented only three groups of stakeholders, namely faculty members, students, and dairy farmers (external), whereas the university has multiple external stakeholders such as fish farmers. Therefore, future research should include more external stakeholders and other HEIs, to have a more comprehensive perceptions of CE by a wide range of stakeholders. Secondly, this study only investigated the stakeholders’ needs once. Future research may investigate stakeholders’ needs from multiple time point of view or from longitudinal approaches. Based on the research findings, participatory research workshops and CoP can be organized in future to accommodate different stakeholders’ CE needs (Nirmal et al., 2016).
5. Conclusion

While there have been many studies on HEIs’ engagement with stakeholders, few have focused on understanding these stakeholders’ perceptions and needs. Thus, the purpose of this study was to assess HEIs stakeholders’ perceptions and needs for CE from a Ugandan case study. CE is explored against the background of the CoP concept to provide insight into how engaged stakeholders perceive engagement. From the CoP perspective, HEIs offer engagement opportunities and build beneficial relationships with their stakeholders. The current study and literature showed that the three categories of stakeholders positively perceived the engagement BENs. This indicates that HEIs should emphasise mutually beneficial CE by setting up structures that support students, faculty members, and community stakeholders’ engagements. However, the findings showed that the restricted engagement OPPs and CHAs hinder stakeholders’ practical CE. This research suggests that HEIs prioritise and pay more attention to creating OPPs and addressing the CE CHAs.

The findings showed that community-related activities were unsupported, and stakeholders’ needs were not addressed. As a result, the three categories of participants express the need to create time, contact office and structure, financial support, and adequate communication for CE elements. The current study and literature findings yield important suggestions to address these needs. The time constraint can be solved by incorporating CE activities in the institutional timetables, designing CE programs as part of the formal curriculum for students, faculty members, and dairy farmers' participation in CE programs. Also, HEIs must emphasise reciprocal engagements through co-learning activities. Also, HEIs must develop CE programs based on the needs of their stakeholders. Institutions should support faculty members and make follow-ups of the CE activities. Moreover, HEIs should ensure adequate follow-up and appropriate information flow to bridge the communication gap amongst their key stakeholders. Moreover, addressing the stakeholders’ needs relies on institutional leadership support to set up structures and contact offices for CE. Institutional leadership must provide the necessary support that allows CE activities to flow in the institutional structures.

In conclusion, the current study suggests that HEIs should emphasise CoP during the engagement with stakeholders. The CoP is a relevant concept to guide practical CE in HEIs. Through CoP, faculty research and students’ education experiences will be enhanced. Students will be able to collaborate with community stakeholders through different forms of
participation. Also, in a CoP, institutions should incorporate a “co-creation,” embrace knowledge sharing, collaboration, and participation, of all stakeholders. We believe that this will enable the development of effective CE interventions that will address stakeholders’ needs. Lastly, this study recommends HEIs pay attention to their stakeholders for meaningful and impactful CE.
6. References


Kuttner, P. J., Byrne, K., Schmit, K., & Munro, S. (2018). The art of convening: How community engagement professionals build place-based community-university


Chapter Four
Co-creation of an Application for University community engagement with dairy farmers in Uganda

Abstract
Prominent within the 21st-century university discourse is the persuasive use of technology engagement tools. However, community stakeholders' unequal participation in developing tools is evident, resulting in unsuitable designed tools. This study describes the design of the Rwenzori dairy app with end-users’ input. The app aims to improve dairy record-keeping, support decision-making, and enhance university research and collaboration with dairy farmers. The app was created using the design thinking model's three stages (ideation, prototyping, and testing) in a qualitative co-creation process. A sample of faculty members, dairy farmers and the researcher developed the initial prototype content based on stakeholders' input. Two software design and development experts created a usable prototype Beta¹ and selected faculty members pre-tested the prototype. Forty-five dairy farmers from the Rwenzori region tested the initial prototype during a one-day living lab workshop. The feedback gathered guided the re-designing prototype. The redeveloped prototype was tested during four living-lab workshops that guided the development of the prototype Beta². Users identified contextual content and functionality for the dairy app. The prototyping and testing stages made creating an app that meets users' needs feasible. The study’s findings demonstrate the benefits of engaging end-users in co-developing tools. Further research is warranted to ascertain users’ readiness to use the developed app.
1. Introduction

The most striking thing today is the realisation that technology and smartphone use have become essential to human life, facilitating interaction among individuals. Where challenges abound, increasing enthusiasm exists for developing and using digital technology tools to facilitate engagement initiatives between universities and communities (Bernardo et al., 2012). The prospects of using digital tools, particularly those based on smartphone apps for interaction, have captured many scientists, policymakers, and conservation professionals (Bartlett et al. 2015; Fordis et al. 2011; Marshall and Taylor 2005; Sharma et al. 2017). The enthusiasm to use apps is enhanced by the increased affordability and adoption of smartphones (Gichamba and Lukandu 2012; Kamboj et al. 2020) and improved internet connection (Di Gangi et al. 2009; Eitzinger et al. 2019). Again, advances in using technology tools were heightened during the global pandemic of Covid-19. To cope with the pandemic challenges, individuals and institutions changed their usual modes of interaction to using internet-based tools (Garfin, 2020).

Contemporary literature shows that apps promote active public participation in urban planning procedures (Delitheou et al. 2019) and marketing (Dube and Helkkula 2015). In agribusiness and farming, apps allow institutions to collect accurate and timely data for research (Daum et al., 2018; Eitzinger et al., 2019; Michels et al., 2019). Such data improve livestock production and productivity (Katamba and Mutebi 2017). Some apps monitor animal health and reproduction management and store farm records (Kenny and Regan 2021). More importantly, apps empower users to create and share knowledge with other stakeholders (Dehnen-Schmutz et al. 2016; Gichamba and Lukandu 2012). For institutions confronted with challenges in the traditional human-to-human interaction model, such as a shortage of budgets and time for physical engagement, utilising applications could be a remedy.

Although apps perform various tasks, Harder et al. (2017) demonstrate that developers do not involve intended users in designing and developing these tools. End users’ non-participation in developing engagement applications leads to suitability issues and failure to meet users’ needs (Al-kumaim et al., 2021; Llema and Vilela-Malabanan, 2019; Mirri et al., 2018). Co-opting and empowering users to participate in tool design and development is critical. For instance, Filieri (2013) and Kumar et al. (2016) demonstrate that user knowledge benefits the institution by adequately assessing and fulfilling users’ needs and reducing the risk of product failure.
Extant literature (Bergold and Stefan 2016; Durugbo and Pawar 2014; Mirri et al. 2018) further contend that developers should prioritise deep empathy and engage users in developing practical solutions.

Co-creation is a popular engagement strategy suggested to enhance end users' participation in designing and developing products (Al-kumaim et al., 2021; Baelden and Van Audenhove, 2015; Herselman et al., 2010; Voorberg et al., 2015). In particular, co-creation stimulates empathy and bridges the gap between developers and users (Shan, Neo, and Yang 2021; Fuster and Senabre 2020). Allowing target users to contribute to applications' design and development ensures that the users' needs are contextualised (Pemsel et al. 2010; Prebensen et al. 2013; Trischler et al. 2019). Moreover, co-creating with target users improves services and stakeholder relationships (Zavratnik et al. 2018). More recently, researchers and practitioners acknowledged that collaborating with target users to develop tools results in adopting more suitable and simple tools (Kenny and Regan 2021; Mansson et al. 2020).

1.1 Study context: An application for university community engagement with dairy farmers

While engaging users in the development and testing of digital tools have been advocated for (Drain et al. 2017), a dearth of empirical studies explores how co-creation can effectively shape the development of engagement apps from the university faculty members, software developers, and dairy farmers perspectives. This study responds to this context by describing an empirical-based design and creation of a dairy application with faculty members, the software development team, and dairy farmers' input. Furthermore, the paper documents the user testing experience with the developed application. The concept of developing an application arose from the institution's efforts to improve engagements with dairy farmers, which were fraught with challenges. For instance, a cohort study (Alice et al. 2021) uncovered a plethora of challenges and needs encountered during university faculty members' engagements with dairy farmers. Among these were limited budgets for faculty engaged in training, insufficient information flow between the institution and dairy farmers, inadequate follow-up of engagement activities, and tick diseases affecting dairy animals, among others.

Furthermore, while the University trained the dairy farmers on the importance of keeping records, farm records are frequently kept manually in notebooks or paper sheets that could not
be stressed. Inappropriate records challenge information tracking regarding animal calving dates and health events, to mention a few. Manteaw et al. (2021) demonstrated that improper record-keeping jeopardises effective farm management and stymies farm growth.

Using the application as an engagement platform could benefit the institution and dairy farmers. Dairy farmers, for example, can easily and conveniently enter and save a digital record of their farming operations. Furthermore, the collected data could easily be monitored to support decision-making and better farm management. The information gathered through the app could benefit institutional research activities and provide timely feedback to farmers. More importantly, the app could relieve the institution's time and budget constraints in collecting timely data for dairy farming research activities. Thus, the research question for our study is how co-creation through design thinking can be operationalised to design an application for university engagement with dairy farmers. This paper is structured as follows: In section two, we describe the methodological part of our research, and in section three, we present the findings and outcomes. Section four discusses the findings, and finally, we will present the conclusions and lessons learnt throughout the process.

2. Methodology
2.1 A qualitative case study project

As a principal methodology, we conducted a qualitative co-creation case study embedded in the three stages of the Stanford d. school/D-design thinking model (Doorley et al. 2018). This design thinking model includes five steps, however the first two, empathise and define, were explore in our previous chapter(Alice et al. 2021). The last three stages encourage iterative cycles of ideation, prototyping, and testing. Because the process is iterative, the university and the community can improve their ideas and answers based on feedback and learning from previous rounds (Retna, 2016). During ideation, solutions are brainstormed (Kumar et al., 2016). Therefore, we used this stage to generate the app's initial requirements and content. The second stage involved creating a usable prototype app and mock-up. The last stage involved hands-on experience to test the functionality and gather feedback on the acceptability of the designed prototype content. We used an iterative approach in our Living lab workshops, where the content and design of the prototype dairy app were constantly modified and enhanced in response to user input and evaluation. Throughout the living lab workshop, participants were actively iterating on the practical content and design for the app.
2.2 Participants

We purposively sampled three categories of participants to engage during the three stages of design thinking to create the application. The first category included key dairy farmers and university faculty members of the agriculture and environmental science—these generated content and requirements for the prototype Beta1. The second category included a specialised software design and development team from Howest University of Applied Sciences in Belgium. These stakeholders joined the process to create a usable prototype and pre-tested it with faculty members from science, technology, and information. The last category included a cohort sample of dairy farmers who shared their community engagement needs in a previous preparatory study (Alice et al., 2021). These stakeholders participated in testing and providing feedback regarding the prototype app. Dairy farmers' participation was ideal for facilitating the design of an app that meets their needs. In September 2019, samples of participants in the first stage were taken. In February 2020, forty-five dairy farmers, two app developers, and five faculty members participated in this living-lab workshop to test the prototype app. After this workshop, the prototype was improved based on the input received during the initial living-lab workshop. Four living-lab workshops comprising twenty dairy farmers, one app developer, and six faculty members each were scheduled off campus in May and June 2020. However, because of the COVID-19 epidemic, these workshops were postponed until April and June of 2021. Table 16 shows participants in the co-creation of the dairy app.

Table 16: Sampled participants for the co-creation of the dairy app.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Ideation stage (n=10)</th>
<th>Prototyping stage (n=10)</th>
<th>Testing stage</th>
<th>4 Living lab workshops (n= 87)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>7</td>
<td>8</td>
<td>39</td>
<td>62</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
<td>2</td>
<td>13</td>
<td>25</td>
</tr>
<tr>
<td>Faculty members</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>App developers</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Dairy farmers</td>
<td>5</td>
<td>-</td>
<td>45</td>
<td>20*4</td>
</tr>
</tbody>
</table>

2.3 Application Design Thinking Co-creation process.

**Ideation:** This stage entailed generating ideas for the app's user requirements, features, and content. The sampled faculty members, dairy farmers, and the researcher participated in a two-day workshop to collect app design parameters and requirements ideas. During this activity,
the researcher presented the research study and highlighted the task for the participants. We used the brainstorming method to gather ideas. Participants suggested parameters as content and described how each generated parameter could be presented or measured in the app. They also sketched the screens that could appear in the app. Suggestions were written on a flip chart to ensure all participants agreed on the application's relevant content. The software development team used the generated content from this workshop to create a usable prototype.

**Prototyping:** This stage involved creating a usable prototype app by technical experts with stakeholders' input, including users. Two Belgian software design and development experts developed a dairy app based on the findings from the Ideation stage. The app was programmed in English to work on Android, PC, and Mac computers and was named the "Cow Analytics app." To use the app, the user needs a modern browser such as Chrome, Firefox, or Edge on every platform. A mock-up workshop to present the structure of the prototype was conducted. During the mock-up workshop, the researchers and faculty members pre-tested the prototype. The pre-test was crucial to validate the app design. We repeated the prototyping several times to establish the app's preferred design and contextual parameters.

**Testing:** The initial testing of the app involved one living lab workshop that took place at the university premises. During this living lab, forty-five dairy farmers had a hands-on experience with the prototype to solicit views regarding the prototype content and functionality. The selected participants owned smartphones and were registered in the application system prior to the activity. The first living-lab workshop was held at the university and was divided into six steps. First, participants introduced themselves, and the researcher highlighted the detailed purpose of developing and testing the app. Secondly, each received a username and password to install the app on their smartphones. Step three involved participants logging in and autonomously exploring the application. At this step, we used the "think aloud" process, which meant the participants could speak aloud about their thinking while navigating the app. This approach gave the researchers and workshop organisers insights into the participants' reasoning and could facilitate the design and testing processes (Mansson et al., 2020). All participants' concerns were written on a flip chart.

The fourth step involved taking a guided tour of the app. The developers explained all the app's features and guided participants on how to use it. Through the Keep-Add-Delete process, we asked participants to highlight preferred parameters as they explored the app. The process was
followed using three flip charts, each indicating either keep, add, or delete. Participants unanimously agreed to keep, add, or delete certain features. Keep were parameters to be retained, and add-ins were new content and features to include or add technical content changes. Delete were abstract content elements to be deleted.

The fifth step was to choose the app name jointly. We used the 'idea generation and voting process (White et al. 2007) to develop a commonly accepted name. Participants randomly proposed names, and they were written on a flip chart. The participants then voted for a suitable app name. The voting exercise provided insights into what users would accept the app (Filieri, 2013). Ideas gathered during testing were used to re-design the app for subsequent testing. Figure 5 shows participants during the testing of the initial prototype.

![Figure 5: Participants during the testing of the initial Beta prototype](image)

Furthermore, three living-lab workshops were conducted off-campus to test the refined prototype Beta. Twenty dairy farmers, three faculty members, and one Howest University in Belgium volunteer participated in each living-lab workshop. We used an iterative approach in these living lab workshops, where participants tested and evaluated the prototype. The content and design of the prototype dairy app were constantly modified based on the feedback gathered, and the most recent version was used in the subsequent living-lab workshop. Figure 2 shows participants during two living-lab workshops.
The last living-lab workshop was conducted on campus, and it involved 20 dairy farmers in evaluating all feedback gathered to check the latest version of the prototype app and highlighting their experiences regarding the design process. The researchers guided participants through a PowerPoint series depicting various app screens. During the workshop, participants demonstrated good acceptance of the app content and the technical design, and there were no new ideas for expanding the app emerging from the last workshop. After this workshop, the prototype app Beta² was created.

2.4 Ethical considerations

All participants signed written consent following information and explanations about this study at the start of the workshops. Also, this is a cohort study; participants had minimal risks of causing ethical anxieties, and we ensured they felt safe to participate.
3. Results

This section describes the app's content and requirements obtained during ideation, the developed prototype, and feedback on the content and requirement acceptability for the Rwenzori dairy app.

Ideation stage

The workshop ideas were used as content for the design and development of the dairy app. Content included: animal identification, feed components, registered feed supplements, milk yield and quality, animal health, markets for dairy products, and animal growth. It is worth noting that the proposed content and requirements were centred on animal nutrition. One farmer stated in an open discussion:

We should develop an application that can monitor animal feeding and milk yield. It should enable farmers to balance feed ratios for dairy animals using locally available feed ingredients. (Respondent at the workshop on 5th September 2019)

Table 17: Ideas about the content of the App generated during the ideation stage.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
<th>Suggested measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal identification</td>
<td>Animals to be identified from birth</td>
<td>To categorise all animals, including calves, heifers, dairy cows, and bulls</td>
</tr>
<tr>
<td>Feed components</td>
<td>Nutritional feeds used on the farm</td>
<td>Feeds in kilograms and quantity of water taken per animal, source of animal feeds</td>
</tr>
<tr>
<td>Feed supplements</td>
<td>Components of the animal feed supplements</td>
<td>Include maize bran, cotton cake, soya bean cake, sunflower cake</td>
</tr>
<tr>
<td>Milk yield</td>
<td>Amount and price of milk</td>
<td>Litters of milk per day per animal. Milk price per litre.</td>
</tr>
<tr>
<td>Quality of milk</td>
<td>Focus on milk solids</td>
<td>Amount of lactose, protein, and water content, Fats and butterfat content, Lactose content, proteins, aerobic plate count, coliforms mills</td>
</tr>
<tr>
<td>Assets and inventory invention</td>
<td>Assets on the farm</td>
<td>The number of: coolers, milking machines, pens for calves, milk parlors, paddocks, and buckets,</td>
</tr>
<tr>
<td>Animal health status</td>
<td>Records on animal size and treatment given</td>
<td>The body size and height of animals, type of treatments given at birth, and when the animal is sick</td>
</tr>
<tr>
<td>Markets</td>
<td>Where farmers sell dairy products</td>
<td>Farmgate, milk traders, cooperatives,</td>
</tr>
<tr>
<td>Growth record of the animals</td>
<td>Monitor growth until the animal is sold.</td>
<td>The weight of animals in kgs at different stages</td>
</tr>
</tbody>
</table>
**Prototyping:** This stage resulted in a prototype app with design specifications and requirements identified during the ideation stage. The Android operating system was chosen because the platform is the most used among the local population in Uganda. English was the language of instruction for the App. Requirements and parameters, such as animal identification and feed components, were included in the design of the prototype.
Testing prototype Beta

We gathered feedback during the testing of the prototype Beta. First, we observed that participants were eager to try the prototype app. Some, however, lacked the necessary experience to log in and navigate the prototype without assistance. Second, due to the model of their phones, installing the prototype was difficult for some participants. As a result, two participants made the following remarks:

*My colleagues exploring the app's features has taken time to open.* (Respondent at the workshop on 5th February 2020)

*I have a problem with displaying some app features. The screens are difficult to view, particularly where I have to double-tap to select the animal.* (Respondent at the workshop on 5th February 2020)

Furthermore, participants comment on the language of instruction for the prototype. They proposed an option to change the language from English to Rutooro language. Another concern was about the app's home screen. One participant stated:

*The home screen picture is unappealing to dairy farmers. We should use images of well-known cattle breeds in the Rwenzori region that produce a high milk volume.* (Respondent 3 at the workshop on 5th February 2020).

Participants further commented on the prototype content. The testing stage highlighted differences between the initial app content and what was feasible for the farmers. During the testing stage, we found that some prototype Beta parameters were rendered abstract to dairy farmers. For instance, one participant asserted:

*Measuring lactose, protein, fats, butter, lactose, proteins, aerobic plate count, and coliform mill content is unfeasible. It is better to measure the amount of milk obtained from the farm.* (Respondent 4 at the workshop on 5th February 2020).

We used the Keep-Add-Delete method to determine feasible content for the app. Participants unanimously agreed to keep the following features from prototype Beta.

a) Animal identification: Identified with tag numbers, local brand names, or notching.

b) Animal feeding. Use approximations of the animal feeds since we cannot get the exact measurements. Feeding should focus on measuring the dairy meal, Maize bran kilograms, pasture amount measured in sacks, and feed supplements in tones or blocks.
c) Animal health. To record health events, like describing the disease symptoms, the vaccine type/treatment given, the hour of giving the treatment, the date, the veterinarian's name, and the total cost of animal treatment in Ugandan shillings.

Participants generally expressed a different perspective that the app's first version did not adequately capture some critical requirements. As a result, they proposed expanding the application to include the following features.

a) Farm's location: Districts including Kabarole, Kamwenge, Kyenjojo, Kyeggegwa, Kasese, Bunyangabu, Bundibujjo, Ntoroko, and Ibanda districts.
b) Farm employees record. Identified by roles, such as farm manager or headsman, their names.
c) Animal status. Record whether the animal is in or out of stock (Sold)
d) Animal feeding type. Record the feeding types, including Zero grazing, Tethering, Paddocking, and Communal grazing.
e) Animal breeding events. The date and source of insemination, the expected calving date, and a summary of the breeding history, including record calves, such as their names, birth dates, and breeds.
f) Animal production. Record milk production per month, a summary of milk litres recorded in the morning and evening, total milk production per month, volume and price of milk, and monthly income obtained.
g) Farm equipment and structure. Chaff cutter, Spray pumps, weighing scale, strip cups, Lactometer, tag applicators, and Baddizor, measuring tapes were the suggested equipment. The farm structure includes deep tanks, crushes, spray races, feeding troughs/water troughs, and farm stores.
h) Reminders. Record sufficient data for timely attention on the dairy animals expected delivery date, vaccination, deworming, and spraying. This could take the form of pop-up messages.
i) Veterinary doctors' contact information and a comment box. To enable easy access to veterinary doctors.

Furthermore, participants suggested deleting the feature for recording milk quality. They noted that local dairy farmers lacked the necessary equipment to measure milk quality. Thus, the feature for measuring milk quality was deleted. Another requirement proposed for deletion was the record of markets for dairy products.
Participants proposed four names for the prototype Beta¹1) Ngabu app, 2) Rwenzori dairy app, 3) Smart dairy app, and 4) Dairy farmers' app. Through the voting exercise, most participants agreed that the prototype should be named "Rwenzori dairy app."

Finally, participants commented on their participation and allowed them the opportunity to share their perspectives without anyone dominating. They appreciated recognising their ideas. However, they expressed the need for user training to use the app. They also proposed that the app should allow users to record data while offline. A comprehensive list of users' requirements was adopted, and the app development team re-designed the prototype.

Prototype Beta²
Figure 7 demonstrates the structure of the Rwenzori dairy app Beta². The user needs to be registered to begin using the app. The home screen requires a user to log in to the app. The user starts dairy farming by adding a staff member and one animal. The user can add a cow, identifying it with a tag, name, or notch. The add multiple cows' function is used to enter multiple animals. The "Add a calf" function allows records of the calf's birth date, name or tag number, and breed. Default values are recorded for tools and infrastructure. The user also enters the farm's location using the district option. Additional information about animal breeding, milk production, feeding, and animal health can be recorded in the app. By selecting the production screen, the user can fill the production for one or more cows. The user can also sell the milk and save the information on the app. The user accomplishes this by using the sell milk screen and filling in details about the milk's date, volume, and price. To record the breeding, the user must first select the cow. Then the date, origin, type of insemination (natural or artificial), and estimated calving date must be entered. The app user uses default values to record the feeding calves and cows. The animal health screen records the animals' health information such as deworming, spraying, drug, cost, and treatment date. The app offers important notifications regarding Vaccinations, deworming, spraying, and the expected delivery date of the dairy animals. The send data function allows users to sync data from the phone to an external database. The data is stored and encrypted to avoid unauthorised access.
Testing Prototype Beta

Gathering feedback from end users from a broader perspective ensured that the app potentially addressed users' needs. During the fourth living lab workshop, participants remarked that the dairy app's content was simple to understand. They liked its functionality and were thrilled that they could save their records on a digital tool. Furthermore, they appreciated the University’s innovation in improving dairy record keeping. During the living-lab workshops, participants mentioned what they liked about the application, and in their responses, they said:

The application operates well on my smartphone, and I am happy to store information regarding dairy farming on my phone. (Respondent 5 at the workshop on 24th April 2021)

I like the milk production function and the instant calculating monthly income from selling milk. This will guide me to know whether I get profits from the farm. (Respondent 6 at the workshop on 24th April 2021)

What is interesting to me is the app’s ability to calculate the expected animal delivery date when the information is entered accurately. (Respondent 7 at the workshop on 8th May 2021)
I am anxious to record events on my farm with my smartphone, even without an internet connection. I am pleased that my vital farm records will remain safe. (Respondent 8 at the workshop on 5th June 2021)

As mentioned in our previous interaction with some faculty members, tick resistance to acaricide drugs is still challenging. I am happy to record the types of animal treatment using this app. If the University does more research about these ticks, I am ready to provide information through this app. (Respondent 9 at the workshop on 5th June 2021).

Some participants considered the living lab workshop insufficient to master the app's procedure. This implied a need for farmer training to use the dairy app. Participants further underscored the importance of changing the language of instruction for the lay dairy farmers to benefit from using the app. During the last living-lab workshop, participants stressed four critical dairy app requirements: animal production, feeding, breeding, and health. However, they did not propose more content to add to the app.

Based on the last living lab workshop, the content and functionality of Prototype Beta² were varied as no additional content was proposed. The Prototype Beta² named the Rwenzori dairy app, has multiple features and functionality that cater to users' needs in managing and organising their daily activities. For instance, the dairy app gives users an easy-to-use interface for creating, viewing, and managing diary entries regarding different parameters. The dairy app also has a calendar that guides farmers on different activities. More importantly, it offers notifications regarding Vaccinations, deworming, spraying, and the expected delivery date of the dairy animals. The dairy app is simple software that offers multiple benefits and can be used offline without mobile data.

4. Discussion
This section discusses the research findings related to the research objective, the implications, limitations, and suggestions for future research.
4.1 Discussion of the Findings

This co-creation study aimed to develop a dairy app inherent in the three stages of the design thinking model. We describe faculty, software developers, and dairy farmers' contributions to the application's design and development. Findings can be interpreted in line with the three implemented stages of the design thinking model.

The ideation stage resulted in the initial prototype requirements and content. Despite the content generated during ideation, some parameters regarding practical content to lay dairy farmers, were deemed abstract during the subsequent stages. To some extent, the involvement of five faculty members and critical dairy farmers, particularly during the ideation stage, was insufficient to guarantee the feasible content for the app. This echoes the results by Liljedal and Dahlén (2018), who reported that the absence of target users developing tools impacts users' evaluation of the product. Our rhyme with other researchers' (Pemsel, Widén, and Hansson 2010; Trischler, Dietrich, and Rundle-Thiele 2019; Filieri 2013) findings highlights the benefit of active and equal user engagement in the co-creation of feasible products.

We repeatedly performed the prototyping stage, and the feedback elicited informed the refinement of the app. Consistent with Kumar et al. (2016), we found participants in our study were cooperative and offered insightful input on the dairy app's requirements and content acceptability. Additionally, this stage helped ensure the app was relevant to the end-users. Our prototyping experience confirms the importance of optimising the interaction between developers and users (Avram et al., 2020; Pereira & Russo, 2018; Trischler et al., 2019). This finding is resounded by Mirri, Rocetti, and Salomoni (2018), who found that active engagement of target users in prototyping and designing activities results in better and more satisfying outcomes.

Furthermore, dairy farmers' engagement in testing and providing feedback regarding the prototype app validates values highlighted in a study (Ting and Lewkowicz 2015) on testing tools with users prior to implementation. For instance, the testing stage revealed the app's contextual requirements and abstract parameters. Our study confirms the findings of Filieri (2013) that users' participation could enable the institution to predict how users would respond to the application. Participants were agile in providing feasible content to enhance app acceptability. Furthermore, the activities during the testing stage improved app design,
functionality, usability, content, and knowledge of dairy farmers' perspectives on app use. The testing stage experience confirms findings from previous co-creation studies that involving users creates an opportunity to discover new and contextual ideas (Evans et al. 2015; Leavy 2012). Additionally, our study supports the findings of Triste et al. (2018) that farmer participation yields valuable contributions to initiatives that affect them.

Furthermore, using living lab workshops observed the necessity of integrating end users throughout the co-creation process. The living lab workshops enabled the development and refinement of ideas and enhanced the app content by incorporating participants in the prototype, testing, and evaluation cycle. This study's utilising living lab workshops and co-creation processes demonstrated essential lessons in user-centred design, iterative development, collaboration, real-world validation, and stakeholder participation. Finally, dairy farmers appreciated their involvement in the app's development stages. Thus, future use of the Rwenzori dairy app could relate to dairy farmers participating in its development and therefore perceived its ownership.

4.2 Study Limitations and future research

While involving different university stakeholders in the app's design and development resulted in a contextually appropriate dairy app, we acknowledge the limitations of this research and suggest new directions for future research. First, we tested the app with dairy farmers who owned smartphones. Additional research should assess Rwenzori dairy farmers' smartphone ownership and readiness to use the app. Furthermore, due to the Covid-19 pandemic, the app's prototyping and testing stages were risky. Participants frequently suggested postponing the workshops, which delayed the final app development.

Finally, some participants' ideas were either ambiguous or fell outside the scope of the study. For instance, some suggested including poultry, piggery, and banana growing records in the app. However, creating an app that captures all suggestions was challenging. On that note, practitioners wishing to implement the co-creation approach should consider the diversity of participants' ideas and find a solution to address such diversity.
4.3 Significance and Implications

This research complements practical insight for implementing co-creation from studies like Ribes-giner et al. (2016) and designing services with community stakeholders (Drain et al. 2017; Jaeger et al. 2012). For instance, it could be challenging for the University to design an appropriate app without dairy farmers' input. We thus support co-creation through the design thinking model for structuring university community engagement activities (Mirri et al., 2018; Trencher et al., 2017). The results confirm that it is essential that universities should create democratic structures that acknowledge community stakeholders' contributions when developing tools.

Additionally, the participation of the university stakeholders, specifically the dairy farmers, in the living lab workshops allowed validation of the dairy app for University CE. Thus, the findings of this study demonstrate the value of developing and testing the prototype dairy app with dairy farmers, as it revealed unexpected problems and usability concerns. The study showed that the participation of different university stakeholders bridged the gap between theory and practice, resulting in a more practical dairy app.

We found that the co-creation provided a catalyst to inspire continuous interaction, understanding user needs and preferences, and actively incorporating their feedback into solution development. Participants appreciate the co-creation approach as it ensures that their needs, knowledge and experiences are considered throughout the co-creation process.

We believe that using co-creation to structure our University CE initiatives was a practical approach to developing a dairy app. For instance, co-creation was illustrated as a fundamental approach providing a collaborative atmosphere supporting successful knowledge sharing and collaboration between the institution and community.
5. Conclusion

This study has demonstrated how three stages of the design thinking model guided the Rwenzori dairy app development. We considered perspectives from university faculty members, dairy farmers, and the software development team. Participants provided ideas for the app's initial content and requirements during the ideation stage. The prototyping and testing stages involved developing a usable prototype app and testing its functionality and content acceptability by end-users. These stages allowed different university stakeholders to collaborate on developing, testing, refining, and generating a feasible dairy app for a local dairy farmer.

The co-creation process provided a unique opportunity to identify users' needs for an app. Practical requirements and content were confirmed through prototyping and testing the app with dairy farmers. We recommend researchers frame their community engagement initiatives using the design thinking model.

Lastly, University CE can be enhanced through an emphasis on co-creation. This study proved that the process empowers communities, bridges the gap between theory and practice, fosters collaborations, and propels participation. The study demonstrated that co-creation is an effective CE strategy that emphasises the necessity of incorporating communities as active participants and co-creators in defining their own needs. The finding informs future university CE processes and increases engagement activities' overall impact and effectiveness.
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Chapter 5
Empirical Evaluation of Rural farmers' Preparedness and Intention to use a Dairy Application for Collaboration with a Higher Education Institution in Uganda

Abstract
The current study evaluates rural farmers' preparedness and intentions to use a dairy application through a broadened Technology Acceptance Model. Data was gathered from 466 respondents from the Rwenzori region of Uganda through a survey. The aspiration Intention to use the application was assessed with nine constructs. A Partial Least Squares- structural equation modeling analysis technique was applied to test the research model using Smart PLS (v3.3.3) software. The analysis results strongly support the anticipated relationships in the research model. In particular, awareness and normative influence showed a positive effect on rural farmers’ preparedness to collaborate through the application. Additionally, readiness, self-efficacy, perceived ease of use, perceived usefulness, hedonic and utilitarian attitudes have statistically positive effects on rural farmers’ intentions to use the application. This study complements the literature by highlighting factors influencing people’s intentions to use applications. Finally, analytical results yielded valuable theoretical and practical implications for higher education institutions, agencies, and policymakers interested in using emerging technologies for collaboration and development. Such implications lead to policy initiatives that promote the adoption and use of technological tools. Forthcoming research should explore the actual utilisation of the application rather than readiness and intention.²

1. Introduction

Community engagement (CE) is critical for higher education institutions (HEIs). In recent years, digital tools such as the smartphone apps have gained significance in CE activities, opening new avenues and improving the efficiency of CE operations. However, is it realistic for HEIs to collaborate with rural farmers through technology-based strategies such as applications? How prepared are rural farmers to use applications? These two questions highlight the inspiration to conduct this research to evaluate the use of dairy app for university CE with rural farmers.

Undoubtedly, the twenty-first century has presented inspiring collaborative strategies that have moved from conventional engagement toward technology-based systems among education institutions, organisations, and community partners (Erdiaw-Kwasie & Alam, 2016; Miller-Rushing et al., 2021; Sayibu et al., 2021). Conversely, the conventional outreach techniques delivered augmented engagement for institutions and partners; they habitually present challenges (Morrell et al., 2015). Most popular challenges include insufficient resources, inappropriate follow-up, and limited financial resources to sustain engagement initiatives (Adekalu et al., 2018; Sheila et al., 2021). Moreover, the onset of the recent coronavirus (COVID-19) pandemic (Osafo, 2021; Zarafshani et al., 2020) appeared to put physical activities conducted by institutions and their community stakeholders in jeopardy (Köpsel et al., 2021; Miller-Rushing et al., 2021). Technology-driven tools are evolving as empowering to fortify institutions' interactions with community partners (Reynard et al., 2018). Concurrently, the proliferation of smartphone usage (Alalwan et al., 2018; Franque et al., 2021; Omar et al., 2021) with rapid internet access has created opportunities to reinforce institutional collaboration with communities (Karimuribo et al., 2017; Parlasca et al., 2020).

Diverse studies have harmoniously supported techno tools such as applications as convenient for human society to accomplish various activities (Ateş & Garzón, 2021; Park, 2020; Rijswijk et al., 2021; Yavuz et al., 2021). For example, applications offer solutions to collect appropriate information for research, perform complex calculations (Schulz et al., 2022), and make communication and information dissemination flexible and efficient (Chang et al., 2016; Thar et al., 2021). In farming activities, applications are valuable in linking on and off-farm data and
management of tasks (Rijswijk et al., 2021), amplifying livestock production, storing records (Schaeffer, 2004), guiding researchers and farmers' on-farm decision-making (Schulz et al., 2022; Younis et al., 2022). Additionally, applications aid interaction among farmers, extension workers, and other actors (Thar et al., 2021).

The usage potential of techno tools inspired Mountains of the Moon University in Uganda to collaborate with rural farmers and co-develop a dairy application (Nanyanzi et al., 2021). A sample of farmers and faculty members generated the content for the application. This was followed by prototyping activities and checking the usability of the application. After creating the application, introductory user training workshops were conducted regarding the use of the dairy application. Using the application was envisioned as feasible to address the stakeholders' needs identified in the study (Sheila et al., 2021). For example, using an application would relieve the institution's period and financial constraints for physical engagements with community farmers while collecting relevant and apt information for research (Daum et al., 2018). Furthermore, a study (Cabrera & Fadul-Pacheco, 2021) supports this interaction highlighting that the collected data could be routinely analysed and used to mentor appropriate decisions in any business venture. Correspondingly, such a tool enables the monitoring and storing digitalised information about users' farming experiences to be more manageable and convenient (Eitzinger et al., 2019).

While the advantages of using such an innovation seem well documented (Alnawas & Aburub, 2016), the question is whether rural farmers intend and are willing to use it. Therefore, understanding farmers' adoption behaviour is necessary for development strategies (Elahi et al., 2021; Elahi, Khalid, & Zhang, 2022; Elahi, Khalid, Tauni, et al., 2022). According to Schulz et al. (Schulz et al., 2022), farmers may not be enthusiastic about using the new technology. The present research takes the initiative to empirically evaluate rural farmers' willingness and intention to use a dairy application. Pinning down these factors underscores critical issues that should be addressed with targeted interventions to encourage technology adoption among the selected population (Caffaro et al., 2020). Moreover, the current research findings should be valuable in guiding higher education institutions and other organisations in developing effective techno-driven strategies.
1.1 Hypothesis development

For years, technology-based mediations have routinely authenticated measures extracted from the Technology Acceptance Model (TAM) (Davis et al., 1989). The theory has been applied in multiple situations, like examining the students’ intention to use social networks as learning tools (Al-Ammary et al., 2014), acceptance of smartphones in a major delivery company (Chen et al., 2011), and estimating techno acceptance in agriculture education (Zarafshani et al., 2020). Nonetheless, scholars accept the reinforcement of relationships not comprised in the traditional TAM and propose new variables (Gellerstedt et al., 2018; Giovanis et al., 2019). To mention a few, Kamal et al., (2020) suggested more variables, including social influence, trust, facilitating conditions, privacy, and technology anxiety, to ascertain the acceptance of telemedicine services. Morosan & DeFranco, (2014) also recognised perceived personalisation and perceived privacy as antecedents to the TAM model's perceived ease of use and perceived usefulness.

Relatedly, the present research study augments this model. It broadens it with rural farmers’ readiness (RED) to engage with a dairy application, forecasted by their awareness (AWA), normative influence (NOP), and farmers’ self-efficacy (FSE) to assess their intention to use a dairy application (BEI). RED is conceptualised as an individual's disposition to embrace new technologies (Mahat et al., 2012). Other research studies use technology readiness to denote the propensity to embrace new technologies to execute distinct chores at work, business, or home (Balakrishnan & Shuib, 2021; Omar et al., 2021). It is paramount to be prepared to take up new interventions (Lai & Ong, 2010). For instance, the present study comprehended AWA about the application’s advantages and NOP as underlying precursors of farmers' preparedness to use the dairy application.

Extant literature such as (Balakrishnan & Shuib, 2021) conveys that individuals' RED arises with AWA of an intervention and its advantages. AWA refers to how a potential user is acquainted with new technology and forms an overall realisation of what it involves (Pai & Alathur, 2019). Shortage of AWA is pinned down as a hindrance to RED in using new technologies (Balakrishnan & Shuib, 2021). AWA of the dairy application and its benefits can regulate rural farmers' RED to use the tool, so we proposed our first hypothesis.

H1: Rural farmers’ awareness positively affects readiness to engage with the dairy application.
Similarly, NOP is an additional element that forecasts an individual's RED to embrace a designated technology (Viswanath Venkatesh, Michael G. Morris, 2003). Individuals may take up behaviour due to external coercion from relatives, peers, and friends (Kamal et al., 2020; Mahat et al., 2012). Normative influence is the person's comprehension that a significant number of people who are vital to them believe that they should or should implement the specified behaviour (Kamal et al., 2020; Pappa et al., 2018; Paton et al., 2014). (Lee, 2014) and Green (1998) put forward that the more individuals are inspired to behave to the standards of their groups, the more they perform a behaviour. In the same light, farmers' allies positively shape the individual farmer's RED to endorse a distinct behaviour (Michels et al., 2020; Omar et al., 2021). The present study forecasted that farmers associated with dairy cooperatives such as Mpanga or Tooro dairy or other dairy farmers might induce individual farmers' RED to engage with the application. We thus came up with the following hypothesis:

\[ H2: \text{Normative influence positively affects the rural farmers' readiness to engage with the dairy application.} \]

We broadened the premises in this study and added new constructs to the traditional model. The TAM conventionally envisages that individuals' intentions are speculated by two principal variables, perceived ease of use (PEU) and perceived usefulness (PUS) (Davis, 1989). PEU is concretely expounded as the degree individuals believe utilising a defined tool or system would be effortless (Davis, 1989; Shivvers-Blackwell & Charles, 2006). PUS is conceptualised as people's confidence that using a specific technique or tool will make it facile to round off specific tasks efficiently (Caffaro et al., 2020). Generating the conviction that a particular tool is required necessitates agreement that it is necessary. In particular, the dairy application is being developed to improve the institution's collaboration activities with farmers. We speculate that rural farmers with pragmatic beliefs about this application are more likely to use it (Kenny & Regan, 2021). Thus, we proposed the following hypothesis.

\[ H3: \text{Rural farmers' readiness has a positive effect on the perceived usefulness of the dairy application.} \]

The mental state that affects people's propensity to embrace new technologies is associated with the degree of readiness the individual feels to use them (Parasuraman, 2000). Receptive individuals are more likely to comprehend that the application is easy to use (Kwahk & Lee, 2008). As a result, we anticipated that individuals ready to use the dairy application suppose that they could comfortably use it with little strive, and we formed the fourth hypothesis:
**H4:** Rural farmers’ readiness has a positive effect on the perceived ease of use of the dairy application.

Furthermore, prior research by Balapour et al. (Balapour et al., 2019) specified the necessity to explore the antecedent of PEU and therefore proposed that FSE be included in the model. FSE is connected to a person's apprehension that he or she can enact a specific behaviour (Lee & Lyu, 2016) (Ozturk, Bilgihan, et al., 2016). Because individuals execute tasks differently based on their FSE appraisal, self-efficacy is critical for producing worthwhile outcomes (Compeau & Higgins, 2017; H. J. Lee & Lyu, 2016). In this study, we coupled self-efficacy to rural farmers’ PEU of the dairy application and composed the following hypothesis:

**H5:** Rural farmers’ self-efficacy has a positive effect on the perceived ease of use of the dairy application.

Correspondingly, the dairy application must be valuable and simple for rural farmers to learn. Extant research proposes that PEU affects (PUS) (Saadé & Bahli, 2005; Venkatesh & Davis, 1996). While testing the determination to use the dairy application, rural farmers who perceive it as easy to use may also perceive it as applicable, as validated by several previous research (Olmos-miguel & García-pe, 2017; Saadé & Bahli, 2005). Consequently, we developed the following hypothesis:

**H6:** Rural farmers’ perceived ease of use positively affects the perceived usefulness of the dairy application.

Additionally, extant literature reliably confirmed that PEU and PUS conclusively affect individuals’ attitudes (Chen et al., 2011; Michels et al., 2019). Attitude is an acquired propensity to act persistently in behaviour (Al-Ammary et al., 2014; Compeau & Higgins, 2017). Attitude could be hedonic (AHE), exemplifying excitement, enjoyment, or sensation due to using a system or product, or utilitarian (AUT), meaning the functional benefits or utility extracted from using the product or system (Hepola et al., 2020; H. J. Lee & Lyu, 2016). AUT is attained by the functionality and economic value obtained from using a tool (Akel & Armağan, 2021). From an AHE viewpoint, users pursue pleasure or fun using a product or system (Ozturk et al., 2016). PUS and PEU are vigorous determinants of AHE and AUT (Lee & Lyu, 2016; Morosan & DeFranco, 2014). Thus, when farmers perceive the application's ease of use and usefulness, they will find it enjoyable and beneficial (Ozturk et al., 2016). From this theoretical background, the following hypotheses were proposed:
H7: Rural farmers’ perceived ease of use positively affects utilitarian attitude toward the dairy application.
H8: Rural farmers’ perceived ease of use positively affects hedonic attitude toward dairy application.
H9: Rural farmers’ perceived usefulness has a positive effect on the utilitarian attitude toward the dairy application.
H10: Rural farmers’ perceived usefulness positively affects hedonic attitude toward the dairy application.

Furthermore, the significance of individual self-conviction or efficacy as a variable that can affect intentions to use a designated technology is documented in numerous studies (Compeau & Higgins, 2017). FSE empowers self-evaluation of one's ability to accomplish an established behavior (Chang et al., 2016; Compeau & Higgins, 2017). Therefore, we forecast the variable to influence rural farmers’ intentions to use the dairy application and thus formulated the following hypothesis:

H11: Rural farmers’ self-efficacy has a positive effect on the intention to use the dairy application.

Finally, when individuals aspire to engage in a distinct behavior, it is because it is advantageous or they derive some gratification (Akel & Armağan, 2021). Scholars such as Ozturk et al. (Ozturk, Nusair, et al., 2016) demonstrate that AHE and AUT positively impact the usage intention (BEI). The application’s value under AUT infers evaluating criteria such as convenience, time-saving, and efficiency (Akel & Armağan, 2021). Farmers who perceive utility benefits are anticipated to have a positive intention of using it (Ozturk et al., 2016). Nonetheless, an AHE characterises a behaviour performed for fun (Kataike et al., 2019). Therefore, we offer the following hypotheses for this study.

H12: Rural farmers’ hedonic attitude has a positive effect on the intention to use the dairy application.
H13: Rural farmers’ utilitarian attitude has a positive effect on the intention to use the dairy application.

To summarise, this study aimed to assess rural farmers’ preparedness and intention to use a dairy application for collaboration with the institutions. The specifics of the study are grounded
on the TAM while consolidating other constructs as elaborated in the theoretical background. In this context, the proposed conceptual research model is shown in Figure 8 below.

In this context, the proposed conceptual research model is shown in Figure 8 below.

*Figure 8: The research model of this study*

From this background, the following section describes the methodology employed and the analyses performed in section three. Section four discusses the findings, implications, and study limitations that could shape future research. Section five highlights the concluding remarks of our study.

2. Research Methodology

This study used quantitative research to evaluate rural farmers' preparedness and intentions to use a dairy application. The advantage of the quantitative methodology is that it provides consistent measurements that can be statistically analysed, and the data can easily yield reliable results (Steckler et al., 1992).

2.1 Study design

Following (Elahi & Khalid, 2022), a multistage sampling procedure was used to collect data from respondents. In the first stage, we deliberately choose the Rwenzori region in Uganda. In the second stage, we selected four districts, including Kyegegwa, Kamwenge Kabarole, and Kyenjojo. These were selected because they contain a high population of dairy farmers in the
region. In stage three, we used convenience sampling farmers who rear dairy animals. Eligible respondents were household heads or members who participated in the Mountains of the Moon University community engagement activities, such as identifying user needs, pretesting, or prototyping the dairy app. Following this criteria, five hundred and twenty respondents participated in this study between March and July 2021. However, four hundred sixty-six respondents completed the survey questionnaire survey. The first part of the survey contained questions about respondents' background information, such as age and marital status. This section also required respondents to indicate whether they used smartphone applications.

The second part of the survey assessed the constructs predicting rural farmers' preparedness and intention to use the dairy application. The four measures for AWA were modified from (Balakrishnan & Shuib, 2021). The NOP had three items revised from (Chiu & Wang, 2008; Ozturk, Nusair, et al., 2016; Viswanath et al., 2003). Items measuring RED were adapted from (Lai & Ong, 2010; Mahat et al., 2012). Items measuring PEU and PUS were taken from (Davis et al., 1989). AHE and AUT measurements were adapted from (Ozturk et al., 2016) and (Babin et al., 1994). FSE was projected using four items adjusted from (Laver et al., 2012; Mahat et al., 2012) (Liaw, 2002). Finally, measures for BEI were adapted (Davis, 1989; Davis et al., 1989; Hepola et al., 2020; Liaw, 2002). We revised items in the survey to fit within the study framework. The second part of the survey used a five-point Likert scale ranging from (1) Strongly disagree to (5) strongly agree. Working definitions of constructs are presented in Table 18 below.

Table 18: Working definitions of constructs.

<table>
<thead>
<tr>
<th>Construct</th>
<th>CODE</th>
<th>Survey Items</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness (AWA)</td>
<td>AWA1</td>
<td>I am aware of the developed dairy application.</td>
<td>(Balakrishnan &amp; Shuib, 2021)</td>
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<tr>
<td></td>
<td>AWA2</td>
<td>I am aware of the benefits of using the application.</td>
<td></td>
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<tr>
<td></td>
<td>AWA3</td>
<td>I am aware of using the application to collaborate with the institution.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AWA4</td>
<td>I am aware of the requirements to use the application.</td>
<td></td>
</tr>
<tr>
<td>Normative influence (NOP)</td>
<td>NOP1</td>
<td>People influencing me think I should use the dairy application.</td>
<td>(Chiu &amp; Wang, 2008; Ozturk et al., 2016; Viswanath Venkatesh, Michael G. Morris, 2003)</td>
</tr>
<tr>
<td></td>
<td>NOP2</td>
<td>Other farmers are using applications; I feel it is suitable for me to use them.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NOP3</td>
<td>People important to me believe that it is good to use the dairy application</td>
<td></td>
</tr>
<tr>
<td>Readiness (RED)</td>
<td>RED1</td>
<td>I clearly understand the purpose of using the application.</td>
<td>(Lai &amp; Ong, 2010; Mahat et al., 2012)</td>
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<tr>
<td></td>
<td>RED2</td>
<td>I believe I can use the application for my dairy business</td>
<td></td>
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<td></td>
<td>RED3</td>
<td>I would share information through the dairy application.</td>
<td></td>
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<td></td>
<td>RED5</td>
<td>I will download and use the dairy application</td>
<td></td>
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<tr>
<td></td>
<td>RED5</td>
<td>I believe the application is a good alternative to notebooks</td>
<td></td>
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<tr>
<td></td>
<td>RED6</td>
<td>I am ready to use the application</td>
<td></td>
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<tr>
<td>Perceived usefulness (PUS)</td>
<td>PUS1</td>
<td>The application is useful for storing records.</td>
<td>(Davis et al., 1989), (Davis, 1989).</td>
</tr>
<tr>
<td></td>
<td>PUS2</td>
<td>The application makes it easier to manage the dairy farming</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>To share information.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PUS3</td>
<td>It is suitable for monitoring the dairy business.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PUS4</td>
<td>It helps to save information permanently</td>
<td></td>
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<tr>
<td></td>
<td>PUS5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived ease of use (PEU)</td>
<td>PEU1</td>
<td>The application is easy to use.</td>
<td>(Davis et al., 1989), (Davis, 1989).</td>
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<tr>
<td></td>
<td>PEU2</td>
<td>The application is easy to learn.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEU3</td>
<td>It is easy to understand the application.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEU4</td>
<td>The application requires less mental effort to use</td>
<td></td>
</tr>
<tr>
<td>Hedonic Attitude (AHE)</td>
<td>AHE1</td>
<td>I got pleasure when testing the application.</td>
<td>(Ozturk, Nusair, et al., 2016), (Babin et al., 1994)</td>
</tr>
<tr>
<td></td>
<td>AHE2</td>
<td>I find the application stimulating</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AHE3</td>
<td>The application is fun</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AHE4</td>
<td>The application is interesting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AHE5</td>
<td>The application is enjoyable</td>
<td></td>
</tr>
<tr>
<td>Utilitarian attitude (AUT)</td>
<td>AUT1</td>
<td>Dairy application is beneficial</td>
<td>(Ozturk et al., 2016)(Babin et al., 1994)</td>
</tr>
<tr>
<td></td>
<td>AUT2</td>
<td>The application is convenient for sharing information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AUT3</td>
<td>The application saves valuable data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AUT4</td>
<td>The application quickly accomplishes many tasks.</td>
<td></td>
</tr>
<tr>
<td>Self-efficacy (FSE)</td>
<td>FSE 1</td>
<td>I can confidently use the dairy application even though there is no one to tell me how it works</td>
<td>[36], (Laver et al., 2012), (Liaw, 2002)</td>
</tr>
<tr>
<td></td>
<td>FSE 2</td>
<td>I can use the application even if I have never been exposed to learning it.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FSE 3</td>
<td>I can use the application only if I have seen someone experiencing it.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FSE 4</td>
<td>I could use the application if someone helped me to get started.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FSE 5</td>
<td>I can use the application after thorough training.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FSE 6</td>
<td>I can use the application if I have support from a friend.</td>
<td></td>
</tr>
<tr>
<td>Intentions to use the app (BEI)</td>
<td>BEI1</td>
<td>I intend to use the dairy application.</td>
<td>(Davis, 1989; Davis et al., 1989; Hepola et al., 2020; Liaw, 2002).</td>
</tr>
<tr>
<td></td>
<td>BEI2</td>
<td>I believe using the dairy application is worthwhile</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEI3</td>
<td>I believe the dairy application is essential for sharing information with the institution.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEI4</td>
<td>I intend to use the dairy application</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEI5</td>
<td>I intend to store dairy records in the application.</td>
<td></td>
</tr>
</tbody>
</table>
2.2 Ethical approval

The current research is a sub-study within a larger project which the institution ethically approved. Furthermore, the authors obtained informed consent from all participants.

2.3 Data analysis

Structural equation modelling using SmartPLS (v 3.3.3) was used to test our research model. This procedure is validated in many studies with the potential to measure this kind of model (Balakrishnan & Shuib, 2021; Franque et al., 2021). We began by assessing all indicators’ outer loadings based on the 0.70 thresholds (Joe F. Hair et al., 2014). Secondly, we evaluated the internal consistency reliability using Cronbach's alpha coefficient and composite reliability values. According to Hair et al., 2019, the reliability values should be greater than 0.70 to ensure satisfactory internal consistency. Constructs’ convergent validity was assessed using the average variance extracted (AVE) for items of each construct. Hair et al. (Hair et al., 2013) emphasised that the lowest justifiable AVE should be 0.50. We further used the Fornell and Larcker (Fornell & Larcker, 1981) cross-loading principle to evaluate the discriminant validity.

Additionally, we assessed the collinearity of the predictors through the VIF value. A bootstrap 5000 resamples was performed to obtain the t-statistics of indicators and assess whether the new model relationships were significant. According to Hair et al. (Joseph F. Hair et al., 2019), the collinearity will be challenged if the VIF value is reported to be>3.000. Lastly, we evaluated the R² to obtain the descriptive power of the latent variables and the blindfolding procedure to generate the Q² values that represent the model's predictive relevance. As stated by Hair et al. (Joseph F. Hair et al., 2019), Q² values must be above zero for each structural model construct to indicate predictive accuracy.

3. Results

3.1 Demographic Characteristics of the Respondents

A sample of 466 respondents participated in the study. The respondents' background information is summarised in Table 19. The majority of respondents, 79.6%, were male, while 20.4% were female. A considerable percentage of respondents (23.8%) were aged 51-60 years.
in terms of age groups. 22.1% were aged between 41 and 50 years, 19.1% were between 31 and 40 years, 16.1% were between 21 and 30, and 18.9% were 61 years and above. The sample comprised slightly educated individuals, with 46.6% indicating they had completed the primary level. Regarding marital status, the majority, 82.6%, were married. Also, 68.7% reported using the applications, while 31.3% had never used such tools.

Table 19: Demographic characteristics of respondents of the sample (n=466)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Classification</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>371</td>
<td>79.6%</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>95</td>
<td>20.4%</td>
</tr>
<tr>
<td>Age groups</td>
<td>21-30</td>
<td>75</td>
<td>16.1%</td>
</tr>
<tr>
<td></td>
<td>31-40</td>
<td>89</td>
<td>19.1%</td>
</tr>
<tr>
<td></td>
<td>41-50</td>
<td>103</td>
<td>22.1%</td>
</tr>
<tr>
<td></td>
<td>51-60</td>
<td>111</td>
<td>23.8%</td>
</tr>
<tr>
<td></td>
<td>61+</td>
<td>88</td>
<td>18.9%</td>
</tr>
<tr>
<td>Education level completed</td>
<td>Primary</td>
<td>217</td>
<td>46.6%</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>124</td>
<td>26.6%</td>
</tr>
<tr>
<td></td>
<td>Diploma/ Polytechnique</td>
<td>65</td>
<td>13.9%</td>
</tr>
<tr>
<td></td>
<td>Bachelor's degree</td>
<td>43</td>
<td>9.2%</td>
</tr>
<tr>
<td></td>
<td>Master’s degree +</td>
<td>17</td>
<td>3.6%</td>
</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>385</td>
<td>82.6%</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>55</td>
<td>11.8%</td>
</tr>
<tr>
<td></td>
<td>Divorced</td>
<td>8</td>
<td>1.7%</td>
</tr>
<tr>
<td></td>
<td>Widowed</td>
<td>18</td>
<td>3.9%</td>
</tr>
<tr>
<td>Used applications</td>
<td>Used applications</td>
<td>320</td>
<td>68.7%</td>
</tr>
<tr>
<td></td>
<td>Never used</td>
<td>146</td>
<td>31.3%</td>
</tr>
</tbody>
</table>

3.2 Measurement model testing intention to use the dairy application.

3.2.1 Indicator loadings

Figure 9 shows the loadings of the measurement model and were close to or greater than 0.7. We subsequently removed some indicators to obtain validity at the advanced stage. Four indicators, RED2, RED3, RED4, and RED6 of the latent variable RED and three for FSE: FSE3, FSE4, and FSE6, were removed. Furthermore, two indicators of PUS, PUS3, and PUS5, were also excluded. We also dropped PEU4, AUT2, and AHE1 from subsequent analysis.
3.2.2: Internal consistency reliability

Table 20 shows an analysis of Cronbach's Alpha values of constructs. The alpha values of AWA (0.901), NOP (0.787), RED (0.949), PEU (0.733), PUS (0.712), FSE (0.826), AHE (0.826), and BEI (0.828) were above the minimum threshold level of 0.70 suggesting a high level of internal consistency. However, Cronbach's Alpha value for AUT (0.593) was slightly lower, but such a value is tolerable in explanatory research (Joseph F. Hair et al., 2019).

Furthermore, as shown in Table 20, the composite reliability (CR) value for all constructs exceeded the minimum value of 0.70 (Joe F. Hair et al., 2014). The CR values of AWA (0.930), NOP (0.868), RED (0.975), PEU (0.847), PUS (0.840), FSE (0.918), AHE (0.885), AUT (0.786) and BEI (0.879) were above the minimum threshold level of 0.70. This demonstrates that all constructs have high levels of internal consistency reliability.

In addition, as shown in Table 20, the AVE values of AWA (0.769), NOP (0.688), RED (0.951), PEU (0.649), PUS (0.637), FSE (0.790), AHE (0.660), AUT (0.551) BEI (0.590) are higher than the recommended threshold of 0.50, and the varied from 0.551 to 0.951. This implies that the analysis results of the nine constructs have high levels of convergent validity.
Table 20: Construct Reliability and Validity

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Cronbach's Alpha</th>
<th>Composite Reliability (CR.)</th>
<th>Average Variance Extracted (AVE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWA</td>
<td>0.901</td>
<td>0.930</td>
<td>0.769</td>
</tr>
<tr>
<td>NOP</td>
<td>0.787</td>
<td>0.868</td>
<td>0.688</td>
</tr>
<tr>
<td>RED</td>
<td>0.949</td>
<td>0.975</td>
<td>0.951</td>
</tr>
<tr>
<td>PEU</td>
<td>0.733</td>
<td>0.847</td>
<td>0.649</td>
</tr>
<tr>
<td>PUS</td>
<td>0.712</td>
<td>0.840</td>
<td>0.637</td>
</tr>
<tr>
<td>FSE</td>
<td>0.862</td>
<td>0.918</td>
<td>0.790</td>
</tr>
<tr>
<td>AHE</td>
<td>0.826</td>
<td>0.885</td>
<td>0.660</td>
</tr>
<tr>
<td>AUT</td>
<td>0.593</td>
<td>0.786</td>
<td>0.551</td>
</tr>
<tr>
<td>BEI</td>
<td>0.828</td>
<td>0.879</td>
<td>0.593</td>
</tr>
</tbody>
</table>

The results in Table 21 demonstrate that the DV is adequate because AVE’s square roots were above the relations between each pair of constructs. Therefore, it can be concluded that sufficient discriminant validity was achieved.

Table 21: Discriminant validity: Fornell Larcker principle

<table>
<thead>
<tr>
<th>Construct codes</th>
<th>AWA</th>
<th>NOP</th>
<th>RED</th>
<th>PEU</th>
<th>PUS</th>
<th>FSE</th>
<th>AUT</th>
<th>HED</th>
<th>BEI</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWA</td>
<td>0.877*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOP</td>
<td>0.042</td>
<td>0.829*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RED</td>
<td>0.189</td>
<td>0.297</td>
<td>0.975*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEU</td>
<td>0.067</td>
<td>0.362</td>
<td>0.405</td>
<td>0.806*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUS</td>
<td>0.091</td>
<td>0.352</td>
<td>0.374</td>
<td>0.268</td>
<td>0.798*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSE</td>
<td>0.155</td>
<td>0.448</td>
<td>0.380</td>
<td>0.537</td>
<td>0.306</td>
<td>0.889*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUT</td>
<td>0.130</td>
<td>0.424</td>
<td>0.416</td>
<td>0.274</td>
<td>0.550</td>
<td>0.409</td>
<td>0.743*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HED</td>
<td>0.172</td>
<td>0.456</td>
<td>0.492</td>
<td>0.476</td>
<td>0.504</td>
<td>0.586</td>
<td>0.605</td>
<td>0.812*</td>
<td></td>
</tr>
<tr>
<td>BEI</td>
<td>0.138</td>
<td>0.475</td>
<td>0.558</td>
<td>0.366</td>
<td>0.469</td>
<td>0.534</td>
<td>0.669</td>
<td>0.675</td>
<td>0.770*</td>
</tr>
</tbody>
</table>

*Notes: square roots of AVEs, and *constructs correlations
3.3 The structural model

The sets of indicators were examined for collinearity, and VIF results are presented in Table 22. According to the results in Table 22, AWA has a role in predicting RED (VIF =1.002), and NOP has a role in predicting RED (VIF=2.015). Also, RED is a predictor of PEU (VIF=1.168) and PUS (VIF=1.196). Furthermore, FSE has a role in predicting PEU (VIF=1.168). PEU is a predictor of PUS (VIF=1.196). Also, PEU is a predictor of AUT (VIF=1.077) and AHE (VIF=1.077). PUS predicts AUT (VIF=1.077) and AHE (VIF=1.077). Also, FSE predicts BEI (VIF=1.534). Both AUT and AHE (VIF=1.589) and (VIF=2.015) predict BEI. Collinearity did not appear as a problem in this study because all VIF values were less than 3 (Joseph F. Hair et al., 2019).

3.3.1 Structural model relationship

The suggested research model's causal relationships were tested by checking the path coefficients. The findings in Table 22 show a significant positive effect of AWA on RED ($\beta = 0.177$, $t =4.507$, $p < 0.001$) hence accepting H1. In addition, NOP positively affects RED ($\beta = 0.289$, $t =7.225$, $p < 0.001$), thus accepting H2. Results in Table 22 also showed that there is a significant positive effect of RED on both PEU ($\beta = 0.235$, $t=5.213$, $p < 0.001$) and PUS ($\beta =0.318$, $t= 5.717$ $p < 0.001$); hence accepting H3 and H4. Furthermore, FSE was found to positively affect PEU ($\beta = 0.448$, $t= 12.114$, $p < 0.001$), therefore accepting H5. The finding further showed a significant positive effect of PEU on PUS ($\beta =0.139$, $t=2.997$, $p < 0.01$), thus accepting H6.

In addition, H7 and H8 were also supported; PEU is the significant predictor of both AUT and AHE ($\beta =0.137$, $t =3.621$, $p < 0.001$) and ($\beta = 0.367$, $t=9.335$, $p < 0.001$) respectively. Similar findings were reported for H9 and 10; PUS is the significant predictor of both AUT and AHE H9($\beta =0.513$, $t=10.453$, $p < 0.001$) and H10($\beta =0.406$, $t = 7.749$, $p < 0.001$).

Finally, the three constructs, FSE, AUT, and AHE, proposed as antecedents of BEI were significant. Consequently, we conclude that there is support for Hypothesis: H11 ($\beta =0.179$, $t =4.219$, $p < 0.001$), H12 ($\beta =0.395$, $t=9.008$, $p < 0.001$) and H13 ($\beta = 0.331$, $t=7.024$, $p < 0.001$) respectively.
Table 22: Results of the structural model

<table>
<thead>
<tr>
<th>Paths</th>
<th>Path coefficients</th>
<th>Collinearity statistics (VIF)</th>
<th>t-Values</th>
<th>P-Values</th>
<th>Hypothesis</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWA -&gt; RED</td>
<td>0.177</td>
<td>1.002</td>
<td>4.507</td>
<td>0.000**</td>
<td>H1</td>
<td>Supported</td>
</tr>
<tr>
<td>NOP -&gt; RED</td>
<td>0.289</td>
<td>1.002</td>
<td>7.225</td>
<td>0.000**</td>
<td>H2</td>
<td>Supported</td>
</tr>
<tr>
<td>RED -&gt; PEU</td>
<td>0.235</td>
<td>1.168</td>
<td>5.213</td>
<td>0.000**</td>
<td>H3</td>
<td>Supported</td>
</tr>
<tr>
<td>RED -&gt; PUS</td>
<td>0.318</td>
<td>1.196</td>
<td>5.717</td>
<td>0.000**</td>
<td>H4</td>
<td>Supported</td>
</tr>
<tr>
<td>FSE -&gt; PEU</td>
<td>0.448</td>
<td>1.168</td>
<td>12.114</td>
<td>0.000**</td>
<td>H5</td>
<td>Supported</td>
</tr>
<tr>
<td>PEU -&gt; PUS</td>
<td>0.139</td>
<td>1.196</td>
<td>2.997</td>
<td>0.003*</td>
<td>H6</td>
<td>Supported</td>
</tr>
<tr>
<td>PEU -&gt; AUT</td>
<td>0.137</td>
<td>1.077</td>
<td>3.621</td>
<td>0.000**</td>
<td>H7</td>
<td>Supported</td>
</tr>
<tr>
<td>PEU -&gt; AHE</td>
<td>0.367</td>
<td>1.077</td>
<td>9.335</td>
<td>0.000**</td>
<td>H8</td>
<td>Supported</td>
</tr>
<tr>
<td>PUS -&gt; AUT</td>
<td>0.513</td>
<td>1.077</td>
<td>10.453</td>
<td>0.000**</td>
<td>H9</td>
<td>Supported</td>
</tr>
<tr>
<td>PUS -&gt; AHE</td>
<td>0.406</td>
<td>1.077</td>
<td>7.749</td>
<td>0.000**</td>
<td>H10</td>
<td>Supported</td>
</tr>
<tr>
<td>FSE -&gt; BEI</td>
<td>0.179</td>
<td>1.534</td>
<td>4.219</td>
<td>0.000**</td>
<td>H11</td>
<td>Supported</td>
</tr>
<tr>
<td>AUT -&gt; BEI</td>
<td>0.395</td>
<td>1.589</td>
<td>9.008</td>
<td>0.000**</td>
<td>H12</td>
<td>Supported</td>
</tr>
<tr>
<td>AHE -&gt; BEI</td>
<td>0.331</td>
<td>2.015</td>
<td>7.024</td>
<td>0.000**</td>
<td>H13</td>
<td>Supported</td>
</tr>
</tbody>
</table>

Note: *P<0.01, **P<0.001

3.3.2. Coefficient of determination (R²) and Predictive relevance (Q²)

Findings in Table 23 show that individual constructs accounted for AHE 38%, AUT (32%), PEU 34% accounted for moderate explanatory power, while PUS 16% and RED 12% were weak. Overall, the rural farmers’ intention to use the dairy application accounted for an average variance of all model factors (BEI, R² =0.583). This implies that 58.3% of the variance in using the application is due to the factors identified in the model.

The blindfolding result in Table 23 shows that BEI has the largest predictive relevance (Q² = .339) while PUS has the smallest predictive relevance of 0.096. Other constructs: AHE (.247), PUS (0.207), AUT (0.172), and RED 0.107 had a medium predictive relevance.
4. Discussions of results

The current study evaluated rural farmers' readiness and intention to use a dairy application for collaboration with Mountains of the Moon University. Findings prove that the model's constructs easily predict rural farmers’ intentions to use the dairy application. First, we found that AWA and NOP significantly affect RED engagement with the application (H$_1$ and H$_2$). This is consistent with what has been reported by related studies (Green, 1998; Kamal et al., 2020; Pai & Alathur, 2019). The significance of AWA and NOP suggests the two constructs play an essential role in farmers' preparedness to embrace the dairy application. These effects underscore the importance of considering relatively unconventional antecedents of technology usage when studying the intention to use applications.

Additionally, RED and FSE were significantly related to the successive constructs of the proposed model. H$_3$ stated that FSE positively affects the PEU of the dairy application. This hypothesis was supported. However, the finding contradicted past studies such as (Ozturk, Nusair, et al., 2016). This is possible because a significant percentage of the respondents (47%) were educated to the lower (primary) level and may lack the confidence to use the application. This finding can be explained as farmers' decision to use the application exclusively relies on self-efficacy, suggesting that this variable plays a functional part in determining the farmers' PEU of the dairy application. In addition, the analysis results provided support for hypotheses (H$_4$ and H$_5$), implying that RED significantly affects PEU and PUS for the dairy application. In contrast, a previous study (Shivers-Blackwell & Charles, 2006) demonstrated that RED is not validated as a significant direct predictor of PEU.

Furthermore, the study supported the relationship between PEU and rural farmers’ PUS of the dairy application (H$_6$). The findings revealed that PEU strongly affects the PUS of the application. This result is consistent with several previous studies (Al-Ammary et al., 2014; Michels et al., 2019; Morosan & DeFranco, 2014), which concluded that PEU is significant in predicting the PUS of any given technology.

In addition, H$_7$ and H$_8$ hypothesised that PUS had a positive and significant effect on rural farmers’ AHE and AUT towards using the application, and both hypotheses were supported. A previous study has validated and explained this relationship (Lee & Lyu, 2016), concluding that PUS is an essential predictor of AHE and AUT of using any techno tool or system. These suggest that when users perceive the dairy application's usefulness, they are likely to attach it
to functional benefits obtained from using it.

The study findings further confirmed a significant positive influence of PEU on rural farmers’ AHE and AUT towards the use of the dairy application (H₀ and H₁₀). A previous study (Ozturk, Nusair, et al., 2016) also found that PEU positively relates to AUT. However, their study found that PEU does not affect HED. The findings stress the importance of easy-to-use and free from the effort application to increase the benefits. In specific terms, the results of this study confirm that when technology is assumed by the individual as simple and easy to use, then target users will have a positive attitude towards using the technology (Al-Ammary et al., 2014).

Moreover, as proposed in the conceptual model, FSE emerged as a significant predictor of rural farmers’ BEI to use the dairy application (H₁₁). This finding is consistent with what has been argued by other related studies such as (Al-Ammary et al., 2014; Balapour et al., 2019). This suggests that FSE impacts their choice to use the dairy application. In practical terms, when rural farmers believe they can confidently use the application, they will be motivated to use it. Furthermore, this research analysed the effect of AHE and AUT on rural farmers’ intentions to use the application (H₁₂ and H₁₃). The results related to these two hypotheses were statistically significant. This is parallel to what has been urged by other research such as (Akel & Armağan, 2021; Kataike et al., 2019; Ozturk et al., 2016). In contrast, few research studies, such as (Lee & Lyu, 2016), discard the effect of AHE on the BEI to using a system or tool. However, the current study highlights both the AHE and AUT's predominant role in utilising the dairy application. Thus, the dairy application's design must comprise interesting characteristics to provide enjoyment and utility elements to benefit rural users.

5. Implications, limitations and contributions

This study offers insights to institutions, agencies, organisations, and policymakers planning to use applications for collaboration with community partners. For example, the findings regarding the effect of AWA and NOP on rural farmers’ RED to use the application directly impact institutions and how they inform and communicate with the target users of a given technology. Furthermore, institutions planning to use such applications should pay close attention to FSE and organise adequate training to ensure the usage of the application. Again, PEU and PUS are essential in shaping target users' AHE and AUT toward usage intentions. Thus, experts in creating applications should place premium attention on
applications' ease of use and usefulness. Finally, our findings revealed a dominant role for the AHE and AUT elements in intentions to use applications, which providers should consider.

5.1 Limitations and future research

The study's findings can be comprehensive on rural farmers from four districts of Uganda. The authors recommend that additional research across the regions and countries use these constructs to establish community partners' intentions to use applications. Finally, the research states the existence of causal relationships between constructs in the proposed model. However, other factors, such as access to the internet and demographic factors, may affect such relationships. Further studies should consider those suggestions.

5.2 Contributions of Research in community engagement

Technology-based tools are critical in university CE, promoting successful communication, cooperation, and information sharing between institutions and the communities they serve. Universities have opportunities to broaden their reach, engage a larger audience, build deeper relationships, and increase the effectiveness of their CE activities by using technology tools. These tools enable universities to establish dynamic, accessible, and engaging venues for collaboration, information exchange, and collective action, enhancing community relationships. Therefore, this research has given insight into the factors that impact the technology-based CE process. The findings shed light on the elements likely influencing the readiness and intention to use technological tools created for CE. The finding also informs future university CE practice and what the focus should be when developing strategies to use technology tools' design during.

6. Conclusion

Tools like applications have become paramount to support collaboration among institutions, organisations, and communities. This research’s objective was to evaluate rural farmers' preparedness and intention to use a dairy application. A survey was collected from 466 respondents in the Rwenzori region of Uganda. The survey focused on demographic characteristics and constructs predicting rural farmers' preparedness and intention to use the dairy application. To complement the TAM, our model included new constructs, AWA and
NOP, as predictors of RED to engage with a dairy application. Using Smart PLS (v3.3.3) software, a Partial Least Squares-structural equation modeling analysis technique was used to test the research model. According to the findings, AWA and NOP showed a positive effect on rural farmers’ preparedness to collaborate through the application. Additionally, RED, FSE, PEU, PUS, AHE, and AUT have statistically positive effects on rural farmers’ intentions to use the application.

The findings of this study will benefit the case institutions, organisations, policy, and decision-makers in terms of gaining some benefit from putting the study constructs into practice to promote the use of applications. Finally, the Mountains of the Moon University aims to increase collaboration with community farmers by adopting this innovation. Therefore, the institution must reflect on these factors that impact rural farmers' intention to use contemporary collaboration strategies to realise this objective.
7. References


Morosan, C., & DeFranco, A. (2014). When tradition meets the new technology: An


Parasuraman, A. (2000). Technology Readiness Index (Tri): A Multiple-Item Scale to


Annex 2: Questionnaire

Section A: Demographic characteristics of respondents (Please tick the most appropriate response).

1. Please indicate your gender
   1. Male
   2. Female

2. Please indicate your age group
   1. (21 - 30)
   2. (31 - 40)
   3. (41 - 50)
   4. (51 - 60)
   5. (61 and above)

3. Please indicate the education level you have completed.
   1. Primary
   2. Secondary
   3. Diploma/Polytechnic
   4. Bachelor’s Degree
   5. Master’s degree +

4. What is your marital status?
   1. Married
   2. Single
   3. Divorced
   4. Widowed

5. Please indicate if you have used a smartphone app
   1. Used app
   2. Never used apps

Section B
Determinants of readiness and intentions to use the dairy app

In the next section, we would like to have your opinion regarding the factors that may affect your readiness and intention to use the dairy applications. These factors range from awareness about the app, normative influence, self-efficacy, perceived usefulness, perceived ease to use, of using app, hedonic and utilitarian attitudes, dairy application. Please rank your level of
agreement or disagreement with the following statements, following the ranking scale of 1, 2, 3, 4, 5, where each stand for;


<table>
<thead>
<tr>
<th>NO</th>
<th>Measures</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<th>5</th>
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<tbody>
<tr>
<td>6</td>
<td>I am aware that there is a dairy application that can be used in managing farm records</td>
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<td>7</td>
<td>I feel confident to use the dairy application even though there was no one around to tell me how it works</td>
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<td>8</td>
<td>People who influence my behaviour think that I should use the dairy application</td>
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<td>9</td>
<td>I am aware I will need the internet to use apps</td>
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<td>10</td>
<td>Dairy application is beneficial</td>
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<td>11</td>
<td>The application makes it easier to manage the dairy business</td>
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<td>12</td>
<td>Using the application is fun</td>
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<td>13</td>
<td>The dairy application is easy to learn</td>
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<td>14</td>
<td>I would be able to use the application if someone helped me to get started.</td>
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<td>15</td>
<td>Other farmers are using applications to manage their farms; therefore, I feel it is suitable for me to use it.</td>
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<td>16</td>
<td>People who are important to me believe that it is a good idea to use the dairy application</td>
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<td>17</td>
<td>I clearly understand the purpose of using the application.</td>
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<td>18</td>
<td>I believe the application is a good alternative other than keeping data in notebooks</td>
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<td>19</td>
<td>Application record and save valuable data</td>
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<td>20</td>
<td>I believe that learning how to use the dairy application is worthwhile</td>
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<td>Statement</td>
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<td>21</td>
<td>I would be glad to share information through the dairy application.</td>
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<td>22</td>
<td>The application can help both the farmer and the institution during engagement activities</td>
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<td>23</td>
<td>The application is useful for record keeping</td>
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<td>24</td>
<td>The app is effective for monitoring the dairy business</td>
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<td>25</td>
<td>The dairy application is easy to use</td>
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<td>26</td>
<td>The dairy application requires less mental effort to use</td>
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<td>27</td>
<td>Share dairy business</td>
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<td>28</td>
<td>I find using applications stimulating</td>
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<td>29</td>
<td>Using the application is interesting</td>
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<td>30</td>
<td>Using the application is enjoyable</td>
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<td>31</td>
<td>I would be able to use the application after more training on how to use it.</td>
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<td>32</td>
<td>The app helps store and share data</td>
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<td>33</td>
<td>Application is comfortable and convenient for sharing information</td>
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<td>34</td>
<td>I can quickly accomplish my tasks using the dairy application</td>
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<td>35</td>
<td>I can use the application even if I have never been exposed to learning how the app works</td>
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<td>36</td>
<td>I would be able to use the application only if I have seen someone else experiencing it before I try it myself</td>
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<td>37</td>
<td>I will download and use the dairy application</td>
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<td>38</td>
<td>I would be able to use the application if I could refer to someone to help if I face difficulties;</td>
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<td>39</td>
<td>I am aware of the possibility of using the app for collaboration with the institution</td>
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<td>40</td>
<td>I believe I can use the application for records and managing the dairy business</td>
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<td>41</td>
<td>It is easy to understand the dairy application</td>
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<td>42</td>
<td>I am aware of the benefits of using the dairy app</td>
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<td>43</td>
<td>I intend to use the dairy application</td>
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<td>44</td>
<td>I get pleasure when using the application</td>
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<td>45</td>
<td>I continue to believe that the dairy application is essential and will use it to share necessary information with the university</td>
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<td>46</td>
<td>I intend to use and support the use of the dairy application</td>
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<td>47</td>
<td>I intend to use the application for record-keeping rather than using papers or booklets in the future.</td>
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Chapter 6
A model of Input Dimensions that Influence University Community Engagement
Process and Outcomes

Abstract
University community engagement initiatives typically address community challenges and improve the university's image. Effective community engagement models are recommended for positive outcomes, but little is known about the input dimensions influencing the engagement process and outcomes. In this study, we developed a conceptual model to understand the input dimensions that influence the university community engagement process and outcomes. Our model comprises of institutional community, personal professional dimensions influencing the community engagement process and outcomes at institutional and community levels. We tested our conceptual model with a sample of 126 academics and 216 community partners from the Rwenzori region of Uganda. The study used structural equation modelling technique to assess the relationship in the model. The quantitative results demonstrated the significance of institutional, community, and professional/occupational dimensions to the engagement participation process. However, the results challenged the proposed relationship between personal dimensions and the engagement process. The findings expand the existing literature and provide insight into structural pathways that significantly influence the community engagement process and outcomes at the university and community levels. Thus, the developed model has various potential applications as a conceptual foundation and practical tool for guiding university community engagement activities. Therefore, we recommend universities adopt the proposed model and its constructs to improve their CE practices and outcomes.
1. Introduction

Optimising the university community engagement (CE) mission has recently been a growing concern among higher education scholars. The growing perception that sustainable solutions to society's most pressing needs (Bowers, 2017; Mbah, 2019), change, and local developments could be achieved through CE has stimulated HEIs to emphasise CE in their mission, policy, and strategy formulations. Not surprisingly, contemporary HEIs are gradually seen to adopt strategic interventions (Shukran et al., 2019) aiming at communities and academics working together to address community problems. Universities in Uganda have not been immune to this trend, and many have developed plans and strategies to expand their community collaborations (Nanyanzi et al., 2022). These collaborative efforts are noted to strengthen institutions and pathways to impact communities (Davies, 2013). Through CE, universities can become significant agents of change and development in society (Sánchez-Barrioluengo & Benneworth, 2019; Shukran et al., 2019).

Despite its importance and the impressive development of literature, CE is generally complex for universities, particularly in African universities (Shawa, 2020). Literature shows that most HEIs rely on trial and error in their CE interventions, a key factor why such interventions yield invisible outcomes (Mutero & Govender, 2019; Starke et al., 2017). A study by Cherrington et al. (2019) shows that institutions still face tremendous challenges in adopting effective CE, and there is a low institutional commitment to CE. Another example is from a case institution Mountains of the Moon University (MMU) which, over the years, launched multiple CE interventions to strengthen the institution and improve community welfare. Inspired to be a community university, MMU developed a niche to be a centre of excellence in teaching, research, and community engagement (vision) and to produce outstanding, well-rounded, morally upright, innovative graduates with a knowledge base for positively impacting the community.

In an attempt to define its identity as a community university, the MMU sought to implement several CE projects. Major CE interventions were supported by VLIR UOS through the South Development Initiative. CE approaches involved training and workshops with dairy and fish farmers in various aspects of dairy farming to implement a project empowering fish farmers through strengthening their business practices and improving dairy farming in the region.
Other CE interventions were initiated and operated by individual faculties or a department for example, the faculty of education conducted several trainings aiming at empowering primary teachers in Rwenzori region. Consequently, participation in any of these engagement activities could bring positive outcomes to both the community and the university.

Despite the multiple University CE interventions, the (Dhaene, Europe) and Paul Kibwika (University of Makerere 2018) report shows that meaningful CE for MMU is lacking and most CE efforts have had minimal impacts on the rural community. As a result, one of the critical recommendations of the IUC report was that the university should develop a contextual CE model that will guide university CE practitioners on how to create effective CE interventions. To this end, the goal of our current research is two-fold. First, from our own empirical experience and prior literature, we propose a university CE model to explain the input dimensions influencing the university CE process and outcomes in a Ugandan context. The relationship between inputs and outcomes is fundamental to understanding the impact of university CE efforts. Input dimensions in this study refer to the resources, activities, and strategies that are put in place to enable CE. Outcomes, on the other hand, are the tangible or intangible results or changes that occur because of these efforts. Secondly, we empirically test the conceptual model to establish structural pathways that affect the CE process and outcomes. Therefore, this study proceeds to address the following research questions:

1. What input dimensions influence the university CE process and outcomes based on existing literature?
2. What is the effect of the proposed model dimensions on the university-community engagement process and outcomes?

One of the contributions of our study is that the proposed model would complement other CE models that are useful in specific cases or, ultimately, as part of a more comprehensive effort to develop a contextual CE model suitable for rural universities. As such, adopting the proposed model could prevent universities from pursuing ineffective or messy community engagement initiatives. In addition, University CE policymakers and practitioners can use the findings to develop strategies to overcome specific community engagement challenges. Adequate consideration of the dimensions in our model could minimise the risk of investing in ineffective engagement ventures.
2. Literature review on university-community engagement and our conceptual model development

The theoretical basis of university CE is an expanded sphere of collaboration between university administrators, students, faculty, and the outside community in the context of teaching and research or as part of other projects and cooperative ventures (Brewster et al., 2016; Shukran et al., 2019). In the last decades, researchers have proposed different engagement models with specific roles ranging from those that conceptualise CE to those that theorise or explain the various approaches or orientations to CE. For instance, Bender (2008) lists three models—the Silo, Intersectional, and Infusion (crosscutting) models—for community involvement in higher education. From her viewpoint, the Silo model acknowledges CE as a specific and primarily voluntary activity for university academics. Priority in university resource allocation is often directed to faculty research, teaching, and learning activities. The university pays minimum attention to CE. The second model (Intersectional Model for CE model) demonstrates that universities' three core activities intersect in a way that a Venn diagram can represent. This model includes service-learning and community-based research where research, development, and community service intersect (Bender, 2008). The intersection model views CE as an indispensable component of ongoing university activities. Third is the infusion model, which identifies universities as having two core businesses: tuition and research and development. One aspect we acknowledge from these three models is that they tend to maintain faculty and researchers in a favoured position over community members.

More researchers have been engaged in developing the CE model. Among these, Weerts (2005) developed a model to identify challenges and opportunities associated with building university-community partnerships. He specifically emphasises the breakdown of social and cultural barriers between organisations, building organisational capacity, and identifying motivators CE as keys to successful CE. Another model focused on explaining the relationship between community engagement and community development (Bridger and Alter 2006). The engaged scholarship model focused on faculty engagement practice and factors that affect engaged scholarship (Franz, 2009). The engagement ecosystem model focused on assessing specific indicators, emphasising networks of students, faculty, courses, and communities working together (Mehta and Weinstein, 2015). Other models were developed to address the dynamics
of individual CE components, such as managing the flow of information in community development projects (Coetzee, 2012).

While each model provides interesting contributions for enabling CE in general, less focus has been dedicated to explicitly demonstrating the input dimensions that affect the university CE process and outcomes. One exceptional model on which part of our current study will stress was developed by Wade and Demb (2009). Their model offers a conceptual perspective of the dimensions likely to influence engagement participation (Figure 1). In its basic form, it postulates that faculty engagement consists of interaction and a degree of balance between personal, professional, and institutional dimensions.

However, their model omits an important community factor influencing the university engagement process and primarily focuses on explanatory dimensions influencing faculty engagement. In contrast, we contend there is more to the picture than Wade and Demb (2009) suggest. For instance, although faculty are vital in implementing CE, CE occurs within systems and in a community with individuals having unique demands that influence the nature and course of the engagement. For instance, although faculty may be enthusiastic and have the resources for CE, there may be a sense of community structural and perception risks that could

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**Figure 1:** Faculty community engagement model (Wade & Demb, 2009)
influence the CE process and outcomes (Calleson et al., 2002). Moreover, University CE entails developing relationships with communities that are never homogeneous and performing different occupations that may affect the nature and course of engagement with institutions. Further research reports that CE is a context-specific activity that may be affected by participants’ readiness for participation. All these factors support the development of a CE model appropriate for a rural university. We argue that university CE models should consider input elements that affect the CE process and outcomes at both institution and community levels.

2.1 Our conceptual model and hypothesis development

The university community engagement process

The university CE process is perceived as the university's ability to integrate CE into activities that bind academics and community partners (Shabalala & Ngcwangu, 2021; Wanjiru & Xiaoguang, 2021). The engagement process is built on a shared relationship in the experience that connects the academics and the community to participate in mutually beneficial activities (Davies, 2013). Academics and the community exchange expertise in the relevant field or first-hand experience of the relevant concerns (Suarez-Balcazar et al., 2013). Activities can be facilitated through participation in engaged learning research and community engaged service activities within the institution that focuses on mutual benefits (Koekkoek et al., 2021; Shukran et al., 2019). For instance, in terms of teaching, university curricula, strategies, and tools are designed to allow reciprocal learning opportunities for all partners (Suarez-Balcazar et al., 2013; Vargiu, 2014) (Brown et al. 2016). At Mountain of the Moon University, opportunities for community-engaged learning activities are created.

Second, the engagement process occurs through engaged research across different stages of faculty or students' research activities (Anzivino et al., 2021). The engaged research process recognises the community as a knowledge-rich partner; the university’s research capabilities become more accessible as a resource to respond to community needs or aspirations (Rojas et al., 2012). Community partners become involved in identifying their needs and participating in co-creating solutions (Frank & Sieh, 2016). Evidence from our co-creation study indicates that involving community partners and academics results in the development of feasible and mutually beneficial tools (Nanyanzi et al., 2021). Engaged research allows faculty and
community members to enhance knowledge exchange, improving academic, economic, and social community welfare (Brown-Luthango, 2013).

In addition, universities provide essential services to the public as benefits of a university’s presence in a community. These activities may comprise but are not limited to university-community service interactions and active community participation in sharing technological knowledge and skills with community members through training or participation in public lectures and capacity-building workshops (Delugan et al., 2014). Participating actively in these engagement activities is critical to obtaining successful university CE outcomes. However, it is unclear which dimensions are associated with university and community members’ participation in these activities. Besides, the engagement may influence university and community-level outcomes. Drawing from the literature and previous studies, we identified input dimensions with multiple elements as antecedents of the CE process and outcomes.

The relationship between institutional dimensions and the engagement process.

Our model assumes that institutional dimensions influence academics and community members’ participation in the engagement process. Institutional dimensions relate to elements such as mission and philosophy, priorities, and leadership support for CE development and implementation (Gupton et al., 2014; Sánchez-Barrioluengo & Benneworth, 2019). For instance, a shared understanding of the institutional mission, values and principles creates an atmosphere conducive to participation and ownership of the engagement process (Furco, 2010). Besides, CE becomes successful when values such as mutual respect, integrity, trust, and accountability are observed (Byrne, 2016).

Furthermore, a university engagement structure aligned with community-identified needs remains crucial for understanding elements that influence the CE process (Chile & Black, 2015; Shabalala & Ngcwangu, 2021). The emphasis on community needs sets a tone for faculty and community members' participation in university engagement initiatives. In our previous work, we found out that community members and faculty had distinct needs for their interaction (Alice, S et al., 2021). The literature further suggests that faculty and community members may be motivated to invest their time and resources in community-engaged activities relevant to their needs (Tarus, et al., 2017).
Our model also considers that institutional leadership support is fundamental and establishing structures that support the CE process. This idea is supported by several studies such as (Farmer-Hanson et al., 2019; van Schalkwyk & de Lange, 2018; Wanjiru & Xiaoguang, 2021; Yamamura & Koth, 2019) who demonstrate that leader support facilitates the initialisation or implementation of CE activities. Besides, a university CE structure supported by the central coordinating body and the appointed leader for CE enables efficiency in CE (Welch & Saltmarsh, 2013). Important to note is that universities often focus on traditional teaching and research roles. These have well-established structures and governance, such as the academic registrar, responsible for teaching activities, and the Research Directorate, responsible for grants. However, universities hardly set up a CE leadership. Cunningham and Smith (2020) emphasized the importance of offices and executives responsible for CE as they play a crucial role in shaping CE outcomes as the focal point for relationship building. A CE office could foster a culture in which students, faculty and the community work together to bridge the gap between academic knowledge and community development.

Effective CE also relies on good communication and information flow between partners (Jinkins & Cecil, 2015; Suarez-Balcazar et al., 2013; Vargiu, 2014). Paying attention to communication implies that partners are informed of the engagements through appropriate communication methods for the community. Communication can be enhanced through helpdesk services, various media such as the radio and digital platforms, scheduled meetings, email messages, phone calls and one-on-one visits (Ogunsanya & Govender, 2019; Suarez-Balcazar et al., 2013; Wanjiru & Xiaoguang, 2021). For example, MMU started a community radio station in the Rwenzori region to support CE activities. Radio is a two-way communication tool, providing a platform for academics and the community to share knowledge and information. The radio is used to enhance the university's distance learning activities. In addition, faculty often use the radio to disseminate their research results in the community. Dissemination activities facilitate the introduction of interventions to improve engagement outcomes (Moore and Ward, 2010).

Studies regarding university CE also show the importance of documenting the nature of the engagement activity, the participants involved, methods used to achieve outcomes, and the engagement outcomes. Documentation allows effective engagement tracking, review and reflecting on participation outcomes (Noel & Earwicker, 2015; Pearl, 2014). CE process becomes inefficient without proper documentation and follow-up.
Researchers suggest that a practical university CE process is related to tactical imperatives, which could take the form of institutional planning for CE (Cunningham & Smith, 2020). An institution's CE plan is critical to inform stakeholders about the engagement objectives and secure their support. Besides, the degree of funding and reward for engaged members are depicted to support effective CE (Moore & Ward, 2010; Murphy & McGrath, 2018; O’Meara et al., 2011; Sánchez-Barrioluengo & Benneworth, 2019). Research further suggests that rewards in terms of financial incentives enhance their participation (Tryon & Madden, 2019; Zanbar & Ellison, 2019).

Besides, institutional dimensions also appear to influence professional dimensions that impact engagement participation (Shephard et al., 2017). The CE process becomes efficient when the university financially and mentally supports the engaged members to develop their competencies in CE. We anticipate that the elements explained above will affect the university CE process. Therefore, we formulated our first two hypotheses as follows:

\( H_1. \) Institutional dimensions have a positive effect on the CE process.

\( H_2. \) Institutional dimensions positively affect professional dimensions influencing engagement participation.

The relationship between professional dimensions and the engagement process

Our model suggests that professional dimensions are critical in building practical university CE processes. Professional dimensions include orientation towards conducting or participating in engaged research, teaching, and community partnerships (Van Schyndel et al., 2019). For instance, a decision to participate in CE may be taken due to professional or occupational orientations in CE aspects. Other Professional dimensions include tenure status, rank in the community, and discipline or responsibilities held in the community (Wade & Demb, 2009).

In the context of our proposed CE model, we assume that professional elements influence the university CE participation process. Therefore, we formulated our third objective as follows:

\( H_3. \) Professional dimensions have a positive effect on the CE process and outcomes

The relationship between the community dimensions and the engagement process

Community dimensions refer to the conditions in the community that enable university CE ventures to create the intended impact. A recent study by Mutero and Govender (2019)
highlighted that while the institutions may have the capacity to implement CE activities, it is crucial to understand the community conditions or elements before engagement. For example, community commitment to engagement may influence the university CE process (Zanbar & Ellison, 2019). In our model, we defined the community dimensions to constitute community perceptions, capacity, commitment toward engagement, readiness for participation, community trust, and community leaders' support (Zanbar & Ellison, 2019).

According to the literature, community perception affect decisions to participate in university CE activities (Frank and Sieh, 2016; Strom, 2011). For instance, how engaged members perceive their roles and the value of their participation determines their satisfaction and builds trust in the university CE activities (Zanbar & Ellison, 2019). Our model assumes that establishing community perceptions contributes to developing and designing appropriate CE activities. It also enables the university to establish the impact of the CE process (Alice, S et al., 2021).

Community capacity relates to the community's ability to participate and contribute to solving problems to sustain the community's well-being. It can be manifested through behaviours such as commitment to university engagement goals, willingness to participate, skills, networks of mutual support and networks for information sharing (De Weger et al., 2018; Gau, 2014). Furthermore, the literature shows community trust can drive or require a practical university CE process (Di Napoli et al., 2019; Smith et al., 2013; Zanbar & Ellison, 2019). Community trust is understood in this case as the community members' assessment of whether the university's CE initiatives meet their expectations (Suarez-Balcazar et al., 2013). Community trust is built through a series of positive experiences and affects community members' willingness to participate in university CE activities (Molinillo et al., 2020). (Lavery et al., 2010) reminds us that a better understanding of the community dimensions is paramount for the university when initiating CE activities. Thus, we suggested our fourth hypothesis:

\[ H_4. \text{Community dimensions have a positive effect on the university CE process and outcomes}. \]

**Relationship between personal dimensions and CE process and outcomes**

We also wanted to understand personal elements that influence participation in CE activities. According to the literature, several characteristics can highlight the role of personal elements in impacting the university CE process (Chang & Chuang, 2011). Personal dimensions in our
model represent individual openness to engagement experience and learning, epistemology, or individual approach to knowledge creation (O’Meara et al., 2011), previous experience, and personal motivation to be actively engaged (De Weger et al., 2018; Xu, 2007). Personal motivation is individuals’ motivation to participate in university CE activities due to the expected benefits, such as acquiring skills and improving their status in the community (Brunton et al., 2017).

Further research shows that individual socio-economic status tends to influence participation in community activities (Tang et al., 2018). For example, how they view their worth or value in impacting the community may contribute to their decision to engage in university activities (Zanbar & Ellison, 2019). These elements can be linked to individuals' decisions to engage in university CE activities. Therefore, we formulated our fifth hypothesis as follows:

\[ H_5. \text{ Personal dimensions have a positive effect on the CE process and outcomes.} \]

Finally, we wanted to determine whether the engagement process influences outcomes at the institutional and community levels. Therefore, we hypothesized that the engagement process influences outcomes at both university and community levels.

**The relationship between the engagement process and institutional-level outcomes**

This study considers participation in the university CE process associated with institutional-level outcomes. University CE outcomes included community trust (Vargiu, 2014), flexible and integrated CE structure, efficiency in CE services (Hart & Northmore, 2011), improved brand image and relationship with stakeholders, sustained engagement value and adoption of best practices to scale up CE. In addition, academics create relevant activities that promote research and personal and professional development (Shephard et al., 2017)(Suarez-Balcazar et al., 2013).

\[ H_6. \text{ The Community engagement process has a positive effect on the institutional-level outcomes} \]

The relationship between the engagement process and community-level outcomes

On the other hand, communities gain a wide range of outcomes through their active interactions with universities (Shukran A.R, Aidah, S, Yunusu, Norzaini. A, Munir. S, 2019). Among these are the potential to address pressing community needs (Suarez-Balcazar et al., 2013), which leads to positive perception and awareness among stakeholders, application, and use of relevant
knowledge and tools. Participating in university CE is also anticipated to enable community ownership of the engagement outcomes, increase the possibility of staying engaged, enable the community to make better-informed decisions, and improve community welfare (Hart & Northmore, 2011), positive community change (Shephard et al., 2017). Additionally, such activities increase community confidence in university CE community activities. Engagement also enhances community access to knowledge resources that benefit social, economic, environmental, and cultural capacity and conditions (Clark, 2015; Wanjiru & Xiaoguang, 2021). Consequently, a practical university CE process increases the relevance of their initiatives and brings multiple benefits to the engaged community.

_H7: The community engagement process has a positive effect on the community-level outcomes._

Our proposed model is depicted in Figure 1. The UCE model is underpinned by four key input dimensions relevant to developing and sustaining the engagement process that yields positive outcomes for the institution and the community. In precise terms, our model assumes that the institutional, personal, professional and community dimension creates the space that enables academics and community members to participate freely in the CE process. The engagement process is acknowledged through participation in engaged teaching, research, and community-engaged services. Successful participation in the CE process results in positive university and community-level outcomes. The proposed model is depicted in Figure 11.
3. Methodology

We used a quantitative research methodology to test our conceptual model of put dimensions influencing university CE process and outcomes.

3.1 Study design

We used a purposive multistage sampling procedure to gather data. In the first stage, we selected five districts in the Rwenzori region where the Mountains of the moon university have had community engagement interventions. These districts include Kabarole, Kamwenge, Bundibujjo, Kasese and Kyenjojo. In the second stage, we used convenience sampling to select academics and community partners for the survey were selected purposively for their diverse, in-depth knowledge drawn from their years of experience with MMU. Following this criteria, one hundred and twenty-six academics and two hundred and sixteen community partners completed the survey between September and November 2022.
3.2 Instrument

We developed two surveys that required between 30 and 40 minutes to complete by community partners or faculty members. These instruments were practically identical, with some slight tailoring based on the type of respondent. The instruments' first part was designed to measure descriptive information about the respondents, such as age and marital status. The second part of the instruments assessed the proposed university community engagement model dimensions that influence the CE process and outcomes. Specifically, the second part tested the hypotheses that institutional, personal and community dimensions affect community engagement process and outcomes.

Institutional dimensions (ID) were measured through six items revised from (Wade & Demb, 2009) and some generated from literature including (Garber et al., 2010; Jaeger et al., 2012; van Schalkwyk & de Lange, 2018). Professional dimensions (PR) were captured through five items modified from (Wade & Demb, 2009) and (Van Schyndel et al., 2019). Items that measured community dimensions (CD) were developed from literature including (Frank & Sieh, 2016; Strom, 2011; Zanbar & Ellison, 2019). Personal dimensions were measured by five indicators developed from (De Weger et al., 2018; O’Meara et al., 2011; Wade & Demb, 2009; Xu, 2007). Six indicators measured the university CE process, and these were generated from studies including (Abrams et al., 2006)(Wade & Demb, 2009)(Kimball & Thomas, 2012)(and Frank & Sieh, 2016). Items that determined the university-level outcomes were developed after consulting relevant literature (Hart & Northmore, 2011; Shephard et al., 2017; Suarez-Balcazar et al., 2013). Lastly, community-level outcomes were determined by six indicators generated from (Hart & Northmore, 2011; Suarez-Balcazar et al., 2013; Wanjiru & Xiaoguang, 2021). All Items in this section were recorded on a 5-point scale that asked respondents to rate the degree to which they agree that institutional, personal, and community dimensions affect university community engagement outcomes. Table 24 summarises the latent constructs, their corresponding indicators and their sources.
<table>
<thead>
<tr>
<th>Dimension</th>
<th>CODE</th>
<th>measures</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Institutional</strong></td>
<td></td>
<td><strong>dimensions</strong></td>
<td></td>
</tr>
<tr>
<td>ID3</td>
<td></td>
<td>The university leadership and policy support CE activities</td>
<td></td>
</tr>
<tr>
<td>ID4</td>
<td></td>
<td>The university communication structure and use of MMU Radio influence engagement participation</td>
<td></td>
</tr>
<tr>
<td>ID5</td>
<td></td>
<td>The university Plans, funds, rewards, and promotes engaged members</td>
<td></td>
</tr>
<tr>
<td>ID6</td>
<td></td>
<td>The university has a clear engagement structure that supports engagement activities</td>
<td></td>
</tr>
<tr>
<td><strong>Professional</strong></td>
<td></td>
<td><strong>dimension</strong></td>
<td></td>
</tr>
<tr>
<td>PR1</td>
<td></td>
<td>The occupation/profession influences participation in university CE activities</td>
<td>Shephard et al. (2017) (Wade &amp; Demb, 2009)</td>
</tr>
<tr>
<td>PR2</td>
<td></td>
<td>My socio-economic status influences participation in CE activities (Rank)</td>
<td></td>
</tr>
<tr>
<td>PR3</td>
<td></td>
<td>Community support influences engagement participation.</td>
<td></td>
</tr>
<tr>
<td>PR4</td>
<td></td>
<td>Professional orientation influences my participation in CE activities</td>
<td></td>
</tr>
<tr>
<td>PR5</td>
<td></td>
<td>Time spent working with the university influences engagement participation.</td>
<td></td>
</tr>
<tr>
<td><strong>Community</strong></td>
<td></td>
<td><strong>dimension</strong></td>
<td></td>
</tr>
<tr>
<td>CD1</td>
<td></td>
<td>The community has positive perceptions about the university CE activities</td>
<td>Selvaratnam, (2013) (Frank and Sieh, 2016; Strom, 2011)</td>
</tr>
<tr>
<td>CD2</td>
<td></td>
<td>The community has the capacity to participate in university CE activities.</td>
<td></td>
</tr>
<tr>
<td>CD3</td>
<td></td>
<td>The community is always committed to participating in co-creation activities.</td>
<td></td>
</tr>
<tr>
<td>CD4</td>
<td></td>
<td>The Community is always ready to participate in engagement activities.</td>
<td></td>
</tr>
<tr>
<td>CD5</td>
<td></td>
<td>The community trusts that university CE initiatives.</td>
<td></td>
</tr>
<tr>
<td>CD6</td>
<td></td>
<td>Community leaders support university CE activities.</td>
<td></td>
</tr>
<tr>
<td><strong>Personal</strong></td>
<td></td>
<td><strong>dimensions</strong></td>
<td></td>
</tr>
<tr>
<td>PD1</td>
<td></td>
<td>I have positive perception to CE experiences</td>
<td>Wade and Demb (2009)</td>
</tr>
<tr>
<td>PD2</td>
<td></td>
<td>Participation in university CE helps me gain and share knowledge with others (belief)</td>
<td>De Weger et al., 2018; Xu, 2007 (O’Meara et al., 2011)</td>
</tr>
<tr>
<td>PD3</td>
<td></td>
<td>My previous experience influences my participation in university CE activities</td>
<td></td>
</tr>
<tr>
<td>PD4</td>
<td></td>
<td>I am always motivated to participate in university CE activities</td>
<td></td>
</tr>
<tr>
<td>PD5</td>
<td></td>
<td>My age influences my participation in university engagement activities</td>
<td></td>
</tr>
<tr>
<td><strong>Engagement</strong></td>
<td></td>
<td><strong>Process activities</strong></td>
<td></td>
</tr>
<tr>
<td>EP1</td>
<td></td>
<td>University creates opportunities to participate in community-based courses and training</td>
<td>Abrams et al., (2006)</td>
</tr>
<tr>
<td>EP2</td>
<td></td>
<td>I have been involved in activities organised by university students to address community issues.</td>
<td>Wade and Demb (2009)</td>
</tr>
</tbody>
</table>
I have been involved in co-creating practical knowledge and tools.

I have been engaged in generating knowledge to meet community needs.

I have participated in sharing technological knowledge and skills with community members (using MMU radio, or the Rwenzori dairy app).

I have participated in either university trainings or research dissemination activities.

**Institutional level outcomes**

<table>
<thead>
<tr>
<th>ULO1</th>
<th>The university gains improved brand image</th>
<th>(Vargiu, 2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULO2</td>
<td>More opportunities to advance scholarship, personal, and professional development in CE</td>
<td>Suarez-Balcazar et al., (2013)</td>
</tr>
<tr>
<td>ULO3</td>
<td>Integration of CE in the university structure</td>
<td>Hart &amp; Northmore, 2011</td>
</tr>
<tr>
<td>ULO4</td>
<td>Sustained CE value</td>
<td>(Shephard et al., 2017)</td>
</tr>
<tr>
<td>ULO5</td>
<td>Adoption of CE in the university curriculum.</td>
<td></td>
</tr>
<tr>
<td>ULO6</td>
<td>Increased number of engaged faculty and students</td>
<td></td>
</tr>
</tbody>
</table>

**Community level outcomes**

<table>
<thead>
<tr>
<th>CLO1</th>
<th>Addressing community needs and aspirations</th>
<th>Wanjiru &amp; Xiaoguang, (2021)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLO2</td>
<td>Positive perceptions and community awareness of CE value.</td>
<td>Suarez-Balcazar et al., (2013)</td>
</tr>
<tr>
<td>CLO3</td>
<td>Increased number of community members using the CE dairy app and MMU radio.</td>
<td>Hart &amp; Northmore, 2011</td>
</tr>
<tr>
<td>CLO4</td>
<td>Community ownership of CE outcomes</td>
<td></td>
</tr>
<tr>
<td>CLO5</td>
<td>Increases networks and number of engaged community members.</td>
<td></td>
</tr>
<tr>
<td>CLO6</td>
<td>Community welfare improvement and positive community change.</td>
<td></td>
</tr>
</tbody>
</table>

### 3.3 Analysis

The model included seven latent constructs with multiple measurements and structural relationships. Since the goal was to test multiple dependency relationships simultaneously to validate the model with the data, the proposed research model was examined using a structural equation using the Partial Least Squares (PLS) technique and SmartPLS (v3.3.3) software. We employed the two-step analysis procedures suggested by Anderson and Gerbing (1988) to test the measurement and the structural model. In the first step, we examined the measurement model's validity and reliability. Cronbach’s alpha and composite reliability (a test of convergent validity in a reflective model) were used to assess the scales’ reliability. We performed two types of validity (convergent and discriminant validity) to evaluate the measurement model. The convergent validity of the measurement is established by examining the loadings, average variance extracted (AVE) and composite reliability. Fornell & Larcker's (1981) cross-loading criterion was used to estimate the discriminant validity.
In the second step, we assessed the structural model. The collinearity of the predictors was assessed through the VIF value. We performed bootstrapping (5000 resampling) to verify the statistical significance of the path coefficient and to evaluate the t-values in our study. In addition, our structural model was assessed by checking the R² values to ascertain the descriptive power of the latent variables. Lastly, a blindfolding procedure was performed to obtain the Q² values that denote the model's predictive relevance. Hair et al., (2019) recommend that Q² values should essentially be above zero for each structural model construct to demonstrate the model's predictive accuracy.

4. Results

The 342 respondents were profiled basing on their identity, gender, age brackets, level of education completed marital statues and year of engagement with MMU. Findings in Table 25 shows that the biggest percentage of the respondents (63.2%) were community members while 36.8% were faculty members. In terms of gender of the respondent, the majority of respondents, 64.6.6%, were male, while 35.4% were female. The biggest percentage of respondents (40.9%) were aged 31-40 years in terms of age groups. 31.9% were aged between 41-50 years, 14.6% were between 211 and 30 years, 7.6% were between 51 and 60, and 5.0% were 61 years and above. The sample comprised fairly educated individuals, with 32.1% had master’s degrees, 18.4% bachelor’s degrees, 23.9% secondary level, 10.0% diploma level, 10.2% primary while 5.0% were educated up to PhD level. Regarding marital status, the majority, 71.3%, were married, 23.4% were single while a smaller percentage of the respondents 2.6% were divorced and 2.6% were widowed. In terms of number of years of engagement with MMU, a majority of the responded 54.7% reported to have been involved between 1-5 years, 31.6% were engaged between 6-10 years, while 6.7% and 7.0% were engaged less than one year and more than 10 years respectively.
Table 25: Demographic characteristics of respondents of the sample (n=342)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Classification</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identity</td>
<td>Academics</td>
<td>126</td>
<td>36.8%</td>
</tr>
<tr>
<td></td>
<td>Community members</td>
<td>216</td>
<td>63.2%</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>221</td>
<td>64.6%</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>121</td>
<td>35.4%</td>
</tr>
<tr>
<td>Age groups</td>
<td>21-30</td>
<td>50</td>
<td>14.6%</td>
</tr>
<tr>
<td></td>
<td>31-40</td>
<td>140</td>
<td>40.9%</td>
</tr>
<tr>
<td></td>
<td>41-50</td>
<td>109</td>
<td>31.9%</td>
</tr>
<tr>
<td></td>
<td>51-60</td>
<td>26</td>
<td>7.6%</td>
</tr>
<tr>
<td></td>
<td>61+</td>
<td>17</td>
<td>5.0%</td>
</tr>
<tr>
<td>Education level completed</td>
<td>Primary</td>
<td>35</td>
<td>10.2%</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>82</td>
<td>23.9%</td>
</tr>
<tr>
<td></td>
<td>Diploma/Polytechnique</td>
<td>37</td>
<td>10.0%</td>
</tr>
<tr>
<td></td>
<td>Bachelor’s degree</td>
<td>63</td>
<td>18.4%</td>
</tr>
<tr>
<td></td>
<td>Master’s degree</td>
<td>110</td>
<td>32.1%</td>
</tr>
<tr>
<td></td>
<td>PhD +</td>
<td>15</td>
<td>4.4%</td>
</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>244</td>
<td>71.3%</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>80</td>
<td>23.4%</td>
</tr>
<tr>
<td></td>
<td>Divorced</td>
<td>9</td>
<td>2.6%</td>
</tr>
<tr>
<td></td>
<td>Widowed</td>
<td>9</td>
<td>2.6%</td>
</tr>
<tr>
<td>Year of engagement</td>
<td>Less than 5 years</td>
<td>23</td>
<td>6.7%</td>
</tr>
<tr>
<td></td>
<td>1-5 years</td>
<td>187</td>
<td>54.7%</td>
</tr>
<tr>
<td></td>
<td>6-10 years</td>
<td>108</td>
<td>31.6%</td>
</tr>
<tr>
<td></td>
<td>10+</td>
<td>24</td>
<td>7.0%</td>
</tr>
</tbody>
</table>

Measurement model

Appraisal of the measurement model was performed through the evaluation of the validity and reliability. In terms of validity, the convergent validity of the indicators was established by determining whether the items’ loading on to their respective constructs is greater than (> 0.50) (Hair et al., 2010). Indicators with low loading ID5, PR5, CLO6, ULO4, ULO5, ULO6 were subsequently eliminated for purposes of achieving validity at a later stage. Figure 12 shows the indicators that met the inclusion criterion.
Internal consistency reliability of the latent constructs was evaluated by checking Cronbach’s alpha values. As shown in Table 26, Cronbach’s alpha values (ID (0.841), PR (0.779), CD (0.871), PD (0.844), EP (0.869), CLO (0.846) and ULO (0.847), of the model indicators met the initial assessment criteria as suggested by (Rouf & Akhtaruddin, 2018). Composite reliability values should range from 0 to 1, with 0.6 as a minimum acceptable value. As shown in Table 26, composite reliability values for all indicators ID (0.884), PR (0.850), CD (0.893), PD (0.885), EP (0.901), CLO (0.891) and ULO (0.907) satisfied the requirement. In addition, our results in Table 26 show that the Average variance extracted (AVE) used as a test constructs’ convergent validity were satisfactory; ID (0.606), PR (0.532), CD (0.583), PD (0.562), EP (0.604), CLO (0.620), and ULO (0.765). AVE should be greater than 0.5.
Table 26: Construct Reliability and Validity

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Code</th>
<th>Cronbach’s Alpha</th>
<th>Composite reliability</th>
<th>Average variance extracted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional dimensions</td>
<td>ID</td>
<td>0.841</td>
<td>0.884</td>
<td>0.606</td>
</tr>
<tr>
<td>Professional dimension</td>
<td>PR</td>
<td>0.779</td>
<td>0.850</td>
<td>0.532</td>
</tr>
<tr>
<td>Community dimension</td>
<td>CD</td>
<td>0.871</td>
<td>0.893</td>
<td>0.583</td>
</tr>
<tr>
<td>Personal dimension</td>
<td>PD</td>
<td>0.844</td>
<td>0.885</td>
<td>0.562</td>
</tr>
<tr>
<td>Engagement process</td>
<td>EP</td>
<td>0.869</td>
<td>0.901</td>
<td>0.604</td>
</tr>
<tr>
<td>Community level outcomes</td>
<td>CLO</td>
<td>0.846</td>
<td>0.891</td>
<td>0.620</td>
</tr>
<tr>
<td>University level outcomes</td>
<td>ULO</td>
<td>0.847</td>
<td>0.907</td>
<td>0.765</td>
</tr>
</tbody>
</table>

Furthermore, we have also tested the discriminant validity using the Fornell-Larcker criterion. The results in Table 27 show that the discriminant validity is acceptable since the square roots of AVE were all above the relations between each pair of constructs. In precise terms, the measurement model certified that the discriminant validity is well established.

Table 27: Discriminant validity: Fornell Larcker principle

<table>
<thead>
<tr>
<th>CD</th>
<th>EP</th>
<th>ID</th>
<th>PD</th>
<th>PR</th>
<th>CLO</th>
<th>ULO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD</td>
<td>0.764*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EP</td>
<td>0.630</td>
<td>0.777*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>0.111</td>
<td>0.294</td>
<td>0.779*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD</td>
<td>0.656</td>
<td>0.555</td>
<td>0.206</td>
<td>0.750*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PR</td>
<td>0.661</td>
<td>0.627</td>
<td>0.390</td>
<td>0.713</td>
<td>0.729*</td>
<td></td>
</tr>
<tr>
<td>CLO</td>
<td>0.529</td>
<td>0.756</td>
<td>0.307</td>
<td>0.498</td>
<td>0.546</td>
<td>0.787*</td>
</tr>
<tr>
<td>ULO</td>
<td>0.539</td>
<td>0.743</td>
<td>0.326</td>
<td>0.529</td>
<td>0.512</td>
<td>0.675</td>
</tr>
</tbody>
</table>

Notes: square roots of AVEs, and *constructs correlations

Testing the research hypotheses

The collinearity of the predictors was assessed through the VIF value, and the results in Table 28 show that the VIF values were less than 3. That is ID -> EP (VIF=1.237), ID -> PR (VIF=1.000), PR -> EP (VIF=2.774), CD -> EP (VIF=2.094), PD -> EP (VIF=2.323), EP -> ULO (VIF=1.000) and EP -> CLO (VIF=1.000). Furthermore, we used bootstrapping to verify the statistical significance of the path coefficient and to evaluate the t-values in our study and all calculated values are shown in Table 28. According to the results, the hypothesised path ID and EP are statistically significant (β = 0.134, t = 2.463, p < 0.014) hence accepting H1.

In addition, the inner model's hypothesised path of ID and PR is statistically significant (β = 0.390, t = 9.067, p < 0.000), thus accepting H2.
The data also strongly supported the hypothesised relationships PR -> EP (β = 0.252, t = 3.330, p < 0.001), therefore accepting H3. Table 28 also shows the relationship between CD -> EP (β = 0.387, t = 6.837, p < 0.000) was statistically significant, thus accepting H4. The data also showed statically significant relations between path EP -> ULO (β = 0.734, t = 21.682, p < 0.000) and (EP -> CLO (β = 0.756, t = 17.319, p < 0.000). This gives support to the hypotheses H6, H7. Surprisingly, the hypothesised path of PD -> EP (β = 0.095, t = 1.483, p > 0.138) in the inner model was statistically insignificant hence rejecting hypothesis H5.

Table 28: Results of the structural model

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Relationship</th>
<th>Path coefficient</th>
<th>Standard Deviation (STDEV)</th>
<th>Collinearity statistics (VIF)</th>
<th>t-values</th>
<th>P Values</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>ID -&gt; EP</td>
<td>0.134</td>
<td>0.054</td>
<td>1.237</td>
<td>2.463</td>
<td>0.014**</td>
<td>Supported</td>
</tr>
<tr>
<td>H2</td>
<td>ID -&gt; PR</td>
<td>0.390</td>
<td>0.043</td>
<td>1.000</td>
<td>9.067</td>
<td>0.000**</td>
<td>supported</td>
</tr>
<tr>
<td>H3</td>
<td>PR -&gt; EP</td>
<td>0.252</td>
<td>0.076</td>
<td>2.774</td>
<td>3.330</td>
<td>0.001**</td>
<td>supported</td>
</tr>
<tr>
<td>H4</td>
<td>CD -&gt; EP</td>
<td>0.387</td>
<td>0.057</td>
<td>2.094</td>
<td>6.837</td>
<td>0.000**</td>
<td>supported</td>
</tr>
<tr>
<td>H5</td>
<td>PD -&gt; EP</td>
<td>0.095</td>
<td>0.064</td>
<td>2.323</td>
<td>1.483</td>
<td>0.138</td>
<td>Not supported</td>
</tr>
<tr>
<td>H6</td>
<td>EP -&gt; ULO</td>
<td>0.743</td>
<td>0.034</td>
<td>1.000</td>
<td>21.682</td>
<td>0.000**</td>
<td>supported</td>
</tr>
<tr>
<td>H7</td>
<td>EP -&gt; CLO</td>
<td>0.756</td>
<td>0.044</td>
<td>1.000</td>
<td>17.319</td>
<td>0.000**</td>
<td>supported</td>
</tr>
</tbody>
</table>

Coefficient of determination (R²) and Predictive relevance (Q²)

The coefficients of determination(R²) for each dependent construct indicate whether the model's independent variables significantly impact that construct. The results in Table 29 show the values of the coefficients of determination (R²) PR (R² = 0.152), EP (R² = 0.493), ULO (R² = 0.557) and CLO (R² = 0.572). The findings suggest that overall, PR accounted for a low variance of all model factors PR (R² = 15%). EP accounted for R² = 49% of the variations in the model. The findings also show that R²= 57% and R² = 55% of the variance in university-level and community-level outcomes is due to the factors identified in the model, respectively.
Table 29: Coefficient of determination (R²) and Predictive relevance (Q²)

<table>
<thead>
<tr>
<th>Construct</th>
<th>R²</th>
<th>Q²</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR</td>
<td>0.152</td>
<td>0.079</td>
</tr>
<tr>
<td>EP</td>
<td>0.493</td>
<td>0.286</td>
</tr>
<tr>
<td>ULO</td>
<td>0.553</td>
<td>0.415</td>
</tr>
<tr>
<td>CLO</td>
<td>0.572</td>
<td>0.347</td>
</tr>
</tbody>
</table>

5. Discussion of the results

In this study, we developed a conceptual model that illustrates the four input dimensions influencing the university CE process. The engagement process includes faculty and community members’ participation in activities, including engaged learning, engaged research and services. The model conceptually suggests that institutional, community, personal and professional dimensions influence faculty and community members’ participation in university CE activities. The model further hypothesised that participation in CE activities affects university- and community-level outcomes. The conceptual model was tested using the structural equation modelling technique with data from engaged community and university, faculty members. Our empirical examination of the model found evidence supporting most of the components and hypothetical relationships in the conceptual model.

As shown in the results section, ID directly affects the university engagement process (H₁). This result supports the insights of (Calleson et al., 2002; Demb & Wade, 2012; Wade & Demb, 2009) concerning the importance of institutional elements in driving CE. In a study (Moore & Ward, 2010), institutional dimensions were found to play a vital role in managing change and supporting community engagement. The results imply that participants in our study acknowledged the role of institutional dimensions such as university leadership support and financial resources for community-engaged activities to establish and maintain an effective CE. Institutional elements serve as enabling resources for active and meaningful faculty and community members’ participation in CE activities.

In addition, ID exerts a direct positive effect on PD that influence engagement (H₂). These findings are consistent with (Milne & Hamilton, 2021), revealing that university elements
influence professional or occupational dimensions. For instance, university support for engaged faculty and community member could easily enhance their engagement participation (Olutokunbo Adekalu et al., 2018). Therefore, institutions should provide support to enhance professional development in CE. The current study, therefore, suggests that institutions should enhance support for the engaged stakeholders to improve CE.

Moreover, our findings suggest that professional or occupation dimensions were associated with the engagement process. A recent study has validated and explained this relationship (Anzivino et al., 2021). We interpret these findings as a sign that the types of activities undertaken by faculty and community members positively impact their participation in community engagement initiatives. Therefore, this study suggests that since engaged faculty and community come from various educational and professional backgrounds, it is crucial to equip them with skills, tools, and resources to support their roles in the engagement process. The data show that the community dimensions possess a significant positive relationship with the CE process (H4). Zanbar and Ellison (2019) and Shabalala and Ngcwangu (2021) also found that incorporating community dimensions influence the university CE process and can go a long way in making CE activities easier to implement. These findings shed new light on the community dimensions that influence the participation of local community members in university CE activities.

However, the results of this study do not support the association between personal dimensions and the engagement process (H5). In contrast, previous literature, such as (Calleson et al., 2002), found that personal elements such as perception and initiative are essential to participating in community engagement. The results seem surprising because to participate in university CE activities, individuals must at least be open and motivated to participate in CE activities. However, it can be argued that a vibrant relationship emerges when communities and faculty engage; personal or individual factors may not necessarily disrupt that. For example, suppose the engagement activity aims to improve the community and the university; personal factors may not necessarily influence the engagement process as individuals will work towards a social goal.

Perhaps not surprisingly, data provided statistical support for the hypothesized relationship between the university CE process and university-level outcomes H6. This result is echoed in previous studies (Aurora et al., 2014; Fitzgerald et al., 2016; Gorski, 2016). These findings
support that when university members reciprocally engage with external groups of people, it boosts trust in the university, improves research and teaching and maintains close relationships with the community.

Finally, the results show that the CE process has a significant positive impact on community-level outcomes (H7). For instance, the engagement activities, which mainly respond to the needs and desires of the community, improve community well-being and allow the community to access and share knowledge with the university.

6. Conclusion

The study aimed to develop and validate a conceptual model to improve our understanding of the empirical elements influencing the university CE process and outcomes. Second, based on an analysis of data collected through a survey, the study provides empirically grounded evidence of the proposed model dimensions and their impact on the engagement process and outcomes at both institutional and community levels. The findings demonstrate the significance of institutional, professional and community dimensions to the engagement process. However, we did not find a significant effect of personal elements in relation to the university CE process. In addition, participation in university CE is significantly associated with institutional and community-level outcomes.

These findings have some ramifications and practical implications for community engagement practitioners. For example, strategies for enhancing university CE should focus not only on the institutional elements but also on the community dimensions to be involved in the engagement. Lastly, effective CE brings benefits, such as community access to institutional resources, knowledge, and networks, that can fuel creative opportunities for the institution and the community. Therefore, universities and communities should choose to cooperate further to increase mutual benefits.
7. Reference


Career through Community Engagement: The Nigerian University Experience.  
https://doi.org/10.7575/aiac.ijels.v.6n.3p.99


Engagement: Starting a Campus-Wide Dialogue. Metropolitan Universities, 28(2), 72–89. https://doi.org/10.18060/21515


Annex: Questionnaire 3
Section A: Demographic characteristics of respondents (Please tick the most appropriate response).

1. Please indicate your gender
   1. Male
   2. Female

2. What is your marital status?
   1. Single
   2. Married
   3. Divorced
   4. Widowed

3. Please indicate your age group
   6. (21-30)
   7. (31-40)
   8. (41-50)
   9. (51-60)
   10. (61 and above)

4. What is your highest level of education?
   1. Primary
   2. Secondary
   3. Diploma/Polytechnic
   4. Bachelor’s Degree
   5. Master’s degree
   6. PhD

5. Please indicate the duration of your engagement with mountains of the moon university.
   1. Less than a year
   2. 1-5 years
   3. 6-10 years
   4. More than 10 years
   1.
Section B
To what extent do you agree that the following institutional elements influence your participation in university community engagement activities? Please indicate your response following the ranking scale of 1, 2, 3, 4, and 5, where each stand for; 1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree

<table>
<thead>
<tr>
<th>NO</th>
<th>ITEM</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>The university established a shared understanding of the value, and meaning of CE and embedded this in the university mission</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>The university engagement structure aligned with community needs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>The university leadership and policy support CE activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>The university communication structure and use of MMU Radio influence engagement participation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>The university Plans, funds, rewards, and promotes engaged members</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>The university has a clear engagement structure that supports engagement activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Personal dimensions
In the following questions, we want to learn about personal factors influencing your involvement in university-community engagement activities. Please indicate how you agree with the following statements following the scale.


<table>
<thead>
<tr>
<th>NO</th>
<th>ITEM</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>I am always open to engagement experiences and learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Participation in university CE helps me gain and share knowledge with others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
14. My previous experience influences my participation in university CE activities

15. I am always motivated to participate in university CE activities

16. My socio-economic status influences my participation in university engagement activities

Professional dimensions

11. Next, we want to learn about professional factors that influence your involvement with the university. Please indicate how you agree with the following statements following the scale;


<table>
<thead>
<tr>
<th>NO</th>
<th>CODE</th>
<th>ITEM</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>PR1</td>
<td>The occupation/profession influences participation in university CE activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>PR2</td>
<td>My socio-economic status influences participation in CE activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>PR3</td>
<td>Community support influences engagement participation.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>PR4</td>
<td>Professional orientation influences my participation in CE activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>PR5</td>
<td>Time spent working with the university influences engagement participation.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Community dimensions

We want to learn about community dimensions that influence your involvement in the university. Please indicate how you agree with the following statements.

<table>
<thead>
<tr>
<th>NO</th>
<th>ITEM</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>The community has positive perceptions about the university CE activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>The community has the capacity to participate in university CE activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>The community is always committed to participating in university CE activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>The Community is always ready to support and participate in engagement activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>The community trusts that university CE initiatives are essential.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Community leaders support university CE activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Engagement process activities


<table>
<thead>
<tr>
<th>NO</th>
<th>ITEM</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>University creates opportunities to participate in community-based courses and training</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>I have been involved in activities organised by university students to address community issues.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>I have collaborated with faculty members to co-create practical knowledge to address community challenges.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Participating in faculty research activities aiming at generating knowledge to meet community needs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>I have participated in sharing technological knowledge and skills with community members (using MMU radio, or the Rwenzori dairy app)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Community engagement outcomes
To what extent do you agree that university or community has achieved the following?
Please indicate how you agree with the following statements.


<table>
<thead>
<tr>
<th>NO</th>
<th>ITEM</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>The university gains trust and improves its brand image</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>CE offers opportunities to advance scholarship, personal, and professional development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Flexible, integrated CE structure and efficiency in CE initiatives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Sustained engagement value and relationship with stakeholders</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Adoption of best practices to scale-up CE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Adoption of best practices to scale-up CE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Increased number of engaged faculty and students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Participation in CE has the potential to address community needs and aspirations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Effective CE process results in positive perceptions and community awareness of its value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>The process results in the application of relevant knowledge and informed decisions making</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Enable community ownership and make better and more informed decisions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Increases confidence, networks and community access to university knowledge and resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Community welfare improvement and positive community change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chapter 7

General discussions and conclusion

1. Introduction

In the final chapter of this doctoral dissertation, the results of the previous chapters are merged to deliberate on the main contributions to scientific knowledge and implications for policy and Community Engagement (CE) practice and to present an outlook and recommendations for future research in this field. The main objective of the doctoral dissertation was to advance knowledge of CE within the context of rural HEIs or universities. The current state of the art has demonstrated that CE is still a challenging mission and weakly developed at the university level (Cherrington et al., 2019; Johnson, 2020; Tarus et al., 2017). Hence, a university CE model is proposed to enhance the university CE process and outcomes. While there is a growing curiosity in improving the CE for mutually beneficial relationships among institutions and their stakeholders, there are gaps in the literature regarding clear models, perceptions and needs of engaged stakeholders, practical approach to engaging university stakeholders in co-creation, intention to use jointly created tools, and the key dimensions that can guide practical university CE. These factors were highlighted in Chapter 1 and thus motivated the design and implementation of this dissertation.

2. Summary of the research objectives and research questions

Table 7.1 presents an overview of the research objectives along with their respective research questions, samples, key findings, and recommendations.
Table 30: Overview of the research objectives and research questions

<table>
<thead>
<tr>
<th>Objectives and questions</th>
<th>Sample</th>
<th>Key findings</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| OB1: Provide a comprehensive overview of conceptualisation and models of CE in HEIs. | 106 studies | * Most publications are from developed countries.  
* Most are conceptual studies.  
* Faculty were considered key participants in the CE.  
* The dominance of the place-based theory  
* Partnership CE model  
* Fifteen that are fundamental to effective community engagement elements | * Need for empirical studies.  
* University CE should focus on place-based engagements.  
* Universities should focus on establishing solid partnerships during CE.  
* Consider fifteen identified elements such as stakeholder needs, motivation of participants, and funding for CE. |
| RQ1: What are the characteristics of community engagement studies in higher education institutions? |  |  |  |
| RQ2: What theoretical perspectives underpin the community engagement of higher education institutions in the selected articles? |  |  |  |
| RQ3: What are the existing models of community engagement models in the selected articles? |  |  |  |
| RQ4: What elements are described in the identified articles fostering effective university CE? |  |  |  |
| OB2:Evaluate stakeholders' Perceptions and needs for CE. | 450 stakeholders (3 groups - faculty, students, dairy farmers) | * The three groups of stakeholders positively perceived the CE benefits.  
* Restricted engagement opportunities  
* Challenges hindered stakeholders' practical CE.  
* Community-related activities are unsupported the university, and stakeholders' needs are not addressed. | * Setting up structures to support students, faculty members, and community stakeholders' engagements.  
* Creating opportunities for CE.  
* Pay attention to CE challenges.  
* Need to create time, contact office and structure, financial support, and adequate communication for CE |
| RQ1: What are the stakeholders' perceptions of CE with HEIs? |  |  |  |
| RQ2: What are the HEIs stakeholders' needs for practical CE? |  |  |  |
| OB3: Engage stakeholders in co-creating an engagement tool. | 139 stakeholders | * Ideation stage resulted in the initial prototype requirements and content. | * Use the design thinking model in co-creation to frame university CE initiatives. |

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| RQ1: What approaches and processes can be used to involve university stakeholders in co-creating a dairy application for CE | s (3 groups) | • Testing stage revealed the app's contextual requirements and abstract parameters.  
• Prototyping staged into contextual requirement and content for a dairy app for CE.  
• Co-creation process provided a unique opportunity to identify contextual users' needs for the dairy app | • Engage multiple stakeholders in co-creation during CE. |
| OB4: Examine rural farmers’ readiness and intention to use a co-created tool.  
RQ1: Do awareness and normative influence positively affect rural farmers' readiness to collaborate through the co-created dairy application?  
RQ2: Does readiness positively affect the perceived usefulness and ease of use of the dairy app?  
RQ3: In what manner does self-efficacy influence the perceived ease of use of the dairy app?  
RQ4: Does perceived ease of use positively affect the perceived usefulness of the dairy application?  
RQ5: In what manner does perceived ease of use influence hedonic and utilitarian attitudes to use the dairy application?  
RQ6: How does perceived usefulness influence hedonic and utilitarian attitudes toward the dairy application?  
RQ7: Does self-efficacy, hedonic and utilitarian attitude influence the intention to use the dairy application? | 466 dairy farmers | • Awareness and normative play an essential role to rural farmers' preparedness to collaborate through the application.  
• Readiness, self-efficacy, perceived ease of use, perceived usefulness, hedonic and utilitarian attitudes have statistically positive effects on rural farmers' intentions to use the application. | • Raise awareness regarding university CE activities. Collaborate with local community groups.  
• Pay close attention to rural farmers' self-efficacy to use technology tools during CE.  
• Place premium attention on applications' ease of use and usefulness.  
• Technology CE tools should comprise interesting characteristics to provide enjoyment and utility elements to benefit users. |
| OB5: Developing and testing the CE model. | 342 stakeholder | • Institutional, community, and professional/occupational | • Institutional dimensions such as university leadership support and financial resources |
RQ1: What input dimensions influence the university CE process and outcomes based on existing literature?

RQ2: How do the proposed model dimensions affect the university-community engagement process and outcomes?

- The university CE process is significantly associated with institutional and community-level outcomes.
- Provide support to enhance professional development in CE.
- Incorporating community elements such as their perceptions, needs, and readiness to participate university CE activities.
- The dimensions of community-engaged activities should be emphasised.
Specific objective one: To provide a comprehensive overview of conceptualisation and models of CE in HEIs.

As many HEIs reorganise the importance of CE as part of their mission, the clarity about theories, models and vital elements of CE that guide and support its practical implementation is still a challenge (Starke et al., 2017). This chapter provided a systematic overview of models, theories, and key elements that can guide effective CE in HEIs. The main findings from the chapter provided evidence that there has been a gradual increase in the number of publications on university CE over the years, and most were theoretical studies. There was no single study performed in Uganda regarding university CE. Community stakeholders were less prominent in these studies. Place-based theory was the most popular theory to explain the university CE phenomenon. The partnership model was more pronounced in the synthesised literature. Finally, fifteen elements were identified as crucial influences of effective university and CE.

Specific objective two: Assessing HEIs stakeholders' Perceptions and needs for CE.

This chapter evaluated university stakeholders' perceived benefits, challenges, and opportunities of being engaged with the university in Uganda. It also identified their needs for CE. Understanding the perceptions and needs would be valuable for designing and guiding future CE interventions. The descriptive findings on CE benefits show that stakeholders value university contributions to stakeholder engagement activities more highly. Consistent with previous research, actively involved individuals perceive the benefits of their engagement (Attree et al., 2011; Sandy and Holland, 2006).

Furthermore, findings showed that stakeholders perceived the opportunities as neutral regarding engagement, suggesting an untapped potential to maximise CE. This result provided additional input regarding stakeholders’ perceptions, as in a previous study (Mehta et al., 2015). The findings showed a lack of engagement prospects, which led to participants not realising their collaboration with the institution. The descriptive results also showed that students and faculty members rated challenges highly. At the same time, dairy farmers disagreed that CE was a barrier, suggesting they may be more willing to participate in university CE activities. Comparing students, faculty and dairy farmers, findings showed that three groups perceived CE differently and highlighted multiple needs. These stakeholders generally emphasised the need for time, contact office and structure, financial support, and sufficient communication for CE aspects.
Specific objective three: Engage stakeholders in co-creating an engagement tool.

Calls from literature justified the motivation for developing the dairy app through the co-creation process. First, apps promote active public participation (Delitheou et al. 2019) and allow institutions to collect accurate and timely data for research (Daum et al. 2018; Eitzinger et al. 2019; Michels et al. 2019). Such data improve livestock production and productivity (Katamba and Mutebi 2017), can be used to monitor animal health and reproduction management and store farm records (Kenny and Regan 2021). Secondly, involving users in the dairy app’s development ensures suitability and meets users’ needs (Al-kumaim et al. 2021; Llema and Vilela-Malabanan, 2019; Mirri et al. 2018).

Therefore, chapter four sought to involve stakeholders in developing a diary application for university CE. This chapter explains how faculty members, software developers, and dairy farmers participated in the application's design and development following the ideation, prototyping and testing stages of the design thinking model (Doorley et al., 2018).

The ideation stage resulted in the initial prototype requirements and content. However, the content generated during ideation and some parameters were deemed abstract during the subsequent stages. This depicted that the involvement of five faculty members and key dairy farmers during the ideation stage was insufficient to guarantee the feasible content for the app as such finding is also found by Liljedal and Dahlén (2018). The prototyping and testing stages were repeatedly performed, and the feedback elicited resulted in a feasible dairy app for university engagement with rural farmers. Consistent with Kumar et al. (2016), we found participants in our study were cooperative and offered insightful input on the dairy app's requirements and content acceptability. Furthermore, experience from this chapter confirms the benefits of optimising the interaction between universities and stakeholders (Avram et al., 2020; Pereira & Russo, 2018; Trischler et al., 2019).

Specific objective four: Examine rural farmers’ readiness and intention to use a co-created tool.

Having developed the dairy app, the next step was to assess factors that could influence rural farmers’ readiness and intention to use the dairy app for university CE. The Intention to use the application was assessed with nine constructs: awareness, normative influence, readiness, self-efficacy to use the app, perceived ease of use, perceived usefulness, and hedonic and utilitarian
attitude. The findings revealed that awareness and normative influence significantly influenced rural farmers’ readiness to interact with the application. The findings apply to the results of related research studies such as (Kamal et al., 2020) and (Pai & Alathur, 2019).

Findings also pointed out that readiness was significantly related to perceived ease of use and perceived usefulness, and farmers’ self-efficacy positively affects the perceived ease of use of the dairy application. Meanwhile, perceived ease of use showed a positive effect on the perceived usefulness of the dairy app. Moreover, findings revealed that perceived ease of use and perceived usefulness showed a positive and significant relationship with hedonic and utilitarian attitudes toward the use of the app. Finally, findings from this chapter revealed that self-efficacy, hedonic and utilitarian attitudes were significant and influenced rural farmers’ intention to use the dairy app.

**Specific objective five: Developing and testing the CE model.**

This chapter focused on developing a conceptual model to understand the input dimensions influencing the university CE engagement process and outcomes at institutional and community levels. The model comprised four input dimensions: institutional, professional, or occupational elements, personal and community dimensions. The engagement process includes faculty and community members' participation in activities, including engaged learning, engaged research and services. The model conceptually suggests that institutional, community, personal and professional dimensions influence faculty and community members' participation in university CE activities. The model further hypothesized that participation in CE activities affects university- and community-level outcomes. The proposed model was tested, and the empirical examination provided evidence supporting most of the components and hypothetical relationships in the conceptual model.

Findings revealed that ID directly affects the university engagement process. This result supports the insights of previous researchers (Calleson et al., 2002; Demb & Wade, 2012; Wade & Demb, 2009) concerning the importance of institutional elements in driving CE. In a study (Moore & Ward, 2010), institutional dimensions were found to play a vital role in managing change and supporting community engagement. Findings also showed that ID exerts a direct positive effect on PD that influences engagement. These findings are consistent with Milne and Hamilton (2021), revealing that university elements influence professional or occupational dimensions.
Furthermore, findings suggest that professional or occupation dimensions were associated with the engagement process. A recent study has validated and explained this relationship (Anzivino et al., 2021). The data show that the community dimensions possess a significant positive relationship with the CE process. Zanbar and Ellison (2019) and Shabalala and Ngcwangu (2021) also found that incorporating community dimensions influence the university CE process and can go a long way in making CE activities easier to implement. Perhaps not surprisingly, findings supported the hypothesised relationship between the university CE process and university-level outcomes. This result is echoed in previous studies (Aurora et al., 2014; Fitzgerald et al., 2016; Gorski, 2016). Finally, the results show that the CE process significantly impacts community-level outcomes.

3. General discussions

University community engagement is a multifaceted and transformative approach involving universities collaborating with communities to address shared challenges and create positive social impact. Within this context, the principles of knowledge exchange between the institution and the communities play a pivotal role in shaping the engagement agenda (Hagen, 2008). This dissertation shed light on various facets of university CE, from its conceptualisation, stakeholder perceptions and needs, technology integration in CE, and the interplay of factors shaping readiness to use technology tools in CE. Additionally, we propose a model and test a CE that could serve as a practical framework for universities seeking to enhance their relationships with local communities.

Our research began by delving into the conceptualisation, models, and key elements for nurturing university CE. The conceptualisation of CE underscores the importance of reciprocity, shared benefits and CE that focuses on the needs of stakeholders. Starting with an assessment of stakeholder perceptions and needs could ensure that engagement efforts are closely aligned with the actual requirements of the stakeholders (Frank and Sieh, 2016; Strom, 2011). Moreover, establishing how stakeholders perceive CE creates an environment that makes the university's initiatives relevant and meaningful.

We explored the diverse perceptions and needs of stakeholders within the university-community ecosystem. These included students, faculty members and dairy farmers. In this study, we assess how engaged stakeholders perceived CE in terms of benefits because CE
should be mutually beneficial. Secondly, to realise these benefits, the institution should avail opportunities for collaboration, and the CE process often involves challenges (Meara & Jaeger, 2006). As demonstrated by survey data, stakeholders perceived CE benefits but also expressed multiple needs that could mutually be addressed. Understanding these details is pivotal in establishing a foundation for successful engagement. Moreover, our findings underscored the importance of empathy, active listening, and responsive communication in bridging the gap between these diverse university stakeholder voices.

In this dissertation, co-creating a dairy app to blend CE with technology tools emerged as a successful aspect of university CE. Existing literature, such as (Delitheou et al. 2019), supports that technology tools present a significant opportunity to enhance university CE initiatives’ effectiveness. This combination leverages the power of technology to facilitate communication, collaboration, and the exchange of information within and between communities (Daum et al., 2018; Eitzinger et al., 2019; Michels et al., 2019). However, the importance of engaging the community or end-user in developing technology tools should be emphasised Harder et al. (2017).

Therefore, the third objective of this dissertation was to demonstrate a co-creation process employed to create a dairy aiming at addressing some of the needs identified in the previous study. The study describes co-creating a dairy app as an engagement platform that can benefit the university and dairy farmers. For example, dairy farmers could use the app as a record-keeping tool to monitor and support better decision-making in farm management. The app could benefit the university's institutional research activities and provide timely feedback to farmers. More importantly, the app could relieve the institution's time and budget constraints in collecting timely data for research activities. University stakeholders were engaged in creating a dairy app that better addresses contextual demands in dairy farming. The app's development was led by the ideate-prototype-test cycle. This iterative process was crucial to minimise the possibility of developing a CE tool to yield successful outputs. In this study, the co-creation of the Rwenzori dairy app emerged as a powerful strategy for fostering university-community collaboration. Moreover, stakeholders’ active participation in the app development process yielded valuable insights, resulting in a tool that addresses practical needs and reflects the essence of co-creation and shared ownership.

While during the development of the dairy app, stakeholders were enthusiastic about engaging in co-creation, interacting, and evaluating the app's actual features, functionality, and usability,
little was known about the factors that could influence the intention to use the app. The fourth study assessed factors that could influence rural farmers' readiness and intention to use the dairy app for university CE. In literature, the Technology Acceptance Model is a widely recognised framework for understanding users' acceptance of new technologies, including software applications like mobile apps. In this study, we proposed a broadened technology acceptance model to assess the readiness and intention to use the Rwenzori dairy app. Testing readiness and intention to use the app provided critical feedback on its usability, functionality, and overall readiness for adoption. The findings from this study signal a promising future for the successful implementation and use of technology tools in university CE initiatives. For instance, the significance of awareness and perceived usefulness of the Rwenzori dairy app suggests that the app successfully communicates its value to users, and users see it as a valuable tool or solution. This is a promising indicator for using the dairy app for university interaction with dairy farmers, as it may lead to higher user uptake, satisfaction, and overall CE success.

At the heart of our research lies developing a conceptual model of input elements that influence the CE process and outcomes. Input dimensions are essential to shaping the overall effectiveness and CE outcomes. This model integrates the insights gained throughout our previous studies and literature. The model included institutional, community, personal and professional elements that could influence the CE process and outcomes at both institutional and community levels. Our findings showed that institutional elements such as focusing on a shared understanding of the mission and values embedded in CE significantly influence a successful university CE process. The findings also showed the significance of professional elements to the CE process. Therefore, in this dissertation, we suggest that strategies to improve the university CE process should empower all engaged members to develop skills and competencies in CE. Delugan et al., (2014) noted that CE could be enhanced through capacity-building workshops for academics and community stakeholders.

Moreover, the significance of community elements such as perceptions and preparedness to engage in the CE process are essential aspects that can considerably influence the success, sustainability, and effect of university CE initiatives. When communities perceive engagement activities positively and are eager to join, it lays the groundwork for fruitful and mutually beneficial collaborations between institutions, organisations, and the communities they serve. Therefore, the developed model in this dissertation could serve as a framework to guide future university CE initiatives.
4. Significance and implications of the research
4.1. Theoretical contributions

In terms of theoretical implications, the five studies contribute to improving the understanding of the CE concept in an African college or university context. The results of this doctoral dissertation contribute in many ways to the current literature.

First, Chapter Two provides a comprehensive overview of how university CE has evolved and the key participants, applied theories, and general models intended to underpin it. Second, the chapter provides a better understanding of the critical components facilitating effective CE in HEIs. The systematic review chapter helps make current academic CE knowledge more transparent and reproducible.

The third chapter of the dissertation examined how engaged stakeholders perceived the concept of university CE. To the best of our knowledge, this study is the first to measure stakeholders’ perceptions of the benefits, opportunities and challenges involved in CE. Community engagement is driven by the expected benefits it brings, and creating opportunities for engagement is crucial. However, it is essential to recognise that CE involves challenges. Therefore, this chapter measured institutional stakeholders’ perceptions of CE subjectively based on potential benefits, opportunities, and challenges involved in the process. Each of these three key variables measuring stakeholders’ perceptions was measured in eight indicators. Therefore, The doctoral dissertation makes a theoretical contribution by suggesting and testing variables that can measure stakeholders’ perceptions of CE.

The fourth chapter addressed the crucial stages that characterise collaborative CE and knowledge creation with a focus on end-user involvement to clarify the requirements of a dairy app. The chapter also provides an incentive for the actual development process, and the collaborative results demonstrate the development process. Following the last three phases of the design thinking model opened new possibilities for collaborative knowledge creation in university CE initiatives.

Chapter 5 incorporates the awareness, normative influences, and readiness for the technology acceptance model to deepen the theoretical foundations of technology acceptance and use. This extension allows a more sophisticated understanding of user behaviour, contextual reasoning, multidimensional constructs, perspectives, and practical implications. This addition allows for
a more complex understanding of user behaviour, contextual factors, multidimensional constructs, perspectives, and practical implications.

Chapter 6 developed a conceptual model of input dimensions influencing effective university CE processes and outcomes. The proposed model complements one of the existing models (Wade & Demb, 2009) and is part of a more significant attempt to establish a contextual CE model suitable for rural colleges.

4.2. Empirical contribution

In Chapter 3, an empirical assessment of university stakeholders' perceptions and needs for CE was conducted. Findings from the analysis show that students, faculty members and community stakeholders perceived the benefits of CE. However, results showed limited opportunities for CE, and challenges hindered effective CE. The limited opportunities for CE suggest a gap between current and desired or expected levels of CE. Therefore, HEIs and policymakers need to be aware of the gaps in CE and understand the importance of addressing them. For instance, with limited opportunities for CE, institutions and policymakers must allocate sufficient resources to support and encourage CE activities. This could include providing funds and infrastructure to support collaboration between the institution and the community. Furthermore, the findings showed multiple needs for effective CE, including creating time, contact office and structure, financial support, and CE elements' follow-up, enhancing communication and information flow. Therefore, this new knowledge could be relevant for policy and HEIs CE actors to address the stakeholders' needs proactively.

Chapter four contributes to practical approaches by involving university stakeholders in developing a dairy app. The Chapter complements practical insight for implementing co-creation from studies like (Ribes-giner et al. 2016) and designing services with community stakeholders (Drain et al. 2017; Jaeger et al. 2012). The co-creation study resulted in an application that could be easily used by a local dairy farmer and could bring mutual benefits to the institution and the community by incorporating the viewpoints of multiple stakeholders, emphasising contextual relevance, and encouraging collaboration. For instance, it could be challenging for the University to design an appropriate app without dairy farmers' input. We thus support co-creation through the design thinking model for structuring university community engagement activities (Mirri et al., 2018; Trencher et al., 2017). Universities should
create democratic structures acknowledging community stakeholders' contributions when developing tools.

Chapter five makes the third contribution to this PhD dissertation. The chapter presents an empirical foundation for describing variables that predict intentions to utilise a CE engagement tool. Findings provides evidence of characteristics that encourage rural farmers to embrace digital tools in engagement programs. As a result, practitioners can improve the user experience, remove barriers, and increase acceptance and use of the technology tools such as the dairy app by considering the model relationships tested in this chapter.

The final contribution is derived from Chapter 6, where associations among constructs comprised a model of input dimensions that influence the university CE process and outcomes at institutional and community levels and were tested. The model partly stressed elements developed by Wade and Demb (2009) and incorporated the community dimension and outcomes at institutional and community levels. The literature hardly suggests a suitable model that HEIs can use in developing countries like Uganda to adopt effective CE. Testing the relationships between institutional, professional, personal and community dimensions and the university CE process provides evidence of key elements that affect CE in HEIs. Furthermore, testing the relationship between the University CE process and outcomes at the two levels provided empirical evidence of elements that could directly influence effective CE outcomes. Thus, adopting the proposed model may discourage HEIs from embarking on unproductive or messy CE efforts.

5. Limitations and suggestions for future research

This PhD dissertation produced diverse insights to understand the university CE in rural context. Nevertheless, the selection and implementation of different research methods in each chapter have limitations that need to be recognised, as some offer promising future research directions.

First, the dissertation's focus on a university (Mountains of the Moon University) and the Rwenzori community is a constraint. The choice of the Moon University mountains and the Rwenzori region of Uganda as the study location was explained in each chapter making the
results of the investigations applicable to regions with similar conditions as the study area. However, variances in institutional culture or priorities, community characteristics, regional context, and disciplinary focus may vary by place. As a result, duplicating this research in various geographic settings with different study designs and sample considerations could provide further data for understanding CE in universities.

6. General conclusion

In summary, the goal of this research was to provide an understanding of higher education community engagement in rural areas. Community engagement is remarkable for fostering relationships and bridging the gap between HEIs and their communities. CE works best when it yields mutually beneficial collaboration where members involved in the CE process could see the value and benefits of being engaged in any venture. Existing research and the studies from this PhD studies confirm that HEIs could play vital roles by stimulating communities to participate in solving challenges faced. To achieve this aggressive objective, it is fundamental for HEIs to prioritise, nurture, and incorporate this mission into research, teaching and all activities performed in the entire university. It is crucial that the entire university is aware and works to connect CE experiences in meaningful ways. While CE is strongly emphasised, establishing stakeholder perceptions is crucial for guiding CE initiatives. The importance of paying attention to community perceptions and assessments about how the community perceives ownership of engagement outcomes, which are vital in ensuring successful engagement interventions. Moreover, a better understanding of community perceptions about university CE can help guide a university CE practitioner in developing more effective engagement interventions, investment and advertising plans, and overall branding of the university.

In this dissertation, we demonstrate a practical intervention to co-create a dairy app with rural dairy farmers. The co-creation demonstrated that each stakeholder could contribute to many different aspects of the engagement process. At the same time, it shows that the whole strategy could fail if the end-users were not involved in the process. Thus, this dissertation promotes the active involvement of rural dairy farmers in the co-creation initiatives and University CE activities.
The critical role of university and community stakeholders in the CE is using the knowledge exchange theory. For instance, the living lab workshops in the co-creation of the diary app highlighted the role of each partner in the process. Moreover, involving the stakeholders in developing the Rwenzori dairy app was insufficient to predict its use. Finally, the PhD dissertation informs University CE. The model is developed through published studies and experience from the prior empirical studies in this dissertation. The model provides an expanded articulation of institutional, professional, personal, and community dimensions that influence the CE process and university outcomes at the university and community levels. We suggest that applying this model could inform university CE initiatives’ design, implementation, and evaluation and result in visible outcomes.
7. Reference


Fitzgerald, H., Bruns, K., Sonka, S., Furco, A., & Swanson, L. (2012). The centrality of


Engagement and Scholarship, 14(1). https://doi.org/10.54656/jgkp9815


Summary

This doctoral dissertation focuses on the higher education institutions' community engagement mission, explicitly focusing on the Mountains of the Moon University in the Rwenzori region of Uganda. The foundation for this doctoral research is the importance of community engagement in enabling higher education institutions to share skills and resources to solve community challenges. In developing countries such as Uganda, community engagement is still a challenging mission for universities. The overall purpose of this doctoral research was to understand university community engagement in a rural context. The doctoral dissertation combines five different yet connected studies regarding university-community engagement.

The first study (chapter 2) systematically reviews the literature on conceptualisation and models of community engagement in higher education institutions. The review aimed to determine how the articles explained community engagement theories, models and elements that foster successful community engagement outcomes. PRISMA was used to examine the primary conceptual and empirical studies. One hundred six articles published between 1998-2019 provided evidence that this research field has witnessed a gradual increase in publications related to university-community engagement. However, a description of the key characteristics of these studies revealed that most of the published literature is from developed countries such as the United States of America, and most were conceptual studies. A notable finding of this review, which influenced the doctoral research, was the importance of understanding the perceptions and needs of university CE stakeholders and engaging them in developing solutions to their challenges. This proposed a research agenda for subsequent studies in this doctoral dissertation.

Based on the review's insights, we noted that while stakeholders' perspectives and needs are crucial grounds for CE, but they are rarely examined. Therefore, the second study (chapter 3) examined engaged stakeholders' perceptions and needs for community engagement. A survey was used to collect data from three categories of stakeholders: dairy farmers, University faculty members and students of Mountains of the Moon University in the Rwenzori region of Uganda. Findings revealed that the dairy farmers, students, and academic staff perceived CE differently and identified multiple need. As a model for community engagement, dairy farmers benefit from sharing knowledge and skills to manage dairy farming as a profitable income-generating activity. On the other hand, students benefit by gaining practical hands-on skills they would
have missed through conventional teaching, and CE enhances faculty research skills and opportunities. Despite the benefits and opportunities associated, stakeholders identified several needs such as creating structures, time for CE, improving communication and adequate flow of information, and follow-up of CE ventures.

The fourth chapter demonstrates a co-creation process involving university stakeholders in developing solutions to their challenges and needs. This chapter explains a process where a sample of university stakeholders co-created a dairy application for university engagement with dairy farmers. The app's premise is to provide a low-cost engagement platform to benefit the institution and the dairy farmers. For example, the app makes it easier and more convenient for farmers to store daily farming information. Thus, the farmers can easily monitor, assess information, and make decision-making. Besides, using a dairy app would relieve the institution's time and expense restrictions for community engagement while also collecting relevant data for research, such as on diseases affecting dairy animals and the type of treatment given. Therefore, the chapter shows a collaborative community engagement process and knowledge creation with end-users. The chapter also provides a co-creation approach based on the design thinking model's ideation, prototyping and testing stages.

Having developed the dairy app, chapter five assessed factors that could influence rural farmers' readiness and intention to use the dairy app for university-community engagement. A broadened Technology Acceptance Model was used in this chapter. The intention to use the application was assessed with nine indicators: awareness, normative influence, readiness, self-efficacy, perceived ease of use, usefulness, hedonic attitude, utilitarian attitude, and intention to use the dairy app. The analysis findings strongly supported the anticipated relationships predicted in the research model.

The last objective in chapter five of this doctoral dissertation focused on developing and empirically testing a conceptual model to understand the input dimensions that influence the university community engagement process and outcomes. The model comprised four input dimensions: institutional, professional, or occupational elements, personal and community dimensions. The engagement process included faculty and community members' participation in activities, including engaged learning, research, and services. The model conceptually suggested that institutional, community, personal and professional dimensions influence faculty and community members' participation in university community engagement activities.
The model further hypothesised that participation in community engagement activities influences university- and community-level outcomes. Findings revealed that institutional, community and professional elements influence the university engagement process. Therefore, strategies to improve the university community engagement process should enhance institutional elements, focus on community dimensions, and empower all engaged members to develop skills and competencies that motivate their participation in community engagement.

From the above research objectives and findings, some of the empirical contributions of this doctoral dissertation are worth mentioning. From this doctoral dissertation framework, the stakeholder perception, needs, co-creating of a dairy app, and evaluating intention to use the dairy app are performed. In addition, the empirical studies in this dissertation were conducted in Uganda, contributing to new knowledge from a developing country viewpoint.

In addition, the doctoral dissertation develops and tests an essential model for guiding effective community engagement. The model demands a dedicated institutional community engagement structure and leadership to coordinate, promote and lead CE efforts. Resources regarding time, financial support, motivation, and professional development in community engagement should be considered to enhance community engagement outcomes. Placing more emphasis on engaged learning courses and embedding CE in university research activities are crucial to realise positive outcomes of the model. Moreover, professional development courses should enable faculty and students to adopt community-engaged teaching-engaged engaged research and actively involve co-learning and co-developing services for mutual benefits. Lastly, university CE efforts and strategies should not entirely depend on the goodwill of researchers and only on project funders. Still, the university should have a clear engagement plan to realise sustainability and change in the community.

Although this doctorate dissertation makes substantial contributions to the field, the overall interpretative capability of the findings is confined to university community interaction in a rural environment in Uganda. It is insufficiently reflective of university community engagement in other communities. As a result, additional studies on a broader representative sample should be considered to give more in-depth insights into the phenomena explored in this doctoral dissertation. For instance, in future research, a comparative study of community engagement approaches, strategies, and outcomes across multiple universities could be conducted to explore similarities and differences.
List of Publications


My life in Europe

The first picture was taken at the 11th European conference on Education (ECE2023) in London, the second was taken at my third arrival at VUB during Winter, the third picture was taken at 14th annual International Technology, Education and Development Conference (INTED2020) Valetia Spain. Followed by my visit to the London bridge, visit to the Atomium Brussel and the Roman bridge South of France. Below are the members I loved engaging with, the choir at Holy Trinity church Brussel, research teach and a lovely sisters.