Applying Living Labs in the design of emerging digital platforms –

a higher education case study in South Africa

Wouter Johannes Grové

A thesis submitted in partial fulfilment for the joint degree of
Doctor of Philosophy (PhD) in Information Systems at the
University of the Western Cape (UWC)
and Doctor in Media and Communication Studies
at the Vrije Universiteit Brussels (VUB), Belgium

Promoters:
Dr Johan Breytenbach, Department of Information Systems,
University of the Western Cape, South Africa
Prof Dr Leo van Audenhove, Department of Media and Communication Studies,
Vrije Universiteit Brussels, Belgium

23 September 2022

ABSTRACT

In this study, the Living Labs approach was evaluated as an approach towards co-creating the design and implementation process of specific digital artefacts. The design process of the ***UDUBSit*** emerging digital platform at a South African higher education institution (HEI) was simultaneously technological and social in nature, and it deeply reflected the underlying mechanisms and tensions inherent to the emergence of planetary-scale computation. The single case study analysis, conducted from a Critical Realist perspective, was the product of a four-year longitudinal research process focused on the development of a location-based, goal-focused mobile application as an intended emerging social networking platform and emerging digital platform. The emerging social networking platform has been developed using the Living Labs methodology, with a particular in-case focus on digital inclusion and online community building using mobile technology within the context of a higher education institution in South Africa.

The study contributes towards addressing the current gap in the extant literature at the intersection of Design Science Research (DSR), Digital Platform (DP) Design and the discourse around Living Labs (LL). At the same time, it also generates potentially useful insights to designers grappling with platform design challenges for online community building and engagement, specifically in a developing world context and a higher education (HE) context.

The contribution of this study to the Information Systems (IS) body of knowledge is defining *Emerging Digital Platforms (EDPs)* conceptually, and creating, refining and validating an analysis tool and conceptual model for the analysis of the application of LL within the context of the design of an EDP within the HE context in South Africa. In this regard, the *Emerging Digital Platform Lenses (EDP Lenses)* were proposed and applied to analyse three iterations of a (failure) case study of an EDP where the Living Labs approach was applied up to the end of the platform’s existence, focusing on co-creation and iterative design, and overcoming real-life barriers encountered. Based on our analysis and findings, we present a comprehensive set of *EDP design heuristics* that may improve future LL applications in a developing world EDP design context and a higher education context.

The process of developing this proposed design analysis tool over the three design iterations of the case, incorporated lessons learnt about digital inclusion, the user experience, end-user co-creation, platform institutionalisation, the capabilities and limitations of mobile technology in a platform design context, and user community engagement. Furthermore, critical and previously under-researched potential *design blind spots* and *forced pragmatic design compromises* surfaced, which may hamper the more effective application in a resource-constrained, developing world context and a higher education context. Our understanding of platform design gained from three design iterations and our analysis of the LL application process compelled us to critique the LL methodology, informing this emerging methodology with valuable insights and design heuristics. The study also engaged in a critical analysis of the theoretical intersection of the LL methodology (as an emerging theoretical area) and DSR.

Keywords: Digital Platforms, Co-creation, Living Labs, Design Science

Declaration

I declare that "Applying Living Labs in the design of emerging digital platforms – a higher education case study in South Africa" is my own work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

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Wouter Johannes Grové   Date: 2022-09-23

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Dedication

The Renaissance scholar, Rene Descartes (1596–1650), posited that, "if you would be a real seeker after truth, it is necessary that at least once in your life doubt, as far as possible, all things". The process of completing a PhD thesis does indeed make one continuously doubt all things, including yourself. Any academic journey, my father always taught me, is primarily an exercise in boxing with yourself. What I learnt during my journey is that this boxing match takes place in the dark, often at strange hours of the night, and often in strange coffee shops across the globe. Often life binds your arm behind your back every now and then, just to keep the challenge real, making the lessons deep and the instructions, comments and advice you receive from your promoters and mentors so much more meaningful. The words of encouragement from your family and friends then becomes so much more profound.

However, at the end of this journey, one can look back at it with a deep sense of wonder. Grappling with the impact of Digital Platforms (DP) on our society and design processes during the times of #FeesMustFall, the Covid-19 Pandemic, the 2016 US elections, the 2021 US Capital insurrection, and the ubiquitous adoption of mobile devices and mega-platform technologies on the African continent, has been a significant challenge, a humbling experience, but also a huge privilege.

I am forever grateful to my Promoters, Prof Dr Leo van Audenhove and Dr Johan Breytenbach, and the members of the PhD supervisory committee for the immense value they brought to this journey through their experience, their challenges of my assumptions, their insights, and their advice. I am also deeply grateful to my Western Cape CoLab and Institutional Planning colleagues, and Dr Leona Craffert and Larry Pokpas in particular, both from whom I am still learning valuable life lessons every day, as well as Prof Walter Claassen, for his wisdom and well-informed insights.

The opportunity to, every so often, spend some time in Belgium, having some distance from the challenges faced in townships and boardrooms in South Africa, has contributed to my aim of presenting a balanced view of both the opportunity and the risk of emerging Digital Platforms. These numerous and highly meaningful encounters were enabled by the Global Minds funding and

support from UWC that I received. Numerous discussions around lunch or a beer in Belgium, Botswana, Boston and Bellville informed and shaped my thinking around the wicked design challenges we face as a planet in harnessing digital technology for real social benefit. For that, I am eternally grateful to each colleague at Vrije Universiteit Brussel (VUB) (specifically at the Department of Communication Sciences—SCOM, as well as the Studies in Media, Innovation and Technology, imec-SMIT research group), and Ghent University's Research group for Media, Innovation and Communication Technologies (imec-mict). I would also like to express my gratitude to each colleague at UWC (at both the Department of Information Systems and the Western Cape CoLab, in particular). I also deeply appreciate the professionalism, dedication and attention to detail of my technical editor, Prof Annelie Jordaan.

I am furthermore eternally grateful to my wife, Suzanne, my children, Wouter, Carien and Riana, my parents, my brother Japie, my mother-law, and my extended family for their unwavering faith, support, patience and love.

This thesis is dedicated to all of you.

List of Abbreviations

AI:	Artificial Intelligence
API:	Application Programming Interface
CMS:	Content Management System
DCDT:	Department of Communications and Digital Technologies
DP:	Digital Platform
dtic:	The Department of Trade, Industry & Competition (previously dti)
DSR:	Design Science Research
DTPS:	Department of Telecommunications & Postal Services (now DCDT)
EDP:	Emerging Digital Platform
EU:	European Union
FOSS:	Free and Open-Source Software
GPDR:	General Data Protection Regulation
HE:	Higher Education
HEI/s:	Higher Education Institution/s
OECD:	Organisation for Economic Co-operation and Development
ICT:	Information and Communications Technologies
IS:	Information Systems
JS:	JavaScript
LL:	Living Labs
MVC:	Model-View-Controller framework
SDK:	Software Development Kit
SST:	Social Shaping of Technology
UWC:	University of the Western Cape
WoS:	Web of Science™

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Chapter 1 – Introduction and Context

The wave is not the water. The water merely told us about the wave moving by.

-R. Buckminster Fuller (1895-1983, American Inventor, Engineer, Poet, Mathematician, and Futurist)

1. Chapter Introduction

It may be argued that dealing with rapid and all-encompassing digital transformation and attempting to harness our own technological creations may be one of the most challenging design problems we, as humans, have ever faced. It may be on par with creating joint, implementable solutions to the large-scale environmental destruction and global climate change brought about (at least in part) by the rapid industrialisation of our species. It may even be on par with designing, managing and understanding an appropriate global response to the COVID-19 pandemic, where bio-medical and digital technologies are seemingly created as many complexities and questions as solutions. Just as large-scale environmental change and fast emerging and evolving pandemics have proven to be difficult to comprehend and highly complex to manage, the same can be said about digital transformation and the emergence of digital platforms (DPs) as socio-technical phenomena.

Digital platforms form a crucial part of the architectural foundations of the digital world we need to affect with our design choices. We need to have an impact on this world and South Africa in particular if we want to unlock the potential value-promise of digital technologies to assist in addressing our growing challenges of inequality and poverty. We also need to address the very real possibility that our design decisions are often only serving to exacerbate inequalities and divides, and that our attempts at empowering others through our design interventions do not always have the intended consequences we may have envisaged.

Bratton (2015) positions digital platforms within an emerging mega-structure of planetary-scale computation. Bratton argues that this accidental megastructure, which is simultaneously designed and designing, can be described as "the accumulative residue of contradictions and oppositions that arose to address other more local problems of computing systems design". Simultaneously, our design choices are increasingly limited by the hard constraints that our own technological creations place on our freedom to design and implement said design choices.

Throughout this study, we will draw attention to the way in which growing phenomena such as surveillance capitalism (Zuboff, 2019), data colonialism (Couldry & Mejias, 2019), and platform imperialism (Jin, 2013) seem to be driving the hardening of these design constraints faced by designers of emerging digital platforms. The more technology options designers seemingly have, the more concentrated these choices seem to be between large and dominant digital platforms' offerings.

Our view of the concept of *freedom of design* was influenced by Amartya Sen's notion of development being seen as expanding the real freedoms that people enjoy and removing major sources of unfreedoms (Sen, 1999). *Freedom of design*, as we operationally define it in this study, refers to evaluating whether the free and sustainable agency of designers of emerging digital platform designers (their *degrees of design freedom*, if you will) are increased or decreased during the phases of the platform design process. *Freedom of design* may be understood as the *degrees of freedom of design decisions* that a digital platform designer can make that have an observable effect on the design artefact.[1] Within the context of digital platform design decision-making, this refers to design decisions that can be freely made without violating any constraints imposed on the designer.[2]

The increasing role of digital platforms in our life, within a context of ubiquitous technological innovation, increasing complexity, rapidly accelerating change and more challenges in even recognising when we are interacting with digital technologies, challenges our fundamental assumptions around digital design as a process and how that can be used to empower users and create positive societal benefit.

An underlying assumption about design within Information Systems (IS) is that we are designing for primarily human users. Yet, the very nature of our humanity is currently being brought into question by rapidly changing technologically driven changes. It is estimated that 40,8% of global internet traffic is non-human (Imperva, 2020). The emerging post-humanist nature of the world around us is often brought to the fore even more by the stark contrast between our rather slow and fragmented societal responses and the ever-increasing real-time processing and predictive capabilities of digital

[1] In Chapters 2 and 3, we will discuss the fact that digital platforms are socio-technical systems. The operational definition should therefore be understood to refer to the *design artefact* as including both social and technical digital platform design decisions.

[2] *Degrees of Freedom* is defined as follows in the context of statistical inference: "Degrees of freedom refers to the number of items that can be freely varied in calculating a statistic without violating any constraints. Such items typically include observations, categories of data, frequencies, or independent variables. Because the estimation of parameters imposes constraints on a data set, a degree of freedom is generally sacrificed for each parameter that must be estimated from sample data before the desired statistic can be calculated" (Eisenhauer, 2011).

systems, best embodied in the dynamic power of dominant digital platform firms (such as Facebook, Google, Amazon, Baidu, Tencent, and Alibaba)[3].

This study attempts to understand in more depth the complex dynamics of designing a digital platform within a Higher Education (HE) context in an emerging economy. The case we examined particularly focuses on an HE context in South Africa. As we progressed through this study and the single case study we examined, it became clear that the positioning of Emerging Digital Platform (EDP) design within the Design Science Research (DSR) discourse needs to consider the hard and dynamic, but also the unspoken, sometimes cloaked or even invisible design constraints faced within resource- and capacity-constrained emerging economy contexts.

The limiting of emerging digital platform designers' *freedom of design* choices imposed by their dependence on foreign-owned mega-platform providers also directly impacts the value that platform users derive and expect to derive from their platform participation. Additionally, we have observed that it is especially vulnerable users and emerging platform designers (such as tech start-up founders) that sometimes, too easily, sacrifice their design freedom (unwillingly or as a result of perceived user benefit, seamless convenience, and frictionless design). Abusive practices such as dark patterns in digital design also come to mind. This potential for disempowerment concerns us, not only at present but also because digital platforms will become an integral part of our lives and the Higher Education environment.

Our study furthermore aimed to contribute modestly through an integrated view of the fragmented Platform Design field, which is at present a deeply multi-disciplinary endeavour informed by research in multiple fields, and by design practitioners and well-funded dominant platform technology providers moving at lightning speed because of market pressure, market opportunity and (often fragmented) regulatory responses that offer exploitable opportunities to scale faster and integrate deeper into our collective life world. We do not claim to be developing a fully integrated perspective of the platform design discourse at present, but rather, our focus is on making a modest attempt at creating a better understanding of emerging platforms within a very specific and limited context. Our study attempts to create a conceptual

[3] We will discuss the "ontological reversal" in IS that Baskerville, Myers and Yoo (2020) propose in more detail in subsequent chapters.

model that better reflects this dynamic design context. Our contribution focuses on informing not only the DSR discourse but also presenting platform designers, platform owners, platform end-users, and possibly regulators with a more nuanced view of platform design complexity in emerging economy HE contexts.

We also critically engage with the utility of Living Labs (LL), an increasingly utilised approach for involving platform stakeholders within the design process. Our study highlights certain weaknesses, blind spots, and forced pragmatic compromises, but also opportunities within the application of LL within the design context of Higher Education in South Africa, specifically the way LL informed the design process of an emerging platform in the South African Higher Education context.

We conclude by providing not only an integrated model aiming to inform alignment between DSR and LL literature but also presenting a practical toolset to platform designers, owners, users, and possibly regulators to generate more meaningful value from platform design projects in HE contexts in emerging economies.

2. Background and Research Context

Within the context of Higher Education Institutions (HEIs) in South Africa, strategic decision-makers are increasingly being confronted with the Digital Economy as emergent reality and strategic imperative. The imperative for competitiveness is an underlying premise of the so-called *fourth industrial revolution* (Schwab et al., 2015) and is a factor that increases the pressure on HEIs to deliver graduates that, as knowledge workers, can adapt to and positively influence the rapidly evolving, increasingly digital environment. The next section describes and analyses this context in more detail.

3. The South African Higher Education Context

The South African Government identifies digital technologies as a critical enabler of development in an increasingly networked world and recognises the imperative that all South Africans should be able to acquire and use knowledge effectively (National Planning Commission, 2012). The Digital Skills Strategy of South Africa (DTPS, 2019) sets out our national strategic direction as follows:

> "This strategy envisages a society of digitally skilled South Africans. This Digital Skills Strategy, prepared by the Department of Telecommunications and Postal Services (DTPS), sets out a structured series of initiatives intended to contribute to the capacities of South Africans to meet the challenges arising from the increasing deployment and adoption of digital technologies in economy and society, understanding that the digital revolution (using cloud technologies that enable big data; bringing virtual and augmented reality into a real world environment; introducing autonomous vehicles and drones; making Internet of Things, artificial intelligence, robotics and 3D printing part of everyday life) occurs within the context of the broader Fourth Industrial Revolution (working with advanced materials, biotechnology innovations, and the wider landscape of scientific innovation). The combined impact of these technology trends is having a substantial impact on the world of work, on schooling, education and research, individuals and communities."

HEIs have been described as being a key driver in the knowledge economy (Olssen & Peters, 2005), and it is expected of them to contribute to the future readiness of the country for the challenges posed by shifts in demand for competencies of graduates. The National Development Plan states: "The use of digital communication has changed society in ways that are not yet fully understood. It is clear, however, that young people have embraced the new media, and this represents a potentially powerful means of fostering social inclusion" (National Planning Commission, 2012).

In South Africa, there are currently 26 public universities and over a hundred private HEIs. For a comprehensive overview of the context of higher education in South Africa over the last 20 years, see Webbstock (2016). A reality that HEIs are increasingly forced to grapple with is the gradual deterioration of South Africa's international competitiveness, specifically as it relates to education and ICT (Schwab et al., 2015). The deterioration challenge has to be faced against the background of huge growth in student numbers, underfunding of the sector, rapid changes in student demographics, and the reality that student success is still skewed by race and previous educational background (Webbstock, 2016). Therefore, the HE context in South Africa is complex and dynamic, still coming to grips with significant apartheid-era structural barriers while also being asked to transform radically to remain relevant and have an impact on the digital economy, which as a boundaryless and highly dynamic market structure requires global competitiveness from all its participants to survive and thrive.

4. The Digital Transformation of Higher Education

Burbridge remarks that, "The world's economy is becoming increasingly knowledge intensive. This will drive further technological, societal and organisational change. A knowledge intensive economy gives the producers of knowledge — universities — a potentially key role in shaping our future" (Burbridge, 2017). The arena in which HEIs interact with the university community has become increasingly digitalised (Brown, 2015). Likewise, the channels by which students are making themselves, their opinions, their intentions, and what they value as future priorities known have also become increasingly digitalised (Brown, 2015). Social media consumption by the younger generations increasingly takes place on and through digital platforms (boyd, 2007). The notion of the knowledge economy and its link with societal development became commonplace, also within the context of Higher Education (HE) (Webbstock, 2016).

The World Economic Forum's *Global Agenda Council on the Future of Software & Society* launched a forward-looking survey report on Technological Tipping Points in March 2015. This report highlighted the increasing permeation of modern life by digital technologies, stating that the world is about to experience an exponential rate of change through the rise of software and services (WEF, 2015). CISCO refers to this new era in digital development as the Zettabyte era (CISCO, 2015b). Cisco (2015b projected that annual global IP traffic would grow past the zettabyte (1000 exabytes) threshold by the end of 2016 and reach two zettabytes per year by 2019. It bears mention that Intellectual Property (IP) traffic is growing fastest in the Middle East and Africa, followed by the Asia Pacific. "Traffic in the Middle East and Africa will grow at a CAGR of 44 percent between 2014 and 2019" (CISCO, 2015a).

Within the South African context, it is interesting to note the manner in which the term "Fourth Industrial Revolution (4IR)" coined by Schwab (2016) has dominated government discourse around digital transformation. This has also translated into Higher Education (see for example Gleason, 2018). It may be argued that the dominance of this discourse places additional pressure on HEIs to embark on digital projects and initiatives, as there is a significant political focus and momentum around this issue, for example, the creation of the Presidential 4IR Commission (as well as the intense and renewed focus on online work and learning in the context of the COVID-19 pandemic).

HEIs have increasingly been using digital platforms in external engagement, marketing and communication (Hanover Research, 2014). Digital technologies have also been viewed as a core strategic enabler of learning in HE, with a move away from only seeing it as IT Infrastructure but rather viewing it as digital learning environments (Brown, 2015). Social media platforms, in particular, have been developing as a more crucial component of the strategy by which institutions present themselves to prospective and current students (Hanover Research, 2014). Platforms, as socio-technical systems, manifest within the context of the network society (Castells, 2000, 2011, 2014; Van Dijk, 2006; Van Dijck, Poell & De Waal, 2018).

It has been argued that HEIs are not particularly good at collaboration for innovation (Burbridge, 2017). Burbridge further argues that universities have been battling to take full advantage of the seemingly significant advantages that the digital age offers them towards realising its claimed value propositions. According to Brown and Duguid in a 1996 article entitled *The University in the Digital Age,* the value of the university lies in the complex relationship it creates between knowledge, communities, and credentials (Brown & Duguid, 1996). The striving for institutional meaning by HEIs within the era of digitally driven change is hardly new and has been taking place since the 1970s (Brown & Duguid, 1996). They also emphasise the importance of the creation and growing of university communities over a simple *knowledge delivery* mindset:

> "The idea that communities are at the heart of what universities do and the experience their degrees represent may seem a heretical, wrong-headed, foolish, romantic, or simply anticlimactic answer. We want only to insist it's not a frivolous one.
>
> A community view, we suggest, allows a more rounded view of what learning, all learning, is and how it happens. A delivery view assumes that knowledge is made up of discrete, pre-formed units which learners ingest in smaller or greater amounts and in specialized settings until graduation or indigestion takes over" (Brown & Duguid, 1996).

The utilisation of digital technologies (and social media platforms in particular) has often been viewed as part-and-parcel of the "democratisation" of education. This techno-utopian perspective has been challenged recently, as events such as the Cambridge Analytica scandal, the Snowden revelations, the Panama Papers, and locally, the abuse of social media by Bell Pottinger as part of the so-called "Gupta-gate" scandal, have shown the potential risks of digital platforms in building cohesive, responsible online communities (ANCIR, 2017). The rise of disinformation in the 2020 US Presidential Elections has been partly ascribed to the rise of novel types of platform-user behaviour, such as what Kate Starbird from the University of Washington termed "participatory disinformation" (Beckett, 2021).

The complexity of the challenges facing HEI decision-makers and designers within this digital age is exponentially increasing as we hurtle towards (or are being hurtled through and by) the emergent realities of planetary-scale computation (Bratton, 2015). This necessitates HEIs to take a critical look at frameworks, models and methods that can benefit their attempts at creating inclusive impact in their ecosystems through the design and implementation of digital platform innovations.

5. Increasing Role of Digital Platforms in Higher Education

Technology is increasingly being positioned as an innovation driver within HEIs (Gastaldi et al., 2015). The accelerating rate of change of technological innovation presents HEIs with a myriad of strategic and operational level technology options between which they must design and create "solutions" to remain sustainable, relevant and competitive. These technologies also increasingly manifest in the form of digital platforms (Gawer, 2010; De Reuver, Sørensen & Basole, 2017) and platform-mediated digital networks comprise a large and rapidly growing share of the global economy (Eisenmann, Parker & Van Alstyne, 2011).

The role and impact of digital platforms, and social media platforms, in particular, have been prevalent in HEIs and have been analysed in a multitude of contexts. Ngai, Tao and Moon (2015) provide a detailed overview of recent social media research. It very quickly becomes clear that social media platforms are being appropriated and applied for a multitude of purposes, ranging from political activism to application in creating social good (Bresciani & Schmeil, 2012), digital social innovation (Bria, 2015), and various others. Although much emphasis in HE has been on the usage of social networks, it deserves mention that social media platforms are but one instantiation of the broader phenomenon of digital platforms. At its heart, the shift to digital platforms signifies a deeper shift to entirely new business models (Veit et al., 2014) within the networked society (Castells, 2011).

Digital platforms play an increasingly important role in the way South African HEIs engage with their ecosystems and stakeholders. Digital communication channels, hosted, mediated and amplified by digital platforms, are featuring more and more as the preferred channel for HE students to make known their displeasure at not being heard by HEIs, as experienced during, for example, the #FeesMustFall protests in South Africa (Grove, Breytenbach & Van Audenhove, 2018). It is however a reality that HEIs are finding it rather difficult to extract value from investments in platform design (see Guri-Rosenblit, 2005). Furthermore, it is a reality that platform projects often fail (Yoffie, Gawer & Cusumano, 2019). Therefore, because digital platforms as innovation interventions may require significant investments within these already resource-constrained HEI environments, the success of such design-driven interventions is becoming increasingly important. However, within the HEI context, digital platform design brings opportunities and challenges, which we aim to discuss and highlight throughout this study.

South African universities have been grappling over many years with the issues introduced by digital technologies within the Teaching and Learning context (Ng'ambi et al., 2016). There has also been an investigation of, for example, the problem of access to digital technologies within the context of distributive justice (Broekman, Enslin & Pendlebury, 2002). Designers within or appointed by HEIs need to respond to fast-paced and wide-ranging technological changes to unlock value and competitive advantage. These transformative technologies range from artificial intelligence, machine learning, intelligent automation and robotics to augmented and virtual reality. These technologies often manifest within or as part of digital platforms (Eisenmann, Parker & Van Alstyne, 2006).

Digital technologies have been viewed as a core strategic enabler of learning in HE, with a move away from only seeing it as IT Infrastructure but rather viewing it as digital learning environments (Brown, 2015). Social media platforms, in particular, have been developing as a more crucial component of the strategy by which institutions present themselves to prospective and current students (Hanover Research, 2014). Understanding Digital platforms become increasingly important within the context of higher education in South Africa. Increasingly, the impact of digital platforms is making itself felt in HEIs and seems to be asking new questions (or repackaging and adding new velocity, impetus and direction to old questions). From a management and leadership perspective, HEIs in South Africa are grappling with how the changing dynamics between the digital economy, digital technology, interactive social media platforms, and users are affecting their ability to build vibrant, innovative and cohesive campus communities. It further bears mention that the youth of today, together with their technological and platform preferences, skillsets (or deficits), and underlying assumptions about the intersection of digital technology and society, will become the societal leaders, academic leaders, decision-makers and citizens of tomorrow. As an example of an institutional response to this challenge, the University of the Western Cape[4]'s *Institutional Operating Plan 2016-2020 White Paper* states as follows:

> "Digital connectedness across a range of media is a characteristic of the 21st century University in a digital age. This connectedness facilitates rapid building of networks, efficient relationships with academic, industrial and community partners, rich internationalisation, making wider knowledge resources available, and providing for more frequent interaction between teachers and students. However, the constant connectedness of the digital world introduces significant skills challenges and requires new forms of social engagement. Failure to attend to these can readily result in digital exclusion and disaffection" (UWC, 2016).

The design challenge for modern universities is to strategically integrate the processes and activities of its methods and processes of connectivity that enable inclusive and dynamic communities.

As Bryant states:

> "The challenge for the modern university is to build this type of connectivity into the practices and strategic direction of the institution. From new arrivals experiences, through to curriculum design, learning, teaching and assessment, social interaction in and out of the classroom, infrastructure strategy and learning spaces and post-graduation processes, the ability of the learner, the academic, the administration and management, the employer and the community to interact, engage and maintain connections is central to the ability to flourish in the new environment" (Bryant, 2012).

The role of HEIs is increasingly one of providing access (often through digital or digitally hybridised means) to communities of scholars and practice. Furthermore, it provides a means of confirmation of a student's experience among these communities, which is becoming a more central task of higher education as learning does not take place independent of communities (Brown & Duguid, 1996). The HEI system should therefore aim to build communities of interactive, reflective learning and practice that remains

[4] This university is the site of the case study we describe and discuss in Chapter 6 onwards.

resiliently adaptable to the development of knowledge, skills, attitudes and networks to react to the future and act towards affecting it in positive ways. The development of the HE system must therefore focus on the expansion of access to and inclusion within communities and not be simply driven by a credential mindset (Brown & Duguid, 1996).

6. Scaling Digital Platforms: Balancing Potential and Risk

Digital platforms are ubiquitous in modern life. Both in economic and civic life, these socio-technical systems have encroached upon most facets of life, ranging from ordering food to spending our time by sharing life-events on social media, watching algorithmically recommended media content on YouTube or Netflix, or booking just-in-time transport via a mobile app. Our social interactions with each other are increasingly mediated by algorithmic means through platform architectures and interfaces. This ranges from our most personal forms of intimacy (personal relationships brokered through *Tinder*) (David & Cambre, 2016) to the advancement of government as a platform (Accenture, 2018).

Within the African context, there has been a significant proliferation of digital platforms (David-West & Evans, 2016; Makuvaza et al., 2018). The phenomenon of digital platforms emerging within the African context has been noted with varying degrees of scaling success (David-West & Evans, 2016) but also scaling challenges and failure (Rossotto et al., 2018). Emerging digital platforms in a developmental context often struggle with scaling sustainably and successfully (Ekekwe, 2015), with international platforms being more successful than African platforms in cross-border scaling (Makuvaza et al., 2018). We believe that international platforms and, mega-platforms[5] in particular, have been more successful at using their ability to leverage data extraction, data collection and data analysis to create predictive tools that can enhance generativity and so enable network effects.
African HEIs have recognised the potential of digital platforms as enablers, and resultant design products of ICT development have included extensive usage of Learning Management System platforms (Sakai[6]; Moodle[7]; Blackboard[8]

[5] The so-called FAANG platforms: Facebook (since October 28, 2021, known as Meta), Amazon, Apple, Netflix and Alphabet (including Google), but also the major Chinese platforms such as Baidu, Alibaba and Tencent.
6 https://www.sakailms.org
7 https://moodle.org
8 https://www.blackboard.com

and GetSmarter[9]); usage of research sharing platforms such as ResearchGate[10] or Academia.edu[11]; Social Media platforms (all South African Universities have a presence on either Facebook[12], Twitter[13], YouTube[14], LinkedIn[15]). This proliferation of platform adoption also extends to HEI stakeholders such as academics using Uber[16] or Lyft[17] during national or international travel. Platforms have entered classrooms (gamified engagement tools such as Kahout[18], Socrative[19] or Google Classroom[20]), graduations (live-streamed on social media channels) and academic presentations (live-streamed on YouTube or Facebook Live[21]).

The platform concept has also even been suggested as a concept to reframe university-business-government collaborations (Nyman, 2015). Platform value capture is predicated upon platform ownership and data ownership. The unequal ability of actors to extract value from digital platform-based technologies has resulted in what has been referred to as "platform imperialism" (Jin, 2013), resulting not only in economic dominance but also being ideological. Unequal flows of data and information, the lifeblood of value capture in the digital economy, results from platform hegemony, and emerging economies face significant socio-technical barriers in addressing its effects.

The converging raw genetic and technological data materials of this emerging form of capital accumulation has been referred to as "geno-digital spores" (Grove et al., 2019; Grove et al., 2021)[22]. Furthermore, digital platforms have increasingly been criticised for having negative societal implications, for example, it has been argued that platform-driven data collection has resulted in new forms of data-hungry economic and organisational mechanisms collectively termed Surveillance Capitalism (Zuboff, 2019). In South Africa, surveillance has been a long-standing presence for citizens (see for example

9 https://www.getsmarter.com
10 https://www.researchgate.net
11 https://www.academia.edu/
12 https://www.facebook.com/
13 https://www.twitter.com/
14 https://www.youtube.com/
15 https://www.linkedin.com/
16 https://www.uber.com/
17 https://www.lyft.com/
18 https://kahoot.com
19 https://www.socrative.com/
20 https://edu.google.com/intl/en-GB/products/classroom/
21 https://www.facebook.com/watch/live/
22 This work was written in the context of the Covid-19 pandemic and some of the observed ways in which the pandemic changed and accelerated our interaction with data-driven decision-making by digital systems (including platforms).

Kuehn, 2018's review of the work of Duncan, 2018). The global digital divide has become enlarged in large part because of the asymmetrical growth of platform technologies that are largely owned by developed countries and America in particular (Jin, 2013).

The increasing dependence of Higher Education on digital platforms was very starkly brought to the fore during the COVID-19 pandemic (see Zhou & Li, 2012; Murphy, 2020). Within the context of the COVID-19 pandemic, the use of digital platforms in the conducting of large-scale public surveillance has also been under scrutiny (see French & Monahan, 2020). Within HE contexts, the pandemic has also led to increased usage of some digital platforms such as Proctorio[23] to monitor student behaviour during, for example, examinations (Harwell, 2020). However, although the pandemic fuelled in increases in platform usage and mega-platform adoption, it did not lead to corresponding increases in emerging digital platforms being designed.

It is against this background that emerging African digital platforms' struggle for maturity and sustainable scaling is concerning. If emerging platforms in HE fails to scale and fails to meet design intentions, it only serves to strengthen and deepen existing inequalities and power asymmetries.

7. The Changing Role of the User in Higher Education

Social media consumption by the younger generations increasingly takes place on and through digital platforms (boyd, 2007). Per definition, HEIs focus extensively on undergraduate and post-graduate teaching and learning, innovation and research. It is a given that their user-base is primarily youth-focused. Rosen (2012a) refers to the increasingly active role of "the people formerly known as the audience". Rosen argues that we must take increasing cognisance of this changing dynamic in the nature of media consumption and, specifically, the shift towards expectations of user-involvement and user control. This increasingly participative culture presents various opportunities and benefits, but it also presents challenges and complexities to organisations (Jenkins et al., 2009).

It is crucial to understand the role of the platform user (and platform designers and/or owners) as being positioned within the political economy of digital platforms and digital data: "In an era where digital data are becoming

[23] https://proctorio.com accessed on 2021/07/26

an increasingly important element in the production of knowledge, wealth, and power, it takes radical solutions to ensure that digital data is not used to merely increase power and profits for the privileged" (Prainsack, 2020). As argued by Bria, user-driven innovation offers the opportunity to connect disruptive and cumulative innovation to achieve systemic innovation (Bria, 2014). Digital platforms can enable innovation and development by creating first and second-order network effects (Eisenmann, Parker & Van Alstyne, 2011) and can play a crucial role in creating, empowering and sustaining online communities (Spagnoletti, Resca & Lee, 2015).

It has become imperative for HEIs to understand design approaches that better reflect and leverage this changing dynamic - including users - in meaningful ways to create more adaptive, relevant systems for their stakeholder-base. The role of the responsible platform designer should therefore not neglect the fact that misuse of digital data and design principles can contribute to injustice and have negative implications for the wellbeing of people and societies.

8. The Changing Role of the Designer in Higher Education

The role of designer in the IS context of HE is subject to various tensions. **Firstly**, limited resources of HE institutions have been well-documented (Ng'ambi et al., 2016). On the other hand, the role of the traditional IT department in HE has changed significantly as these technologies have become more and more distributed and accessible within organisations (Czerniewiccz, Ravjee & Mlitwa, 2006). Just as HEIs need to become orchestrators of ecosystems rather than pipeline "knowledge-product" providers, the same can be said for the role of Information Systems practitioners, despite their often-limited capacity and resource constraints. The distributed nature of digital skills and the empowered nature of modern ICT users have disrupted the way HE needs to conceptualise their design-role.

A **second** powerful dynamic that influences the role of designers in HE is the fact that digital technologies have been said to contribute to the dehumanisation of HE (Hussein, 2009; Kahn, 2017). It has been argued that we should "program or be programmed" (Rushkoff, 2010). This gives an added impetus to designers to redefine the level of responsibility they have in their design endeavours.

A **third** dynamic is the fact that design itself is becoming dehumanised as digitally mediated design tools are gradually increasing the distance between the design process and the end-user humans that design should benefit from and be focused on. Design is challenged by the fact that our very understanding of what it means to be human is being challenged by rapid and comprehensive digital technological changes. In some of our previous work we have argued that this poses various challenges to IS design of, for example, knowledge management systems (Grove, 2018). The recent work of Baskerville, Myers and Yoo (2020) on the ontological reversal in information systems expands these arguments in further detail. It is becoming more and more important for designers to operationalise their understanding of what it means to be human and design for human benefit. In the words of Wittel:

> "It is important to stress however that the social can never be fully separated from the technological. Every medium is simultaneously technological and social. Technological structures and relations between human beings are interlocked and mutually constitutive" (Wittel, 2012).

It is also important that designers be aware of both the allure and the risks of so-called *dark pattern design* (see for example Gray et al., 2018). Designers need to challenge the often-accepted Silicon Valley informed narrative that design *per se* is good. Designers of digital platforms making use of artificial intelligence, machine learning and/or neural networks will increasingly be confronted by the question whether they are designing or being designed, as argued by Bratton (2015).

9. Platform Design in HEI as Driver of Innovation

The term innovation covers immense territory (Gregor & Hevner, 2014). In the next section, we will aim to contextualise (i) the changes in the role of HEIs within processes of innovation, (ii) how this may affect the design of emerging platforms, and (iii) how it serves to underscore the increasing importance of the user. Gastaldi et al. (2015) call the current decade the fourth Higher Education innovation era, in which HEIs become "orchestrators of continuous innovation ecosystems". In this era, the developmental potential of HEIs on the level of ICT hinges predominantly on their ability to design such ecosystems: locally relevant, socially embedded digital platforms that facilitate continuous innovation (Avgerou, 2010). Against the reality of emerging platform imperialism (Jin, 2013), this is no simple matter. Platform imperialism refers to the hegemonic power of specifically American digital platforms, which, through capital accumulation, controls non-Western countries. Therefore, it may be safe to say that American imperialism has continued with platforms (Jin, 2013).

HEIs need to innovate continuously to ensure they remain relevant to society, and this innovation increasingly takes place by means of the design and utilisation of digital systems. It has been suggested that "in some way, higher education is standing on a precipice, whether to disappear into the abyss of irrelevance or to take off soaring to new heights in an ICT revolution is not necessarily clear" (Webbstock, 2016). In HE, the continuous innovation landscape (which is also one of the key areas of inter-institutional competition in HE) has been shaped over the last three decades by three eras (Gastaldi et al., 2015).

In the pre-Internet 1990s, the landscape was characterised by centralised inward-looking innovation systems (closed innovation) in which collaboration was focused mainly on formalising agreements with supply chain partners (Gastaldi et al., 2015). In the second era (2000s), which also coincided with an increasingly digital economy, organisations progressively started opening some boundaries in externally focused open innovation (Gastaldi et al., 2015). Gastaldi identifies the third era (2010s) as that of Open Collaborative Ecosystems (OCEs):

> "OCEs are based on principles of integrated collaboration, co-created shared value, cultivated innovation ecosystems, unleashed exponential technologies, and extraordinarily rapid adoption. They also capture the elemental characteristics of the constant transformation of network ecosystems: the continual realignment of synergistic relationships of people, knowledge and resources for both incremental and transformational value co-creation (Ramaswamy & Gouillart, 2010, cited by Gastaldi et al., 2015).

The need for responsiveness to changing internal and external forces makes co-creation an essential force in a dynamic innovation ecosystem (Russell et al., 2011, cited by Gastaldi et al., 2015). In the third era, borders are constantly blurring, formal and informal networks interplay, organisations and individuals have multiple memberships to dynamic and evolving structures" (Gastaldi et al., 2015).

Of specific significance to HEIs, in their grappling with the issue of a multiplicity of digital platforms emerging within their institutional landscapes is the fourth era that Gastaldi identifies. The role of HE in this era may move more toward becoming "orchestrators of continuous innovation ecosystems" (Gastaldi et al., 2015), and Gastaldi paraphrases Dhanaraj and Parkhe (2006) in defining orchestration as the set of deliberate actions to create and extract value from a CI ecosystem. In this ecosystem, they argue, significant enablement roles will be played within the realm of IT resources, IT capabilities, IT investments, operations support systems as well interpretation support systems (Gastaldi et al., 2015). Therefore, HEIs will not only be required to engage with digital platforms (as a critical form of digitally mediated engagement very prevalent in Gastaldi's third era) that they design themselves and those that they buy or appropriate, but also those that they inherit through their increasingly transversal collaborations with its broader innovation ecosystem. The university ecosystem also does not exist in isolation from the dynamics, structural fluidities and rigidities of the planetary scale computational Stack (Bratton, 2015) and may therefore be impacted (often simultaneously) by both its design and designing.

Within the HE context, it is of critical importance for digital platforms to remain innovative and relevant to fast-changing contexts and external environmental factors. It is key for HE organisations to acknowledge that, "the need to find a solution to the tensions between exploration and exploitation cannot be properly addressed if organisations and individuals do not keep track of changes occurring in the surrounding environment" (Gastaldi et al., 2015).

Within the South African context, designers also need to be aware of the risks related to the so-called "Digital Divide". This divide relates to inequalities in motivation, physical access, digital skills and different usage (Deursen & Van Dijk, 2014). Recent polemic around digital platform design decisions and its impact on increasing inequities have been widely covered in the press and by researchers, for example, election meddling in Nigeria (Nwangwu, Onah & Otu, 2018) and Russia (Badawy, Ferrara & Lerman, 2018), algorithmic bias (Burgess, 2018; Katell et al., 2020), and the need for the establishment of "new" legal rights to protect vulnerable populations, such as the *right to reasonable inferences* (Wachter & Mittelstadt, 2019) and the (quite controversial) *right to be forgotten* (Rosen, 2012b; Mantelero, 2013; Weeks, 2013; Lomas, 2018)

It would also be naïve of HEIs to fail linking the arguments and actions of their diverse and dynamic student communities (such as that expressed by the

2015 #FeesMustFall[24] student protest movement, which can be viewed as a seminal event within the digital transformation journeys of the HEIs in South Africa) to the broader political contestation of the national arena. The technology design issues touched upon, for example, observed digital technology-focused machine breaking during these protests (Grove, Breytenbach & Van Audenhove, 2018), may be indicative of a larger societal disconnect rather than just localised manifestations of discontent. As argued by Stellenbosch University's Prof Nico Cloete, it is not only universities that are on a knife's edge, but it is the country as a whole and "the universities – with their strategic location in the contestation for resources (both material and social capital) – are merely a symptom" (Cloete, 2016).

The emergence of digital platforms within the context of higher education (HE) in South Africa presents increasingly complex challenges to decision-makers, policymakers and information management professionals. Although social media platforms are often viewed as the main exemplification of digital platforms, it is important for Higher Education Institutions (HEIs) to know that the impact of the digital platform business model has a much deeper societal implication than this. This is powerfully argued through, for example, the work of Jin on platform imperialism (Jin, 2013), as well as within Bratton's (2015) concept of the emergent accidental mega-structure of "planetary scale computation", which we discuss in some more depth in **Chapter 2**.

The design challenges posed by the emergence of digital platforms therefore clearly (and sometimes even forcefully) assert itself onto the HEI executives' and decision makers' agenda and probably will increasingly manifest in the foreseeable future. The design of scalable, sustainable, locally relevant and societally responsible digital platforms within the context of HEIs is, however, fraught with challenges and presents a "wicked" design problem". We will discuss this in more detail in the next section. The constrained context in which South African HEIs need to engage with these deep transformation challenges and the "co-evolution of the universities with their societal environments has a thousand-year history, but a challenging near future" (Nyman, 2015).

[24] We discuss in more detail the #FeesMustFall protests that took place in South Africa as a recent and relevant example of a *wicked design problem* in IS in Chapter 1 Section 11.

10. Designing Digital platforms in HEIs as a 'Wicked Problem'

The design and implementation of locally relevant digital platforms present a myriad of complexities, including, for example, the technical and technology choices required, digital skills and capacity needed, both by end users and by HE *Information and Communications Technology* (ICT) departments, as well as the change management processes required to successfully institutionalise, adopt, scale and maintain technologies.

It may be argued that designing digital platforms in the South African HE context may start exhibiting more and more of the characteristics of a *wicked problem*, especially against the background of the increasing complexities of a distressed economy, political uncertainties, social discontent (i.e., #FeesMustFall protests) and the various societal processes all these tension-drivers have catalysed and those it reflects. It also seems that the design process itself presents a *wicked problem*. In solving *wicked problems*, the solution of one aspect may often reveal other, possibly more complex, problems (Sanders & Stappers, 2008). *Wicked problems* refer to problems characterised as having (Hevner et al., 2004):

- Unstable requirements and constraints based on ill-defined environmental contexts
- Complex interactions among subcomponents of the problem
- Inherent flexibility to change design processes as well as design artefacts (i.e., malleable processes and artefacts)
- A critical dependence on human cognitive abilities (e.g., creativity) to produce effective solutions
- A critical dependence on human social abilities (e.g., teamwork) to produce effective solutions

Within the context of information systems, both practice and theory grapple with the rather blurry intersection between the design, implementation and utilisation of digital platforms (Sun, Gregor & Keating, 2016). Design science has been advanced as an IS research approach that may offer the potential of closing the utilisation and relevance gap between IS research and IS problems (Carlsson, 2007).

Unlocking the seemingly high potential value of digital technologies is however not a simple exercise. See for example Heeks (2009) and Walsham (2017). The increasingly participative culture presents various opportunities and benefits, but it also presents challenges and complexities to organisations (Jenkins et al., 2009). Some of the challenges include what Jenkins et al. (2009) refer to as the *participation gap* (mainly centred around issues of unequal access); the *transparency problem* (challenges to young people in learning to recognise the ways that media shape perceptions of the world); and the *ethics challenge* (the breakdown of traditional forms of professional training and socialisation that might prepare young people for their increasingly public roles as media makers and community participants).

The role of increasing digitisation, often through the means of digital platforms, in changing the organising logic of digital innovation has also been emphasised (Yoo, Henfridsson & Lyytinen, 2010). Therefore, HEIs need to revisit their underlying assumptions of innovation architectures and design processes continuously.

The field of the Social Shaping of Technology (SST) (Mackenzie & Wajcman, 1999) provides a useful lens to analyse the interaction between the design of emerging technologies and the societies into which they are introduced. The increasing body of knowledge around this topic has been examining not only the effects of technologies, but also both the content thereof and the innovation processes employed in its creation and development (Williams & Edge, 1996). One of the crosscutting themes within the broader literature around SST is the insistence that the *black boxes* of technology must be opened to allow the socio-economic patterns embedded in both the content of technologies and the innovation processes to be exposed and analysed (Williams & Edge, 1996). The SST literature generally critiques *technological determinism*, also in terms of how it views the role of design within the innovation process (Williams & Edge, 1996). Within SST, the negotiability of technology is emphasised, as there is scope for particular groups and forces to shape technologies to their particular ends, resulting in potentially different kinds of outcomes (both socially and technologically) (Williams & Edge, 1996).
A second useful concept within SST is the notion of *irreversibility*, specifically the way earlier technological choices shape subsequent development and foreclose certain choices (Williams & Edge, 1996). The cumulative nature of entrenched choices in the development of particularly shaped social and technical infrastructures may result in a *lock-in* to established solutions, which, although possible to reverse, is onerous and complex (Williams & Edge, 1996).

SST stands critical toward the linear models of innovation that relate to innovation as a one-way flow of information (Williams & Edge, 1996). The criticism also extends to public technology policies based on these linear conceptions of innovation, assuming that technology development follows separate linear phases and the underlying *privileging of technological supply* (Williams & Edge, 1996).

It is our contention that the design and appropriation of digital platforms within HEIs can benefit from critical discourse around the extent to which current technology innovation is still driven from a techno-determinist viewpoint rather than listening to and empowering users.

11. #FeesMustFall – Example of Wicked Design Problem in Higher Education

We will be briefly highlighting a particularly interesting and relevant example of such a recent challenge, namely the 2015-2016 #FeesMustFall protests at South African HEIs, as it effectively highlights some of the key contextual challenges and *wicked problems* that the design of digital platforms in HEIs in South Africa faces. It also forms a part of the design context of the case study we present in **Chapter 6**.

Since October 2015, HEIs in South Africa have been faced with mass student protests under the banner of the #FeesMustFall campaign (Karodia, Soni & Soni, 2016). The #FeesMustFall movement has highlighted the growing role of social media, specifically social networking platforms, in influencing and shaping higher education communities in South Africa (Schlebusch, 2015). This example is of particular interest to us because of the central role of digital platforms therein. It is also interesting as a contextual side note, as the case study we are examining (see **Chapter 6**) was developed partly within the time span and context of these protests and the introspection, polemic and debate the protests ignited within South African HEIs.

A Washington Post article dubbed October 21, 2015, as a watershed moment in the realm of media consumption in South Africa. It has been identified as the date when "mainstream media became old in South Africa. It was the day the hashtags took control" (Jacobs & Wasserman, 2015). It has been argued that the hashtag student movements can be described as "internet-age networked student movement, insofar as the use of internet-based communication by students (and other actors), in particular the use of social media platforms such as Twitter, WhatsApp, Facebook, Blogs, YouTube, and Cloud-based services, signals the advent of a new way of mobilising and organising student political power" (Luescher, Loader & Mugume, 2016).

During the #FeesMustFall protests, students extensively used social media to garner support for their cause, make their viewpoints known, and discuss and report on the protests. Eyewitness News reported more than 140 000 tweets worldwide with the hashtag #FeesMustFall on one of the first days of the protests (Camilla Bath, 2015). The unprecedented action from some HEIs in South Africa of obtaining court interdicts against the #FeesMustFall hashtag and its usage paradoxically acted as a driver for its utilisation (Peterson, Radebe & Mohanty, 2016).

It has been argued that "#FeesMustFall" has been using social media to subvert traditional media (Thomas, 2015). The #FeesMustFall protests and its extensive use of digital platforms, as well as the fact that student activists have focused on developing and using their own platforms for communication and mobilisation of support, corresponds with the view that the widespread adoption of social media in activist movements signifies a new phase in the development of alternative communication (Poell & Dijck, 2015). It also served to reduce the student reliance directly on traditional mainstream media. These dynamics have a huge potential impact on the manner in which HEIs view, appropriate, utilise and adapt the role of digital technology (in this regard, see Grove, Breytenbach & Van Audenhove, 2018).

During the #FeesMustFall protests, several incidences of seemingly Luddist *"machine breaking"* occurred (Rand Daily Mail, 2016; SABC News, 2016). Digital technologies that were utilised to amplify and even drive some of the narratives around the protest movement, specifically targeted for damage by protestors. This seeming paradox is one of the various aspects of HEI communities' interaction with increasingly prevalent digital platforms that is not yet well understood (Grove, Breytenbach & Van Audenhove, 2018). It is also yet uncertain whether these interactions should be classified as symptoms, root-cause manifestations, drivers or randomly meaningless actions within the complex interplay between HEIs, their technologies, digital platforms and their stakeholder bases.

The #FeesMustFall activist movement has highlighted the growing role of social media, specifically social networking platforms, in influencing and shaping HE communities in South Africa (Schlebusch, 2015). It has furthermore highlighted the viral ability to spread information at a high pace and velocity. The #FeesMustFall protests also served to amplify in the public domain the severe challenges that many HE institutions are facing. It has also emphasised the potential of digital platforms to possibly drive rumour, innuendo and perpetuate inaccuracies at a scale and tempo previously not known within the context of HE in South Africa.

Virtual communities have been described as complex and evolving socio-technical systems (De Moor, 2005). Therefore, it is increasingly necessary for HEIs to gain a more comprehensive insight into the past, present and future of digital platforms. It has also been argued that intellectual engagement with the so-called "hashtag student movements" in South Africa is important within the context of the South African HE sector (Luescher, 2016). One of the key themes from protesting students was that HEIs are not listening to them (Irvine, Foran & Lezra, 2016). This seems like a simplistic argument, but we are of the opinion that it may be one of the various symptoms that indicate that within the arena of HE, student engagement is fundamentally changing. Seemingly, there is disconnect between the application of digital technologies (i.e., social media platforms) by HE institutions for *"talking to"* students and *"listening to"* students.

It is our argument, supported by our literature reviews **(Chapters 2 & 3)**, that more sensitivity to the social shaping of technology in the design of digital technologies (specifically digital platforms) within the HE context, as well as more focus on open innovation and user-innovation (approaches with an inherent focus on "listening" rather than only "talking"), may play a positive role in preventing an even more disconnected future.
Building digital platforms (DPs) within the contextual background of #FeesMustFall is a *wicked problem,* as evidenced by, for example, the highly complex interactions among subcomponents of the problem as well as the critical dependence on human cognitive and social abilities to produce effective design solutions. A further factor complicating the emerging platform design challenge in HE contexts is digital inclusion, not just as design goal but also as contextual reality.

12. Platform Design in HEI and Digital Inclusion

Digital platforms have been observed as often being a channel of first access to digital inclusion within the context of HE (Gallardo-Echenique, Marqués-Molías& Bullen, 2015). However, *digital inclusion* is a multi-dimensional concept that also needs to take cognisance of, amongst others, the interaction between offline exclusion and online digital inclusion, with the latter mediated by aspects such as access, skills and attitudinal or motivational aspects (Helsper, 2012).

Within the application of digital platforms in HEI contexts, specifically in South Africa, the realities of digital inclusion maturity become an important potential factor affecting the design process and context. In this regard, the locally developed DSFOne[25] framework may provide a useful comprehensive framework of digital skills required by organisations and their stakeholders to be more competitive in the digital economy (Claassen, 2017, 2021). Although it has not been conceptualised as a maturity framework, it may be argued that it can potentially form the basis of the development of maturity models for different sectors. Additionally, it may offer some interesting possibilities as a tool to map the digital skills required to design, access, apply and derive value from digital platforms.

A further digital inclusion-related design challenge is the creation of inclusive virtual communities in the HE context. Virtual communities are complex and evolving socio-technical systems (De Moor, 2005). Online communities, at its heart, is about more than technological infrastructure and underlying systems, as the overall system is now a social one (Whitworth & De Moor, 2003) and can be defined as "not just a set of individuals, but a form of self-sustaining social interaction that endures" (Whitworth & De Moor, 2003).
Understanding online communities and human interaction with them, Information Systems research has expanded from individual usability and dyadic computer-mediated communication as perspectives to a focus on virtual communities (social groups)(Whitworth & De Moor, 2003). Inclusive design with HE contexts therefore presupposes a focus on the social group as a key unit of analysis.

Another definition of *communities* is that which comprises the enduring interpersonal relations that form around shared practices: "People come to share the same community by sharing the same tasks, obligations, and goals" (Brown & Duguid, 1996). It is interesting to note that the stated purpose of the digital platform case that we are examining in this study was expressly stated to build a trusted university community (see **Chapter 6**).

[25] https://www.wcapecolab.org/dsf1

The design of inclusive HE online communities acting as effective enablers of social and digital inclusion is characterised by complex tensions between subcomponents of the problem (as witnessed in, for example, the #FeesMustFall machine-breaking examples previously mentioned), as well as unstable requirements and dynamic constraints and has a crucial dependence on human social abilities to produce effectively functioning digital platforms. It may therefore be characterised as a *wicked design problem*.

The field of DSR in Information Systems, which is fundamentally a problem-solving paradigm, is particularly interested in solving *wicked problems* (Pries-Heje & Baskerville, 2008). A *wicked problem* cannot be approached without engaging with considerable uncertainty (Pries-Heje & Baskerville, 2008). To deal with *wicked problems,* which are characterised by conflicting values of decision makers, poor formulation and confusing dynamics, Pries-Heje & Baskerville (2008) suggested a design theory nexus, defined as a set of constructs and methods able create models that connect numerous design theories with alternative solutions.

The following guidelines have been suggested to determine whether DSR is suitable for particular research problems (Gleasure, 2013):

- **Guideline 1:** An IS research problem is *wicked* when the prescriptive aspect of that research problem is less mature than its descriptive or normative dimensions.
- **Guideline 2:** An IS research problem is *wicked* when causal factors affecting the problem variable are difficult to identify and/or isolate.

- **Guideline 3:** An IS research problem is *wicked* when mediating influences and interactions between causal factors affecting the problem variable are difficult to identify and/or isolate.

The complexity, novelty, multiplicity of actors and multiplicity of potential design goals of digital platform design in the HE context in South Africa position it clearly as a *wicked problem.*

13. Living Labs as Promising Approach to Overcoming Limitations

In the *Organisation for Economic Co-operation and Development* (OECD) context, LL has been identified as a key tool and potential lever in the process of accelerating and deepening university-industry innovation collaboration, and this has been a response to shifts that occurred in the strategic discourse between government, industry and universities (Burbridge, 2017). Furthermore, LL has been identified as a promising approach to the design of more inclusive technology solutions in a South African context (Herselman, Marais & Pitse-Boshomane, 2010; Coetzee, Du Toit & Herselman, 2012; Parker, Wills & Wills, 2013; Callaghan & Herselman, 2015).

According to the integrative definition proposed by Era and Landoni (2014), LL can be defined as a design research methodology aimed at co-creating innovation through the involvement of aware users in a real-life setting. Key elements that flow from this definition are user empowerment through co-creation and deliberative user awareness. This presupposes deliberate attempts by designers to involve users, share relevant information and actively co-create solutions to challenges in an iterative fashion through active experimentation in a real context.

Against the background of the various and varied current debates in the South African Higher Education ecosystem (see for example Allais, 2016; Case, 2016; Essop, 2016; Hall & Tandon, 2017), LL may present a promising strategic response to deepening and enhancing the societal relevance of investments in collaborative innovation.

Although LL seems to have potential to empower users in design processes in this context, our literature review (see **Chapters 2 & 3**) indicated that limited work has been done at the intersection points of the design of emerging DPs and LL within a HE context in South Africa. We aim to address that gap with this study.

14. Research Problem

The design of LL within the context of the development of emerging digital platforms is not very well understood against the background of current debates in DSR. See for example Thakurta et al. (2017), for a discussion of some of the current debates in DSR. Our literature review (see **Chapters 2 & 3**) further highlights a lack of focused research at the intersection of DP design research, LL research and DSR. The intersection between LL methodologies and Design Theory in Information Systems is not particularly clear at present.

15. Research Questions

The core question we would like to answer is:

How can Living Labs be applied in the design of emerging digital platforms?

We will be investigating an HEI case study in SA (described in **Chapter 6**). The ***UDUBSit*** mobile application is a particularly interesting example of a struggling emerging digital platform battling to scale and grow. In fact, the project has been terminated because it did not manage to gain scale and lost its generative momentum.

The application was developed by means of applying the LL methodology and gives us an opportunity to evaluate the following sub-questions critically:

How does Living Labs inform the design of an emerging platform?

Sub-questions:

- *How does Living Labs inform the object design of an emerging digital platform?*
- *How does Living Labs inform the realisation design of an emerging digital platform?*
- *How does Living Labs inform the process design of an emerging digital platform?*

The sub-questions were developed based on the three different design decisions IS professionals make when developing IS initiatives (Van Aken, 2004), which have previously been applied within IS design research from a critical realist perspective (Carlsson, 2005).

As Carlsson (emphasis added) explains:

> "Using van Aken's (2004) classification we can distinguish three different designs a IS professional makes when developing an IS-initiative: 1) **an object-design**, which is the design of the IS intervention (initiative), 2) **a realisation-design**, which is the plan for the implementation of the IS intervention (initiative), and 3) **a process-design**, which is the professional's own plan for the problem solving cycle and includes the methods and techniques to be used to design the solution (IS intervention) to the problem. IS design science research should produce knowledge that can be used by the professionals in the three types of designs" (Carlsson, 2005)[26].

[26] This classification was originally stated in van Aken and van Aken (1994: 20): "Een ontwerp is een model van een te realiseren entiteit of proces. Met objectontwerp wordt bedoeld een model van de realiseren eindsituasie en met

This analysis and the *Emerging Digital Platform Design Lenses* that we developed (**Chapter 4**) assisted us to comment critically on the contribution of LL to EDP design in an HE context (**Chapter 7)** and suggesting a set of *EDP design heuristics* as recommendations (**Chapter 8**).

16. Aim of the Study (Purpose)

This study aims to analyse the case of the ***UDUBSit*** project at the University of the Western Cape, a potentially revelatory longitudinal case of an attempt at designing and implementing an emerging digital platform in HE as part of developing and refining a conceptual model of applying LL in the design of emerging digital platforms. Firstly, we will briefly highlight the challenges and questions it introduces in the applied context before we summarise some of the challenges it presents to academic discourse, within Design Science Research in particular.

Utilising a case study approach, the purpose of this study is to understand the application and potential utility of the Living Lab approach in the design of a goal-focused, location-based digital platform within the time-bound context of a South African higher education case. As evidenced through our Literature Review in **Chapters 2 and 3**, this is a largely under-explored area within DSR. The case study also forms the basis of a critical analysis of the theoretical intersection of LL (as an emerging theoretical area) (Era & Landoni, 2014; Ballon & Schuurman, 2015; Schuurman, De Marez & Ballon, 2015) and Design Science Research (DSR), which can be described as having a more mature theoretical basis at present (Peffers et al., 2007; Gregor & Hevner, 2013; Livari, 2014).

Our research strategy was to conduct a *single case, embedded design, explanatory case study,* as defined by Yin (2014). The further intention is to develop a conceptual model that can potentially inform future applications of LL, taking into account the complexities around the generalisability of single case study designs (Eisenhardt, 1989; Eisenhardt & Graebner, 2007).

realisatieontwerp een model van het realisatie process. Met procesontwerp wordt bedoeld een model van het ontwerproces zelf, zoals bijvoorbeeld de wijze waarop de ontwerpspecificaties tot stand zullen komen, hoe en door wie gegewens verzameld zullen worden, hoe en door wie het ontwerpproces zelf zal worden uitgevoerd (voor zover dat te voren ontwerpen is), hoe de besluitvorming over de projectresultaten zou moeten lopen, enzovoort".

We approach this study from a critical realist perspective (see **Chapter 5**). Our focus is to gain a better understanding of the underlying mechanisms that combine in order to cause changes in the observable reality, and this leads us to use Bhaskar's *Critical Realism* (CR) (Bhaskar, 2008) as an appropriate paradigmatic starting point and lens for our investigation. Critical realism focuses on providing "clear, concise, and empirically supported statements about causation, specifically how and why a phenomenon occurred" (Wynn & Williams, 2012).

This study is approached with sensitivity towards the role of the researcher (who was also a project manager of the case under analysis for a part of the project's lifecycle), and we acknowledge the potential biases this introduces, some of which are highlighted by Carlsson (2005).

17. Research Approach

Our research approach is outlined in **Figure 1.**

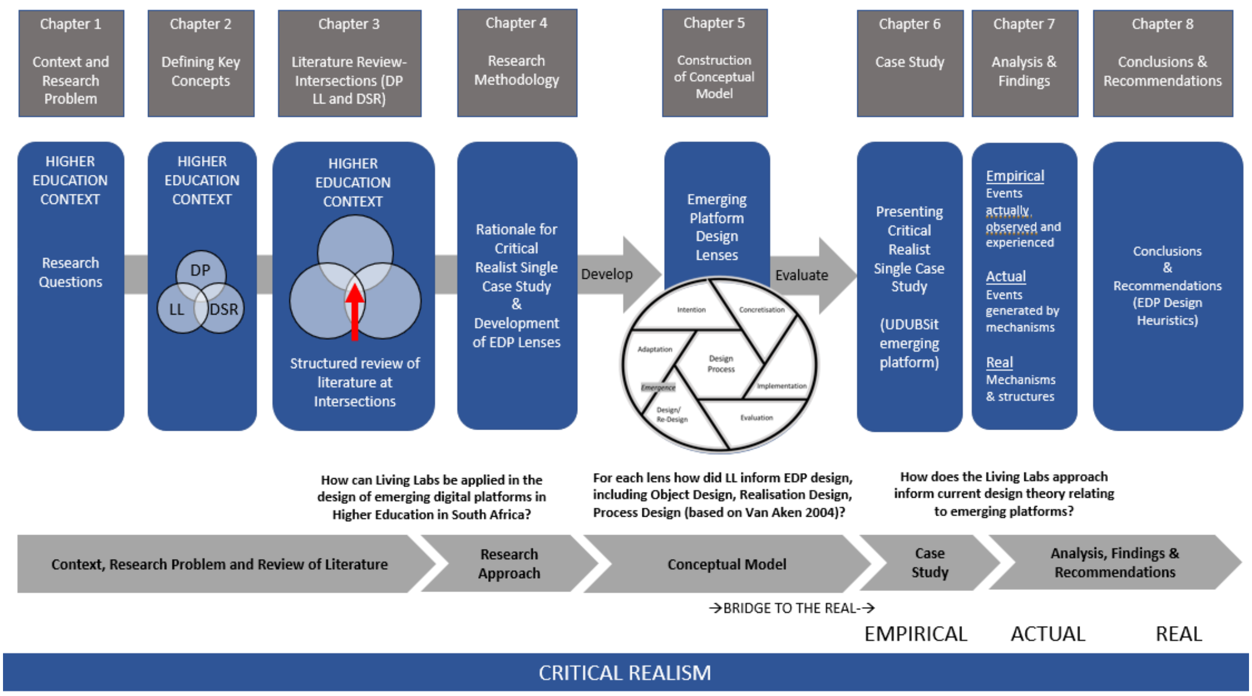


Figure 1: Research Approach (Author)

To analyse the intersection of literature around emerging DPs and LL, as well as the application of LL in the design of emerging platforms, it is necessary to develop conceptual clarity on what each of the terms entails. The concepts of *Living Labs, Platform Design* and *Emerging Platforms* need to be carefully analysed, contextualised and nuanced to contribute to conceptual clarity and utility **(Chapter 2)**. Of significance within our study are the areas of intersection between these concepts **(Chapter 3)**. It is also critical to understand the context in which we are studying these concepts and their intersectional dynamics (**Chapter 1**).

It is likewise necessary to delve deep into the current state of the art around principles of platform design. We do this, however, mindful of the fact that the process of design within a context of planetary-scale computation means making design decisions but also exhibiting tolerance for being designed (in as much as you are aware of that given the sometimes-glacial timescales and subtleties of these revolutions and evolutions). It is thus our opinion that although design often claims, in the popular and even academic discourse, to be *shaping the future* (see for example Yelavich & Adams, 2014), this is perhaps an oversimplified approach that calls for a more balanced and nuanced view. Design will (almost) always be reactive and context-dependent, never fully pro-active. It is our opinion that designers can benefit from increased self-awareness of this hardening reality.
In our study, we also became increasingly aware of the fact that the developing world is seldom really the intended audience of technology development (Loudon, 2016). The reality is that platform design in the developing world often means adapting to the simultaneously hard and dynamic constraints of dependencies on external mega-platforms. Developing-world platforms (or "emerging platforms", as we prefer to refer to it) therefore may find themselves being designed due to forced design compromises and dependencies rather than designing with freedom.

We also aim to position our study within the field of Design Science Research in Information Systems, being mindful of what design science is not (Baskerville, 2008). Given the multi-disciplinary nature of the platform discourse, this may mean delving into various, often overlapping, academic fields to ensure a comprehensive and balanced view of the current narratives within Information Systems. We discuss this mainly in **Chapter 2** as we define the key concepts we are focusing on in this study. Thereafter, we will detail the structured literature review process to focus on the current state of the literature at the intersection points we are focusing on (**Chapter 3**). We developed the *Emerging Digital Platform Design Lenses* (**Chapter 4**) as tool to facilitate the structured and comprehensive addressing of the research questions). In **Chapter 6**, we will present the ***UDUBSit*** case study, and in the subsequent chapters (**Chapters 7 & 8**), we will discuss our analysis, findings and recommendations **(Chapter 8)**.

18. Assumptions, Limitations, and Delimitations

This study is limited in its scope of the investigation, as the discourse around DSR in IS presents but a small subset of the broader concept of design and the richness of research in the contexts of, for example, architecture, art, industrial design, evolutionary biology, product design and other applied fields such as engineering. The focus on Living Labs as specific innovation and co-creation approach means this study possibly underemphasised or even ignored other potential co-creation approaches that may potentially be useful in informing emerging digital platform design.

In **Chapter 4**, the inherent weaknesses of the single-case study are positioned and discussed, therefore placing limits on the generalisability of this approach. The possible utility of this research approach, as well as the motivation for choosing it, is also positioned.

The specific ***UDUBSit*** case study analysed presents a failure case, which also presents some limitations on its generalisability. However, it is our argument that most EDPs fail to achieve scale on the level of the mega-platforms, hence the study of a failure case may present a more useful contribution to both the academic and practitioner-level discourse as it is more representative of the South African HE context as reality. The fact that the ***UDUBSit*** case is a South African case study means it is bound by the highly unequal South African context, which may limit its generalisability to more equal and digitally advanced countries.

The ***UDUBSit*** EDP was designed as a mobile application, with that technology having its own peculiarities, market dynamics and design constraints. The generalisability of findings to other types of possible technologies, such as websites, and therefore needs to be approached with circumspection.

The aim of this study was not fully examine internal organisational dimensions of the University where the case was situated. Therefore, the limits to the *capacity to design* that we describe as one of the mechanisms impacting on how LL informed the EDP design process is oversimplified, and future research may want to delve deeper into the role of, for example, power dynamics, project ownership, organisational policy frameworks, organisational culture, change management and digital leadership.

The assumptions and limitations of this study are discussed in **Chapter 8**, section 7, in more detail.

19. Findings and Recommendations

The key findings of our study focused firstly on the key and sometimes unique emerging platform design challenges faced by HEIs, as well as the contribution that LL can make in informing this design process.

Research Question: How does Living Labs inform the design of an emerging platform?

Based on our analysis of the ***UDUBSit*** case in **Chapter 7**, we found that the LL approach did not inform the EDP design process consistently through the different phases in the design process. The LL approach failed to inform the EDP design processes more effectively because of the following main structures and mechanisms identified:

- **Failure to recognise digital platforms as a *new institutional form***
    - Failure to re-position the EDP design process within the emerging design context of planetary-scale computation
    - Linked to the above, failure of the LL process to engage with the ontological reversal in IS design science as emergent design and societal context
    - Failure of the LL approach to recognise platforms as a different institutional form led to *EDP design blind spots* in its application
    - Cloaked (often invisible, often friction-less) EDP design decision options hiding unfavourable models of inclusion, including the assumption of user empowerment
    - Cloaked convenience (hiding highly complex, increasingly automated technological mediation) and LL failed to surface and engage on a deeper level of complexity and its implications for co-creation of the EDP design, and remained largely blind to the power and information asymmetries that diluted the application of the LL approach as it competed with the powerful tensions and gravitational forces introduced by the allure of mega-platform convenience
- **Failure to surface and mitigate *limits to the capacity to design***
    - Inconsistency, due to limits to the capacity to implement LL within the institutional ecosystem created inconsistency in the way LL informed the EDP design process

  - LL failed to surface or mitigate key capacity constraints within the institutional ecosystem
- **Failure to surface and mitigate *limits to the freedom of design***
  - Failure of the LL approach to surface and mitigate *forced pragmatic compromises* limits *freedom to design*
  - Planetary-scale computation with mega-platforms as growing gravitational fields often exerted invisible/seamlessly convenient forces that *limited freedom to design, especially in resource-constrained contexts*
  - Cloaked convenience (hiding highly complex, increasingly automated technological mediation) and LL failed to surface and engage on a deeper level of complexity (and entrenching information asymmetries) that were invisible yet critical to deciding the ultimate control of data and predictive tools and analytical insights required to compete with the gravitational fields mentioned above

Sub-question 1: How does Living Labs inform the object design of an emerging digital platform?

The object design of the ***UDUBSit*** mobile application (the design of the IS intervention/initiative) was informed inconsistently by an LL approach hampered by challenges with the institution's capacity to concretise the intended and appropriate design artefacts to attain the intended platform owner and platform designers' objectives. The LL approach largely failed to address the *object design* of this EDP as it failed to identify a digital platform correctly as a different type of institutional form that requires a specialised approach to *object design* and *object design* co-creation. This failure caused the *object design* to exhibit several *blind spots.* The introduction of *forced design compromises* is detailed in **Chapter 7.**

Sub-question 2: How does Living Labs inform the realisation design of an emerging digital platform?

The *realisation design* (the plan for the implementation of the IS intervention/initiative) was informed inconsistently by an LL approach hampered by challenges with the institution's capacity to design sustainable implementation plans to concretise, implement, evaluate and scale the EDP as a socio-technical solution. The LL approach largely failed to address the realisation of this EDP as it failed to identify a digital platform correctly as a different type of institutional form that requires a specialised approach to realisation design and the co-creation thereof with all platform stakeholders. This failure caused the *realisation design* to exhibit several *blind spots.* The introduction of *forced design compromises* is detailed in **Chapter 7.**

Sub-question 3: How does Living Labs inform the process design of an emerging digital platform?

The LL approach was particularly weak in informing *process design,* as it remained situated in an innovation process outside institutional adoption and integration with institutional processes. In the ***UDUBSit*** case, the process design plan was informed inconsistently by an LL approach that was hampered by challenges with the institution's capacity to design sustainable processes to concretise, implement, evaluate and scale EDP as socio-technical solution, and to embed, institutionalise and evaluate the initiative and apply the LL approach more consistently and in more depth over the three design iterations. Largely, LL failed to address the process design of this EDP as it failed to identify a digital platform correctly as a different type of institutional form that requires a specialised approach to process design and integration of the design feedback from all sides of the platform over the three observed design iterations. This failure caused the *process design* to exhibit several *blind spots.* The introduction of *forced design compromises* is detailed in **Chapter 7.**

Our analysis of the UDUBSit case (**Chapter 7**), applying the EDP Lenses detailed in **Chapter 5**, lead us to suggest a set of *EDP design heuristics* as practical recommendations for the future improvement of the informing of EDP design processes by the application of the LL approach **(Chapter 8).**

20. Merits and Contribution

The study contributes to the academic debate around emerging digital platforms while simultaneously also generating potentially useful insights for designers grappling with the challenges of emerging platform design, specifically in developing world contexts and HE contexts. The study further addresses the current gap (as highlighted in **Chapter 3**) in the extant IS literature at the intersection of DSR, DP design and the discourse around Living Labs.

The following four categories of findings constitute the contribution of this study:

Firstly, the contribution this study makes to the IS body of knowledge lies in defining the *emerging digital platform (EDP)* conceptually. The study furthermore contributes through creating, refining and validating an analysis tool and conceptual model, as well as the *Emerging Digital Platform Lenses (EDP Lenses)* for analysis of the application of LL within the context of the design of an EDP.

Secondly, this analysis tool was applied to analyse three iterations of a (failure) case study of an EDP where the LL approach was applied. This served as a comprehensive framework to analyse, at a granular yet integrated manner, the contribution the LL approach made to inform the different design phases of the emerging platform. This analysis informed the identification of the key structures and mechanisms that affected the way in which the LL was informing the EDP design process and surfaced some design blind spots, pragmatic design compromises and failures to surface and mitigate design capacity limitations. These factors may hamper the more effective application of LL in resource-constrained, developing world contexts and HE contexts in particular – an area of Information Systems that remains largely unexplored in extant literature.

Thirdly, based on our analysis and findings, we present a comprehensive set of *EDP design heuristics* that may improve future LL applications in developing world EDP design contexts and HE contexts.

Fourthly, our understanding of platform design gained from three design iterations and our analysis of the LL application process compelled us to critique the LL methodology, informing this emerging methodology with valuable insights from our emerging platform design theoretical analysis and proposed design heuristics. The study specifically highlighted the potential vulnerability in EDP design contexts of the LL process to the tensions and power dynamics created by planetary-scale computation as design context and the emergence of digital platforms as a new institutional form.

21. Chapter Conclusion

In this chapter, the focus was on providing an overview of the research context of this study. The higher education sector in South Africa is grappling with the simultaneous challenges of contributing to the alleviation of deeply systemically entrenched inequality, widely distributed poverty, and historically high levels of youth unemployment. At the same time, the sector must also respond to a rapidly changing skills demand-and-supply ecosystem and the rapid digital transformation of labour and skills markets.

The rapid pace and deeply systemic nature of digital transformation is disrupting the underlying mechanisms by which governments, education providers, businesses and other non-state organisations in the higher education ecosystem engage inside and outside of their respective organisational structures. This is leading to various new challenges being posed to decision makers within these HEIs (both on managerial and executive level) and on the level of the designers, implementers and evaluators of digital platforms.

Digital Platforms, as an emerging new institutional form and type of socio-technical system, present both opportunity and risk to HEIs. It can assist in alleviating the challenge of creating cost-effective, scalable solutions to, for example, communication, innovation, and student engagement challenges faced within HEIs. Digital platforms may also offer more appropriate responses by institutions to the changing nature of the user of ICT systems in HE (students, staff and management, as well as the extended institutional ecosystem). The design of EDPs may be positioned as a strategically important capability required to ensure that HEIs remain relevant and competitive within a fast-changing national and global context.

In the chapter, the tension was highlighted that even though DP may offer significant potential, there is increasing concern about the disempowerment of the intended beneficiaries of HE platform implementations, i.e., end-users, who may be vulnerable to exploitation by data commodification and the seamless convenience of promised DP technologies originating and being designed outside the local South African context. The #FeesMustFall case was briefly presented as an interesting example of how this disempowerment is being experienced by students in a South African context.

The chapter further discussed the utilisation and potential promise of co-creation and co-design approaches, specifically the LL approach, which may assist in developing digital technologies that are more inclusive. In our analysis of the discourse in literature at the intersection of Digital Platform Design, LL and Design Science Research (**Chapters 2 & 3**), a lack of clarity was found on how LL can be applied in the design of emerging digital platforms.

This study's aim was to address this research question, as well as the sub-questions of how LL informs the object design, realisation design and process design of an emerging digital platform. The research approach was to conduct a single case, embedded design explanatory case study of an emerging digital platform project, the ***UDUBSit*** application, at the University of the Western Cape in South Africa, from its initial conceptualisation to its eventual failure to scale and become sustainable in its context.

A further aim of this study was to engage in a critical analysis of the intersection of DSR, LL and DP design to (potentially) inform future applications of LL in HE contexts while being sensitive to the complexities around the generalisability of single case study designs. A Critical Realist perspective allowed for a focus not only on the observable reality of the ***UDUBSit*** case at the University of the Western Cape that was investigated but also on identifying underlying mechanisms that combined to cause changes in the observable reality.

Our analysis and findings **(Chapter 7)** were discussed, and the study concluded with making recommendations, including a set of design heuristics that may better inform the future application of the LL approach in the design of EDP **(Chapter 8)**. Further areas of research were also suggested that might potentially inform the discourse within Information Systems.

Chapter 2 – Key Concepts

The real voyage of discovery consists not in seeking new lands but seeing with new eyes.

-Marcel Proust (1871-1922, French novelist)

1. Chapter Introduction

It is useful to first present and position key concepts discussed throughout this study, which is the focus of **Chapter 2**. In **Chapter 3**, a structured literature review explores and highlights in more detail the specific intersection points in the literature between these concepts. This approach enabled recognition of the multi-disciplinary questions being asked of various academic disciplines by digital platforms and their design (this chapter) while then allowing a more detailed and specific focus on the way this presents within the Information Systems discourse (**Chapter 3**).

Consequently, the focus of this chapter is on defining and contextualising the key concepts analysed in our study, namely Digital Platforms (DPs), Emerging Digital Platforms (EDPs) and Living Labs (LL). Furthermore, these concepts were positioned within the broader field of Design Science Research (DRS) in Information Systems (IS), as we are particularly interested in understanding how LL can potentially inform the design of EDPs in the Higher Education (HE) context in South Africa. The mechanisms by which digital platforms scale and evolve over time are also investigated, as this provides some insight into the barriers EDP designers may experience in their attempts to grow towards a more sustainable impact within their often resource-constrained design contexts. These mechanisms may also be relevant to co-creation processes in design. While LL, as a subset of the DSR approach, has presented itself as a potentially useful tool to empower users with technology design processes in South Africa, the mechanisms by which LL affects the design of emerging platforms, and design decisions specifically, are under-investigated at present. This gap in the literature became even more evident from our structured literature review presented in **Chapter 3.**

2. Digital Platforms

Within the current popular discourse around digital platforms, the noise-to-signal ratio is very high[27]. Unfortunately, since platforms have such a wide spectrum of actual and potential societal impacts, opportunities and risks, the academic discourse tends to be fragmented. Sometimes the discourse seems

[27] A Google.com search of the term "Digital Platform" on 2020/06/02 yielded 9,160,000 results. Admittedly, there are probably more scientific ways of proving the high noise to signal ratio, but even a glance through the first couple of pages of Google search results will quickly show to the observer that a significant percentage of the narrative is driven by commercial interests, consulting firms and examples of platform instantiations being marketed or profiled. A search for the same keywords on scholar.google.com on the same date yielded 38,800 results.

to be over-informed by a reliance on commercially driven grey literature. Digital platforms themselves are also actively shaping and influencing the narrative about themselves, sometimes appropriating academic research in unethical ways in the process. See for example the well-published Facebook "Experimental evidence of massive-scale emotional contagion through social networks" case around the work of Guillory et al. (2014) and the subsequent ethical issues highlighted in the Editorial Expression of Concern and Correction over this article as issued by the *Proceedings of the National Academy of Sciences* (Guillory et al., 2014). There is a lot of variance in the literature between, for example, the overly optimistic grey literature views of Artificial Intelligence, the perspectives of the Future of Life Institute (2021) and the work of, for example, Nick Bostrom (2003, 2014, 2020).

These factors, amongst others, tend to lead to an oversimplified understanding of these very complex phenomena. This can be counterproductive in informing HEIs' long-term strategic decision-making and impact. This also contributes to confusion for platform owners, designers and users, which, as we argued in **Chapter 1**, contributes to making platform design in HE contexts a *wicked problem*.

As a starting point, we need to gain a more in-depth understanding and define this dynamic (and sometimes slippery) concept of *Digital Platforms (DPs)*. Furthermore, we need to clarify our understanding of how digital platforms change over time specifically in the context of the emerging world, what we call *Emerging Digital Platforms* (EDPs). We also need to gain a more in-depth understanding of how and to what extent design decisions and the application of *Living Labs* in design influence that process.

3. Defining Digital Platforms

DPs seem to be expanding their presence in our life world (Heyman & Pierson, 2015). DPs are shaping every sphere of our lives, including markets, commons, and public or private spheres (Van Dijck, Poell & De Waal, 2018). Within the African context, there has also been a proliferation of platform organisations and technologies (David-West & Evans, 2016). In the African context, however, platform business model prevalence is still insignificantly small when compared to the global picture (see **Figure 2**). It is our contention that, at least in part, the lack of dominant African platforms is due to challenges inherent in the conceptualisation, concretisation, implementing and scaling of these emerging platforms.

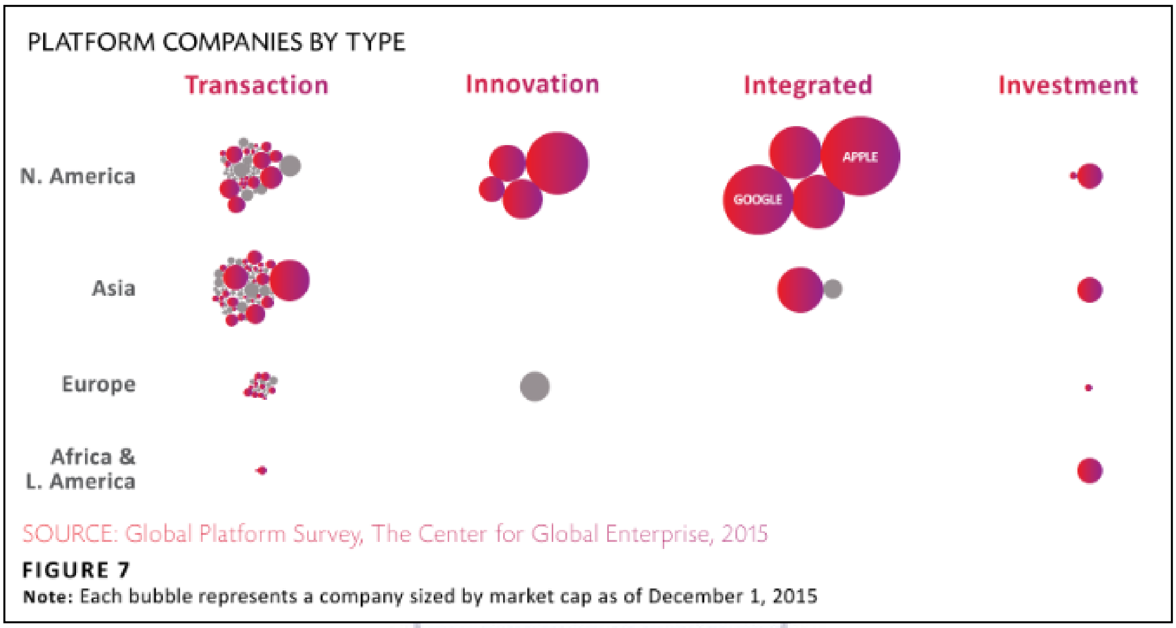


Figure 2: Platform Companies by Type (Gawer & Evans, 2016:14)

The platform concept has seen proliferation within management research (Porch, Timbrell & Rosemann, 2015), and attempts have been made to create an integrative framework around technological platforms (Gawer, 2014). The concept of platforms, although often mentioned in IS literature (and in popular discourse, of course), is still not clearly defined (Sun, Gregor & Keating, 2016), and those authors, in a review of platform literature, mention that there were 47 attempts to explicitly or implicitly define platforms among the 132 sample articles they analysed. In the literature, there is a wide range of definitions ranging from the more general and broader, for example, Gawer (2009), to the more technically focused and specific (for example, Donders, Pauwels and Loisen, 2014). Benjamin Bratton defines platforms within the context of his perspectives on planetary-scale computation:

> "Platforms are what platforms do. They pull things together into temporary higher order aggregations and, in principle, add value both to what is brought into the platform and to the platform itself. They can be a physical technical apparatus or an alphanumeric system; they can be software or hardware, or various combinations" (Bratton, 2015).

Bratton also views organisational and technical theories of platforms that have been advanced as not yet robust enough:

> "Perhaps one reason for the lack of sufficient theories about them is that platforms are simultaneously organisational forms that are highly technical, and technical forms that provide extraordinary organisational complexity to emerge, and so as hybrids they are not well suited to conventional research programs" (Bratton, 2015).

Bratton (2015) furthermore argues against the reduction of the institutional logic of platforms to be viewed merely as markets, machines or states. He argues that platforms represent a third institutional form along with states and markets, and this reconceptualisation is required to better understand the specific convergence of architectonic and computational forms that platforms have become. We agree with Bratton's notion that digital platforms represent a new type of institutional form.

We also agree with the view of Dell'Era et al. (2017) that platforms can be viewed as designable entities, at least in part. They cite two definitions of design that clearly positions it as something more than just having an artefact focus (Dell'Era et al., 2017):

> "The etymology of design goes back to the Latin *de + signare* and means making something, distinguishing it by a sign … Based on this original meaning, one could say: design is making sense (of things)" (Krippendorff, 1989, cited by Dell'Era et al., 2017).

> "Design, can be defined as the human capacity to shape and make our environment in ways without precedent in nature, to serve our needs and give meaning to our lives (Heskett, 2002, cited by Dell'Era et al., 2017).

Platform value creation entails configuring specific design elements when building a new platform (Tura, Kutvonen & Ritala, 2018) and design includes both the process of bringing a new artefact into being as well as the resultant artefact (Peffers et al., 2007). However, the emergence of automated design technologies, such as AI-driven software development tools, may represent signs of the possibility that human designers may be facing an emerging "loss of control over design". See for example Github's CoPilot[28] as an example of the convergence of the human and the artificial in the process of the design and building of digital artefacts. It was reported that, after its launch in June 2021, 30% of new code on GitHub has been written with AI assistance (Coberly, 2021).

[28] https://copilot.github.com/

McAfee and Brynjolfsson define platforms as online environments that take advantage of "free, perfect and instant", specifically referring to the near-zero marginal cost of access, reproduction and distribution that digital platforms can enable (McAfee & Brynjolfsson, 2017).

Within IS, research specifically focusing on platforms has also been somewhat limited (Sun, Gregor & Keating, 2016). There have been certain crosscutting core design problems identified in platform design, namely platform architecture, value creation logic, governance and platform competition (Tura, Kutvonen & Ritala, 2018). The more granular aspects of platform design are often not that well represented in the literature; for example, the pre-launch phase of platforms is under-researched (Tura, Kutvonen & Ritala, 2018), and there is not sufficient clarity around the processes of platform design, value creation, design challenges and outcomes (Tura, Kutvonen & Ritala, 2018). Although it may be argued that some platforms may scale and grow easier than others (compare Facebook, with its almost global appeal, to Beerole[29], a specialised professional platform for beekeepers), design choices play a role in influencing this trajectory and the value realisation of a platform (Tura, Kutvonen & Ritala, 2018).

The dynamic and multi-disciplinary nature of digital platforms is evident from the fact that DPs' current trajectories in academic discourse build on a diverse history of research, ranging from Jean Tirole's work on two-sided markets (Rochet & Tirole, 2004) to older research on networks (Van Dijk, 2006; Castells, 2007, 2011) and more recent innovative, dynamic work on market design (Coyle, 2016), thus developing a competitive advantage for platforms (Gawer & Cusumano, 2008).

In the literature, platforms have also been explored in IS from both a product-oriented and an ecosystem-oriented view (Skog, Wimelius & Sandberg, 2018), as well as from a service innovation view (Lusch & Nambisan, 2015). Recently, two theoretical approaches have emerged in the study of new digital media objects, namely *infrastructure studies* and *platform studies* (Plantin et al., 2018).

> "…infrastructure studies, emerging from science and technology studies and information science, and platform studies, centred in media studies. The former has focused on analysing essential, widely shared sociotechnical systems. Using case studies ranging from electric power grids ... to communication networks ... to scientific

[29] https://www.beerole.com/about/

> ‘cyberinfrastructures’” (Edwards et al., 2007, cited by Plantin et al., 2018).

This school of thought highlights key features of infrastructure such as ubiquity, reliability, invisibility, gateways, and breakdown.

By contrast, platform studies explore how computing devices (such as Intel-chip-based PCs) and software environments (such as gaming systems) affect the characteristics of application software built upon them. Plantin et al (2018) states that in media studies, the “platform” concept has been extended from its initial focus on game design to including content-sharing websites and social media applications. Key features discussed in platform studies include programmability, affordances and constraints, connection of heterogeneous actors, and accessibility of data and logic through application programming interfaces (APIs) (Plantin et al., 2018). Platform studies investigate how communication and expression are both constrained and enabled by new digital systems and media (Plantin et al., 2018).

Plantin et al. argue that by cross articulating these two perspectives, we can improve our understanding of digital media:

> “Digital technologies have made possible a ‘platformisation’ of infrastructure and an ‘infrastructuralisation’ of platforms. Articulating the two perspectives highlights the tensions arising when media environments increasingly essential to our daily lives (infrastructures) are dominated by corporate entities (platforms)” (Plantin et al., 2018).

The notion of platforms as infrastructure is particularly relevant to design limitation and boundary conditions for emerging platform design. These emerging platforms (often presenting in the context of start-ups, social enterprises or internal organisational ‘skunk-works’ projects) do seldom have the technical capability and internal depth of skills to create fully independent, stand-alone platforms without having dependencies on different layers within the traditional software stack. See Wodehouse (2015) for a simple but representative definition of the Software Stack. These layers are mostly owned, controlled and operated, and their design is driven by external (predominantly Western/developed world, profit-driven) parties (Jin, 2013) controlling the extraction of data as part of the process that has been described as “data colonialism” (Couldry & Mejias, 2019), “surveillance capitalism” (Zuboff, 2019) and “platform imperialism” (Jin, 2013).

In the analysis of innovation, new technologies cause new types of accidents and inversely, accidents lead to new technologies (Virilio, 2006b). The argument above from Paul Virilio is one of the triggers that influenced the development of Benjamin Bratton's notion of planetary-scale computation (Bratton, 2015). The notion of platforms as infrastructure is also reminiscent of the sometimes integrated, sometimes overlapping structures of *The Stack* of planetary-scale computation as proposed by Bratton (2015).

Ian Bogost (2016), in a review of Bratton's work, summarised "*The Stack*" as follows *(emphasis added)*:

> "The book's premise is that today's computing systems are best understood as a **global megastructure** (the titular Stack). The Stack is layered, and Bratton identifies **seven tiers** that comprise it: Earth, Cloud, City, Address, Interface, User. **Earth** entails the material and energy-harnessing geological demands of computing; **Cloud** names the weird sovereignty of corporatized, global technology services like Google; **City** addresses the lived experience of cloud-computerized daily life; **Address** deals with identification as a form of management and control; **Interface** with coupling users to computers; and **User** with the human and non-human agents that interact with computational machines. Bratton's fundamental claim is that the Stack is replacing other forms of governance and sovereignty—and with great political consequence" (Bogost, 2016).

Furthermore, Bratton advances "digital design" as an example of one such accident (Bratton, 2015; Bogost, 2016). It is our opinion that emerging digital platform design is deeply impacted by both the traditional view of "systems design" within IS and by the emergence of the accidental mega-structure (or composite mega accident) of Bratton's Stack.

Therefore, we believe that it is crucial for emerging platform designers to be aware of the inter-related layers of this "Stack" (of which the Digital Platform is a key emerging structural and conceptual feature and/or driver). *The Stack* and its increasingly post-human nature characterised by automated decision-making, artificial intelligence design and re-casting of the role of human designers, have direct implications for how we design, and particularly co-create, within and through the User layer. This also affects the role that co-creation approaches such as LL may potentially play in informing EDP design.

According to Facin et al. (2016), platforms can be considered as one of the paradigms for managing new product development and innovation. However, there are many different and other fragmented views of the concept. They summarised the main research themes related to the platform concept in product development as being:

- Product platforms as drivers of innovation and growth
- Differentiation and platform-based products
- Commonality and product platforms (sharing of components)
- Modularity and product platforms
- Mass customisation and product platforms
- Methods to improve performance in the conception of product families

A bibliometrics analysis of the literature by Facin et al*.* (2016) found that a focus on ecosystem building in platform discourse only recently started gaining some momentum, as did the managerial questions around capability building, strategy and ecosystem building based on platforms. The emergence of the platform concept in product development has been showing an increase in the emergence of the digital in product development and transference of industrial platform concepts to digital where scaling boundaries and principles are different to the HE context. The reason for our opinion that the scaling principles are different is because of the differences underlying the largely profit-driven industry platforms versus HE platforms that must balance a different set of targeted outcomes, such as community impact, academic rigour and inclusiveness above profitability.

It has been argued that platform research is maturing within the fields of economic and industrial innovation management fields (De Reuver, Sørensen & Basole, 2017). However, the argument has also been offered that, although there may be some opportunities in IS to borrow concepts and notions from these fields, digital platforms are notably different (Yoo, Henfridsson & Lyytinen, 2010). Jin (2013) emphasises the fact that modern digital platforms are often much more than just intermediaries. Jin also states that platforms are deeply involved in political culture and cannot easily claim to be neutral actors without agency. At the same time, platforms (such as Facebook and Google) often underplay their role as being only neutral intermediaries to limit legal liability (Gillespie, 2010, 2018). Platform ownership is very concentrated and divided into a minority of Western states as platform owners and a vast majority of non-Western states that do not have advanced platforms (Jin, 2013).

Although platforms promised much in terms of creating and facilitating more egalitarian information flows and knowledge distribution within society, the reality is that the design decisions of platform owners/designers over time resulted in the creation of something else entirely. These design decisions have either primarily been focused on creating shareholder value and monetisation opportunities throughout design lifecycles or have resulted in decisions that have *de facto* created platforms in the image of the societies that they function within (exacerbating extremes, inequalities, group think and numerous other rather destructive societal dynamics).

Although digital platforms are developing an infrastructural nature (Plantin et al., 2018) and its own affordances, there is also simultaneously tension between this and the fact, as Miller et al. (2016) and Borgerson and Miller (2018) argue, that the world is also changing social media. Although our study does not focus in depth on the digital anthropological aspects of digital platforms and platform evolution, we recognise that this field may have various valuable perspectives to offer, for example, Daniel Miller's work around Facebook (Miller & Venkatraman, 2018). A very useful definition for platforms is provided by Van Dijk (2013):

> "Technically speaking, platforms are the providers of software, (sometimes) hardware, and services that help code social activities into a computational architecture; they process (meta) data through algorithms and formatted protocols before presenting their interpreted logic in the form of user-friendly interfaces with default settings that reflect the platform owner's strategic choices".

The key elements of this definition are:

- Platform architecture (software/hardware)
- Key transaction (social activities captured into computational architecture based on formatted protocols and data-analysis algorithms)
- User interfaces

Choudary (2015) and Choudary et al. (2016) argue that within the platform era, the previously dominant "pipeline" value creation mechanisms with business ecosystems are being supplanted by platforms with different value creation mechanisms. Platforms, at their core, aim to enable interaction between participants (producers and consumers) (Choudary et al., 2016). Furthermore, platforms need to be able to attract users and encourage interactions by performing functions of pulling, facilitating and matching (Choudary et al., 2016). Successful platform scaling occurs when platforms are layering new interactions on top of the core interaction (Choudary et al., 2016).

In summary, Choudary and colleagues view the essential building blocks of a platform as “The Toolbox”; “The Magnet” and the “Matchmaking” function (Bonchek et al., 2013). These building blocks can be described as follows):

- **The Toolbox** creates a connection by making it easy for others to plug into the platform. This infrastructure enables interactions between participants.

- **The Magnet** creates a pull that attracts participants to the platform with a kind of social gravity. For transaction platforms, both producers and consumers must be present to achieve critical mass. The platform needs to harness the network effect for growth.

- **The Matchmaker** fosters the flow of value by making connections between producers and consumers. Data is at the heart of successful matchmaking and distinguishes platforms from other business models. The Matchmaker captures rich data about the participants and leverages that data to facilitate connections between producers and consumers (Bonchek et al., 2013.

Also, see **Figure 3** for a visualisation of the “Platform Thinking Canvas”, which we find a useful conceptual tool to envision the different platform elements required to function together to enable platforms to grow and scale.

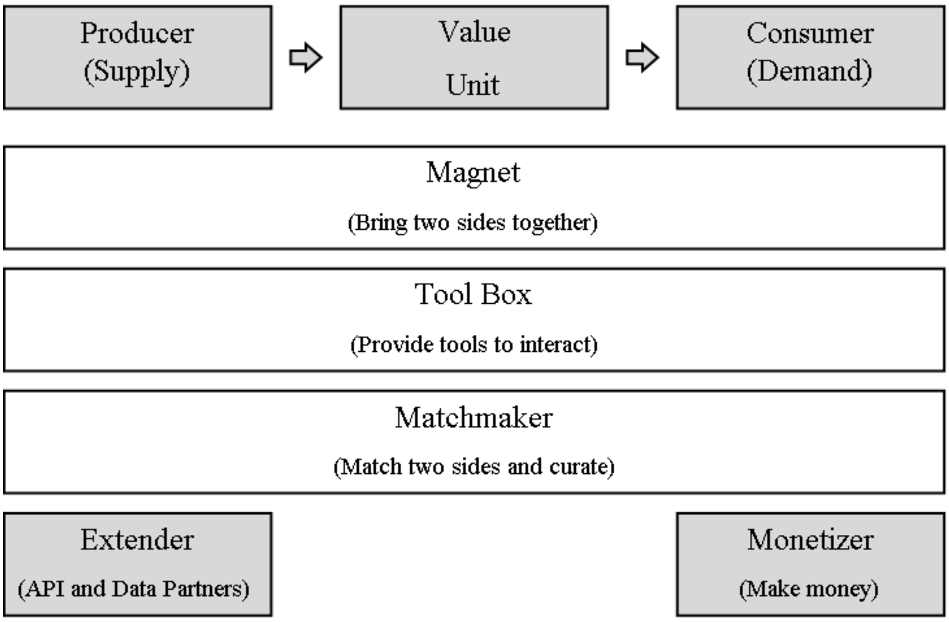


Figure 3: Platform Thinking Canvas (two-sided market) (Choudary, 2015)

Our working definition of *digital platforms*, flowing from the literature, is as follows:

> A Digital platform is a design artefact that digitally facilitates the exchange of value between multiple ecosystem actors in a market.

Our working definition of *platform design* is as follows:

> Digital platform design is the process of design decisions taken by platform designers (which may be in the sometimes over-lapping role/s of platform owner, platform provider, platform developer) to determine or influence the intention, concretisation, implementation and/or evaluation of the digital platform, as well as the socio-technical end-product/s of such processes. To a (usually) limited extent, this may sometimes also include platform users or other platform ecosystem participants.

Platform designs are subject to changes brought about by external factors, as well as the outcomes (intended or unintended) of the process of design decisions implicitly or explicitly taken by platform designers.

3.1. Scaling Digital Platforms

One of our key interests in this study is to understand which design decisions make emerging platforms scale more effectively, specifically in emerging world HEI contexts.

Platform design needs to manage two interconnected challenges (emphasis added): "**Firstly**, how to facilitate and regulate value creation and capture into smaller components and tasks, and **secondly**, how to coordinate these to best enable the realisation of platform value and the goals of the ecosystem" (Tura, Kutvonen & Ritala, 2018). Some of the key elements that make a platform strategy successful include (Bonchek et al., 2013) (emphasis added):

- **Connection**: how easily others can plug into the platform to share and transact
- **Gravity**: how well the platform attracts participants, both producers and consumers
- **Flow**: how well the platform fosters the exchange and co-creation of value

The success by which a platform realises value to its owners and stakeholders is impacted by many choices (or design decisions) (Tura, Kutvonen & Ritala, 2018). Further key platform design decisions may include:

- The ability to connect resources successfully across markets through effectively leveraging complementarities and network effects (McAfee & Brynjolfsson, 2017; Tura, Kutvonen & Ritala, 2018)
- Platform governance (Tiwana, 2014; Staykovska et al., 2015)
- Management of and response to competition (Rochet & Tirole, 2004; Gawer & Cusumano, 2013; Parker, Van Alstyne & Choudary, 2016)
- Platform openness (Jin et al., 2014; Schreieck, Wiesche & Krcmar, 2016; McAfee & Brynjolfsson, 2017; Hein et al., 2019)
- Platform quality (Zhu & Iansiti, 2007, 2019)
- Management of consumer expectations (Zhu & Iansiti, 2012)
- Creating curated, consistent and positive participant experiences and minimising unpleasant surprises to participants (McAfee & Brynjolfsson, 2017)
- Balance between value generated for and captured by various stakeholders (Parker, Van Alstyne & Choudary, 2016)
- Optimising three categories of platform evolution mechanisms, namely *platform design* (i.e., technical features, incentive mechanisms); *platform operations and capabilities* (i.e., internal and support, data-driven operations)), and *platform ecosystem and governance* (i.e., fair revenue-sharing with third-party contributors) (Asadullah, Faik & Kankanhalli, 2018)
- Digital platforms need to be generative and evolvable for long-term sustainability (De Reuver, Sørensen & Basole, 2017)

- Some platforms successfully strengthened their ability to evolve and grow by adopting strategies of infrastructuralisation (i.e., Facebook authentication) (De Reuver, Sørensen & Basole, 2017)
- Platform owners need to strategically position their platforms against competitors in their specific market and context by being early enough in the market space that potential participants have not already adopted another platform/s where network effects have already created generative momentum (McAfee & Brynjolfsson, 2017)

According to Spagnoletti, Resca and Lee (2015) (emphasis added), platform design entails that the three platform architecture components (**core, interface and complements**) should together support the three types of social interaction structures required to create an online community, namely, **information sharing, collaboration, and collective action.** Some of the other key features within the field of platform studies focus on programmability, affordances and constraints, connection of heterogeneous actors and accessibility of data and logic through application programming interfaces (APIs) (Plantin et al., 2018). According to Edelman (2015), platform designers need to ask five key questions in order to launch and scale a platform (**Table 1**):

Table 1: Key Questions on Platform Scaling (Edelman, 2015)

Key question	**Focus**
Can I attract a large group of users at once?	• Accessing existing users on other platforms and migrating them to new platforms • Leveraging publicly available user data
Can I offer stand-alone value?	• Add a service that is useful even if few users join the platform • Clearly identify your addressable niche • Find or build small social groups
How will I build credibility with customers?	• To attract initial users, a new platform must satisfy those concerns by building credible expectations for its future success • The basic strategy for credibility building is to attract a marquee platform contributor. o Pay them to join o Buy the marquee brand
How should I charge users?	• Reduce user risks by subsidising early users or offering flexibility of pricing
How can I make my platform compatible with legacy systems?	• Offer just enough compatibility to attract new users • Anticipate resistance from legacy systems

The existence of a virtual community is more than just functional (task-oriented), as a community arises from social and not just economic benefits, and a virtual community exists when "a socially self-sustaining group, with persisting social practices, acts in a common computer-mediated space" (Whitworth & De Moor, 2003). The design of a virtual online community therefore, requires more than just functional IS system design and the mere existence of the digital technology that Whitworth and De Moor (2003) call a "virtual community environment" or (VCE) does not guarantee that a virtual, engaged community will arise.

Jin (2013) argues however that in defining platforms, we should also take cognisance of its specific combinations of technical, political, cultural and economic characteristics in a way that is balanced, not emphasising one above the other. In general, we have found this aspect lacking or being underemphasised in most digital platform definitions within IS.

Jin (2013) provides a useful conceptualisation of the nuanced complexity of digital platforms that we find quite useful for our study (see **Figure 4**). Jin motivates this expanded definition of platforms as follows: "Drawing these meanings together allows us to see that platforms emerge not simply as indicating a functional computational shape, but with cultural values and communication aspects, including both public and corporate spheres, embedded in them".

Jin (2013) further highlights the following (**Figure 4**):

- Platforms consist not only of hardware architecture but also as software frameworks enabling other programs to run.
- Platforms enable interaction, communication and selling (transacting), and are therefore substantially defined by market forces; platforms furthermore act as mediators and co-ordinators between stakeholder constituencies.
- Platform value is embedded in design, which is not value neutral and reflects the values, cultural biases and communicative preferences of its designers. Tensions can exist between user values and designer values (and in our opinion) also between owner values, designer values and user values).

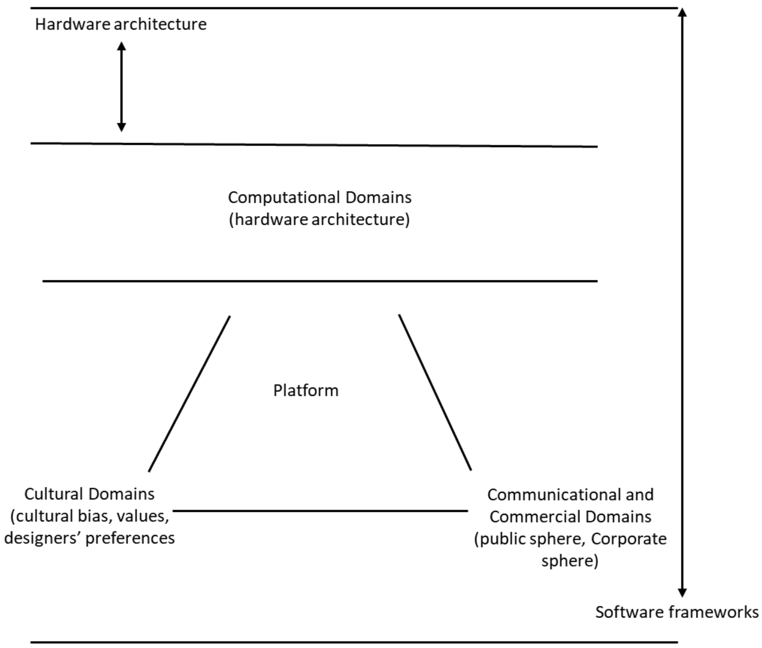


Figure 4: How to Understand Platforms (Jin, 2013)

The mega-platforms (the so-called "FAANG" platforms, referring to five prominent American technology companies: Facebook (FB)[30], Amazon (AMZN), Apple (AAPL), Netflix (NFLX), and Alphabet (GOOG), formerly known as Google) have been using their technological design, computational capacity, commercial muscle and ability to set and influence technical standards as means of entrenching their power. In this contested space, "the technological design of online spaces, tools, applications and devices constitute a contested terrain where the imposition of designers' values and preferences are at odds with the values and preferences of the intended user base" (Bodle, 2010).

The success of mega-platforms is often related to the fact that they can successfully leverage their design skills and capacity to create generative (and commercially scalable[31]) mechanisms of control over computational domains as well as commercial and communicational domains, which are becoming continuously entrenched and embedded over time. These mega-platforms are also in uniquely powerful positions to leverage their control over their immense collections of user behaviour data and predictive capability, and deep data-driven knowledge of cultural domains and user behaviour.

[30] Since October 2021 Facebook has been renamed to Meta.

[31] This scalability does not always directly translate to profitability in the short -term as significant investments may be required in subsidising a side (or sides) of the platform to facilitate a critical mass of value-creation transactions within the platform.

From a user’s perspective, our interfaces with mega-platforms are becoming increasingly invisible and seamless. A powerful example of this was the controversial demonstration[32] of the ability of Google Duplex to interact with humans in booking a restaurant table, without the humans realising they are engaging with a digital platform-based bot (Leviathan & Matias, 2018). Other examples of disappearing interfaces include “always listening” home speakers powered by Amazon Alexa[33], Apple’s Siri[34] or Google Home[35].

According to Bratton (2015), the instrumentality of platforms as well as their socio-technical nature is important*:* “Platforms are what platforms do. They pull things together into temporary higher order aggregations and, in principle, add value both to what is brought into the platform and to the platform itself. They can be a physical technical apparatus or an alphanumeric system; they can be software or hardware, or various combinations”. Bratton (2015) furthermore emphasises that platform dynamics include (emphasis added) the following:

- Possessing **institutional logic that is not reducible to ‘being’ states, markets of mere machines**: “Their initial program may be born of economics, but their execution can push sideways through other models of value, confounding and compressing the political spectrum along with them”.
- The concept of platform design includes tension between being prescriptive and allowing freedom of decision-making to role players. In the words of Bratton (2015): “The construction of platforms draws in, to varying and contingent degrees, strong connotations of “design” (design as in to ‘designate’ and to govern through material intervention) and in this platforms are plots and… also diagrams that ‘ensnare’ actors in their fatal outcomes (design as in ‘to have designs on something,’ to trap the user). At the same time, platforms are not master plans and in many respects, they are the inverse. Like master plans, they are geared toward the co-ordination of system Interfaces into particular optimised forms, but unlike them, they do not attempt to fix cause and effect so tightly”.

32 See coverage of this demo video here: https://www.youtube.com/watch?v=JvbHu_bVa_g
33 https://www.amazon.com/alexa-skills/b/?ie=UTF8&node=13727921011
34 https://www.apple.com/siri/
35 https://assistant.google.com/platforms/speakers/

In the process of conceptualising and describing our current reality of emergent planetary-scale computation, Bratton (2015) suggests some key design considerations within platform design **(See Table 2).**

Table 2: Platform Design Principles (Bratton, 2015)

Platform Design Principles (Summarised; emphasis added)
1. As opposed to other macro governance institutions, platforms do not work according to detailed premeditated master plans; rather, they set the stage for actions to unfold through **ordered emergence.** Platforms can be centralising and decentralising at the same time.
2. Platforms are based on a **rigorous standardisation of the scale, duration, and morphology of their essential components.** The simplicity and rigidity of these standards make platforms predictable for their users, but also allow them to support idiosyncratic uses that platform designers could never predict. Platforms distribute autonomy to the edge of its networks but standardise the conditions of communication between them.
3. This standardisation of essential components produces an effect of **generative entrenchment** by which one platform's early consolidation of systems (formats, protocols and interfaces) decreases a user's opportunity costs to invest more transactions into that particular platform while it increases the costs to translate earlier investments into another platform's (at least partially) incompatible system. According to Bratton (2015), "Platforms are generative mechanisms — engines that set the terms of participation according to fixed protocols (e.g., technical, discursive, formal protocols). They gain size and strength by mediating unplanned and perhaps even unplannable interactions. This is not to say that a platform's formal neutrality is not strategic; one platform will give structure to its layers and its Users in one way and another in another way, and so their polities are made. This is precisely how platforms are not just technical models but institutional models as well".
4. **Standardised components may also be reprogrammable** within constraints by users, allowing them to innovate new functions for machines that are composed, at least partially, of pre-existing platform systems.
5. The design and governance of platforms often rely on **formal models** to organise, describe, simulate, predict, and instrumentalise the information under its management.
6. **Platforms' mediation of user input information may result in an increase in the value of that information for the User.** Platform network effects absorb and train that information, making it more visible, more structured, and more extensible for the individual user or in relation to other users, who make further use of it, thereby increasing its social value. Each time a user interacts with a platform's governing algorithms, it also trains those decision models incrementally to better evaluate subsequent transactions. An economically sustainable platform is one for which the costs of providing systemic mediation are, on aggregate, less than the total value of input User information for the platform.
7. Like centralising systems, platforms **consolidate heterogeneous actors and events into more orderly alliances**, but they themselves are not necessarily situated in a true central position in relation to those alliances in the same way that, for example, a master planning committee or federal capitol building would be. Like some decentralised systems, platforms rationalise the self-directed manoeuvres of Users without necessarily superimposing predetermined hierarchies onto their interactions.
9. Even as platforms guarantee identities to the users of its systems, for better or worse, they do not provide these evenly or equally. **A platform governs one User differently than it does another.**

Platform Design Principles (Summarised; emphasis added)
10. An ideal platform architecture **produces a strategic minimum of new content into its own communication economy**. An ideal platform is like an empty diagram through which Users mediate new and archived information.
11. Any structuring component of an ideal platform architecture is **replaceable** by a new component. The platform could be replaced piece-by-piece to evolve into something entirely different while retaining its essential shape. Any given component (e.g., layer, protocol, interface) could be replaced, inclusive of all components of the platform in its totality.
12. Platforms may respond to user inputs immediately and may draw on archived rules to recursively govern those interactions in real-time, or it may react to those interactions once some qualitative or cumulative threshold requirement has been met, perhaps by many Users at once. **Platforms govern both instantaneously and cumulatively**.
13. Ideal platforms not only act on new interactions according to programmed rules and in relation to archived structured information, but also serve as distributed sensing systems that **incentivise the detection of errors** (or mere anomalies), which are interpreted by the platform's formal models.
14. The competition between platforms may occur over new tabula rasa space or over the recomposition of one or more existing systems in accordance with a platform's strategy. To date, many successful platforms are those that provide Users with new capabilities by making their existing systems more efficient. The platform can realise platform surplus value from this **generative entrenchment**.
15. Platforms link actors, information and events across **multiple spatial and temporal scales at once**. Platform ubiquity makes it more robust in relation to some threats, both intrinsic and extrinsic, and more vulnerable in relation to others.
16. A platform's actual processes may be very different from how they are understood by their users, who may form mental images of those processes based on their own individual interactions or on how the platform has represented itself to them. **Platforms do not look like how they work and do not work like how they look**.
17. Platform sovereignty may be planned or unplanned, universal or specific, generative or reactive, technologically determined or politically guaranteed. **Platform sovereignty** is automatic under some circumstances and highly contingent under others and it may function differently in relation to different components of the platform system.

We view these principles as important underlying factors affecting the scaling and growth of a platform, as well as its potential to inform the design challenges posed by "wicked problems" more comprehensively. Influenced by Bratton's perspectives on planetary-scale computation and the deeply entrenched socio-technological structures formed by data-hungry digital platforms, we proposed in previous work the term *geno-digital spores* as a more appropriate metaphor rather than the widely used "digital footprints" (Grove et al., 2019; Grove et al., 2021).

We argue that users, through their interaction with convergent technologies, both digital and biological, are creating billions of real-time (or very-near real-time) data trails that are captured, analysed and used to predict by those in power (mega-platforms included). We used the term "geno-digital" data to denote an integrated dual-structure (a double helix of sorts) of technologically visible digital and/or genetic data points about our human identity that is created, collected, extracted, stored, transformed, analysed and used for prediction by digital means. These types of data points are interlinked, interdependent, time and context-sensitive, inevitably incomplete and of increasing interest to those in power. As Bob van Dijk, the CEO of the Naspers Group, recently stated: "Data is hard cash in an increasingly digital world" (Van Dijk, 2020).

Another manner in which mega-platforms obtain and secure power is by means of creating, obtaining or holding on to intellectual property (IP) rights such as patents (Jin, 2013). Large platform companies such as Amazon have been accused of buying innovative IT start-up firms and "strip-mining" them of their innovations (Wakabayashi, 2019), engaging in bullying and aggressive behaviours (McCleod, 2020) or simply killing them off. It is also informative to look at the enormous imbalance between IP creation and ownership between a developing country such as South Africa and developed countries. In most cases, the mega-platforms hardly ever locate meaningful research and development centres in developing countries. These firms often only have a sales office presence in these countries and little, if any, R&D and IP transfer. Analysing all patents registered in South Africa between 2005 and 2015, only 4,064 were South African patents, whereas foreign patents amounted to 36,067 registrations, an average of less than 400 South African patents granted each year (Berger and Rens, 2018).

It is our contention that significant value can be created and retained for HE stakeholders when they retain more control of design decisions. However, the nature of modern mega-platforms both obscure design decisions and create easily available "frictionless" dependencies on their technology infrastructure (hardware, software, market access) and predictive data analysis capabilities. Emerging platforms find it increasingly difficult to retain meaningful control of design decisions, including the choice of software architecture, hardware and quality control requirements[36], as well as the process of collecting and extracting maximum value from user and interaction data generated by the emerging digital platform. These "retention of control" decisions, however, will always need to be balanced against

[36] The dominance of online database hosting services provided by Google, AWS, Microsoft, as well as the App Store/Play Store requirements dictate design choices and limit freedom of design by virtue of their dominant market positions.

available resources and skills available to conceptualise, concretise and implement EDP design processes.

3.2. Digital Platforms in Information Systems

Platform designers are, by and large, responsible for making key design decisions. These design decisions are a series of core compromises that designers need to make to enable and facilitate the intention of the platform owner (which we can assume[37] are focused on value creation in a sustainable manner for a particular organisational or broader platform ecosystem). This entails decision making that is pro-active in some instances and reactive in others, balancing opportunities, capacities and resource constraints. Within the IS field, there has been increased interest to understand digital platforms better, as De Reuver, Sørensen and Basole state:

> "Unquestionably, digital platforms are going to be an intrinsic part of IS research and we are currently in the middle of the maturity curve. Digital platforms form uniquely new socio-technical artefacts that force IS scholars to engage in conceptual and methodological innovation. While insights from other academic disciplines, such as economics, strategy and telecommunications, can provide an important foundation to understanding digital platforms and ecosystems, there are many fundamental differences that must be considered" (De Reuver, Sørensen & Basole, 2017).

IT platform design and development have been identified as one of the current research themes within the published research around digital platforms (Sun, Gregor & Keating, 2016). Although the concept of digital platforms has been deeply ingrained into the management theory and information systems lexicon, there is still a lot of uncertainty around the dynamics of their design. Within the IS debates around digital platforms, three important issues are still unclear, according to a recent review article by De Reuver, Sørensen and Basole (2017) (emphasis added):

> "**Firstly**, the discourse will need to engage in further conceptual clarification of the digital platform concept and delineate the platform and ecosystem constructs in a digital context. The **second** main issue is concerned with the scoping of digital platforms, for example, developing a typology expressing the variety of digital platforms. **Thirdly**, critical methodological issues are to be resolved in the study of digital platforms – many of which are common to the challenges of studying digital infrastructures" (De Reuver, Sørensen & Basole, 2017).

[37] Perhaps naively in some cases…

Although the platform concept has been investigated extensively within various academic fields over time, digital platform design seems to present different and difficult new challenges. As stated by Tiwana (2014), the software seems to infuse some unique but poorly understood properties into platforms.

Given the increasing prevalence of digital platforms within our everyday lives, the design of platforms will become more important to the ability of HEIs to respond to stakeholder demands and meet the growing user expectations. However, it is clear that existing platform design practices, in part, may have contributed to the current challenges of creating platforms that are fair and equitable and are making a sustainable positive impact on its broader stakeholder base. In this regard, we will aim to align our literature analysis (**Chapters 2 and 3**) and conceptual model of platform design (**Chapter 4**) with the well-accepted DSR approach of Peffers et al. (2007).

It is critical for us to aim to create a pragmatic understanding of emerging platform design, as platform design is becoming an important driver of innovation in HEIs.

3.3. Platform Design as Driver of Innovation

The design of digital platforms is firmly positioned as an important issue within the realities of planetary-scale computation, as stated by Bratton (2015) that organisations and leaders globally are grappling with. An underlying narrative in Bratton’s work is whether we are designing platforms or whether platforms are designing us. It serves to mention that there seems to be further tension between losing control of design and losing control to design. For the purposes of our study, we however aimed to focus specifically on the discourse within the Information Systems literature and the context of HEIs in South Africa.

The design knowledge base has not yet been comprehensively analysed within the context of the design of emerging platforms within the South African HE context, as various of the other main research themes in IS highlighted by Sun et al., namely IT Platform Investment, IT Platform Governance, IT Platform adoption, usage, and impact (Sun, Gregor & Keating, 2016).

Engagement by HE in South Africa around the emerging issue of digital platforms has furthermore been generally lacking so far. The current weaknesses in our understanding of platforms, as socio-technical artefacts and lack of focused research within this context, have also been exposed in our review of the literature at these intersection points (**Chapter 3**). This lack of clarity in our understanding of emerging platform design in HEIs is problematic because platforms are important levers in driving innovation.

DSR has been emerging as a recognised research approach, albeit still relatively isolated from other areas and their knowledge bases (Herwix & Vom Brocke, 2017). DSR is a useful framework for our goal of making sense of the concept of emerging platforms, as well as the processes of design inherent in their creation. Peffers et al. (2006) outline a well-accepted approach to conducting and presenting DSR. Structuring our approach (as well as the emerging platform lenses we develop in **Chapter 4**) to align with Peffers et al. will not only assist us with presenting and evaluating our case study (**Chapter 5**) in a comprehensive manner against relevant literature in IS, but also other academic fields that can sensibly inform our work.

The phases in DSR suggested by Peffers et al. (2006) are as follows:

- Problem identification and motivation
- Objectives of a solution
- Design and development
- Demonstration
- Evaluation
- Communication

The DSR process is graphically depicted in **Figure 5.**

Platforms present a powerful model for the creation of innovative digital products (Plantin et al., 2018). DPs have dramatically reduced the transaction costs and friction costs of service provision and asset sharing, with the marginal cost of producing additional products tending toward zero (Schwab, 2016). Platforms are viewed as a high-potential approach to unlocking opportunities of scale and creating first and second-order network effects (Eisenmann, Parker & Van Alstyne, 2011). Furthermore, platforms have the ability to accelerate innovation and better enable the contribution of third parties to value creation (David-West & Evans, 2016).

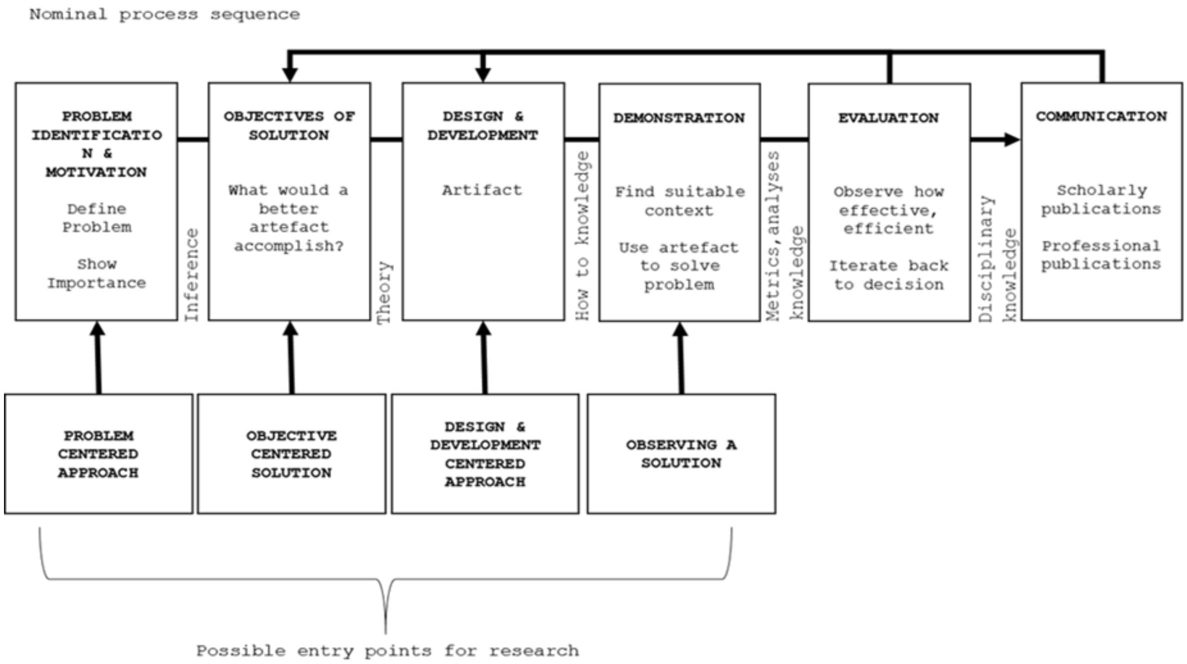


Figure 5: Design Science Research Process (DSRP) Model (Peffers et al., 2006)

An important scaling mechanism of platforms is the creation of network effects that can be direct or indirect (Gawer & Evans 2016): "Examples of direct network effects are social media, which become more valuable if more end-users join the platform. Externalities are indirect when the value of the platforms depends on the number of users in a different user group" (De Reuver, Sørensen & Basole, 2017). DPs also play a key role in enabling and sustaining online communities (Spagnoletti, Resca & Lee, 2015) and are often linked to the ecosystem construct or metaphor (De Reuver, Sørensen & Basole, 2017). DPs also play a supportive role in mediating co-creation and different ways of interacting within communities (De Reuver, Sørensen & Basole, 2017).

To build healthy online communities, an effectively functioning "collective actions commons" need to be designed and managed (see for example Schweik and English (2013) in an attempt to create a general theory of internet-based collective action in the context of a digital information commons). Early examples of collective action commons include the free and open-source software (FOSS) movement and the "copy left" copyright innovation of Richard Stallman at MIT (Stallman, 1985, 2015, n.d.). Since Stallman's innovation in the 1980s, FOSS has continued to grow and is now widely and globally deployed" (Schweik & English, 2013). Yochai Benkler (2006) introduced the concept of "commons-based peer-production". A characteristic of digital platform development has often been the deliberative and strategic creation of walled gardens (Knott, 2017), which, as part of the broader concept sometimes referred to as "platform power", is very difficult for regulators to come to grips with (Lynskey, 2017).[38] In reality, modern mega-platforms represent the exact opposite of the original intentions of the early internet innovators - a commercialised watering down of what the "commons" represents.

It is also a challenge for organisations in developing markets to design and develop digital platforms without making use of the "walled garden" - ecosystems of large technology firms. Quite often, the design decisions of these developing organisations are positioned more as a choice between competing ecosystems (such as Amazon Web Services vs. Google Cloud Services) than as a process to create technology solutions from scratch. The HEI sector is particularly vulnerable to this dynamic, constant funding pressure, coupled with increasing student and staff demands for digital connectedness. For a deeper analysis of the seeming paradox between students requesting digital access and simultaneously destroying the means of such access during the #FeesMustFall protests, see Grove, Breytenbach and Van Audenhove (2018).

3.4. Types of Platforms

Social networking platforms (as an example of digital platforms) have been one of the most public and prevalent manifestations of social media observed over the last few years. Social media can be defined as "the colonisation of the space between traditional broadcast and private dyadic communication, providing people with a scale of group size and degrees of privacy that we have termed scalable sociality" (Miller et al., 2016). For a detailed summary of social media definitions, also see Fuchs (2017).

Social networking platforms are, however, not the only types of platforms potentially relevant in the context of HEIs. Facin et al. (2016), for example, distinguish between internal platforms (product platforms), supply chain platforms, industry platforms and multi-sided platforms. See **Table 3** for examples of each, as well as their key design rules. Various other platform typologies have been suggested; for example, (Gawer, 2014) distinguishes between internal, supply chain and industry platforms. Our intention with this study is not to delve too deeply into the variety of platform types, as our specific interest is mainly in the internal platforms that are designed within HEIs to facilitate online communities.

[38] Lynskey suggests that the term "platform power" should be replaced by the broader concept of a 'digital gatekeeper'.

Table 3: Types of Platforms (Facin et al., 2016:483) (simplified and adapted by researcher)

Types of platforms	Context/level of analysis	Participants/ constitutive agents	Objectives	Design rules
Internal Platforms (product platforms) *Example: Sony Walkman*	Within the firm	One firm (one firm and its constitutive sub-units)	• To increase productive efficiency • To produce variety at a lower cost • To achieve mass customisation • To enhance flexibility in the design of new products	Close interfaces: Interface specification shared within the firm but not disclosed externally
Supply chain platforms *Example: Nissan-Renault*	Within a supply chain	Several firms within a supply chain (assembler and suppliers)		Interfaces selectively open: Interface specifications are shared exclusively across the supply chain
Industry Platforms *Example: Facebook, Apple iPhone, and App Store*	Industry ecosystems	Several firms that do not necessarily buy or sell from each other, but whose products/ services must function together as part of a technological system (platform leader and complementors)	For the platform owner: • To stimulate and capture value from external, complementary innovation For complementors: • To benefit from the installed base of the platform and from direct and indirect network effects of complementary innovation	Interfaces around the platform allow plugging-in and innovation of components Open interfaces: Specifications are shared with complementors
Multi-sided platforms *Example: eBay/Amazon*	Industries	Several firms transacting with each other through the intermediary of a multi-sided market	• To facilitate the transactions between different sides of the platform or market	Not addressed in the literature Mainly through price mediation

3.5. Impact of Digital Platforms on Society

If we look at the various planes on which digital platforms seem to be impacting society, these impacts are often deep (for example, the colonisation of the life-worlds of individuals and groups in society by Facebook, as highlighted by Heyman (2015) and Heyman and Pierson (2015). Outside the private sphere of individuals, these changes are also evident in various spheres of public life, for example, the disruption of elections (Badawy, Ferrara & Lerman, 2018). In our attempts to make sense of these fast-moving, often seemingly chaotic changes, we are reminded of Virilio's concept of dromological globalisation. Dromological globalisation views our continued invention or adoption of new technologies as being destined for "a successively violent, increasingly integrated history of accidents" (Virilio, 2006a).

In his introduction to the 2006 reprint of Virilio's *Speed and Politics*, Benjamin Bratton makes the statement that today "information is architecture by other means, framing and contouring the relative motility of social intercourse" (Virilio, 2006a). Therefore, we need to position digital platforms carefully, not as mere design artefacts, but also as integrated socio-technical systems within the complex and dynamic context of planetary-scale computation. This is necessary to understand some of the limitations this deepening reality may pose for emerging platform design. We also need to get a sense of how platforms emerge, in an evolutionary (the current *mot du jour*) or "disruptive" manner over time, but also as (potentially) designable artefacts and socio-technical systems.

The prevalence of digital platforms is leading to changes in organisations, markets and the logic of innovation (Kuebel & Zarnekow, 2014). Digital platforms have been viewed as a key enabler of the on-demand economy (also referred to as the sharing economy); also, digital platforms have been creating new ways of consuming goods and services (Schwab, 2016).

Platforms have been identified as a crucial driver of the fourth industrial revolution, with the purely digital platforms as hallmarks of the third industrial revolution increasingly adapting into or being supplanted by fourth industrial revolution platforms intimately connected to the physical world (Schwab, 2016). Hence, platforms and emerging platform business models increasingly alter the relationship of users with physical assets, marking a profound and notable shift from ownership to access (Schwab, 2016). See the work of Perzanowski and Schultz (2016) for a detailed discussion of how digital technologies and digital platform firms have altered the nature of personal property in the digital economy. (Throughout the book, the role of deliberate design decisions within this process is highlighted, resulting in weakening the hold the average user of digital technologies still manages to maintain on their personal property rights in the context of digital technologies).

In the analysis of platform design literature, there is an ever-present tension between top-down, expert-driven design and the more organically generative conceptualisations such as Rhizomatic design (Deleuze & Guattari, 1987). Platform design literature is not considering DPs and platform ecosystems as Rhizomatic phenomena; it is presented from a predominantly expert-driven approach. DPs also cause organisations to redefine their relationship with physical space and traditional notions of geo-political boundaries, as Bratton states: "Cloud platforms not only have geopolitical ramifications and implications; they are a geopolitical condition and constitution in their own right" (Bratton, 2015).

The way platforms disrupted traditional notions of geo-political boundaries also have implications on an organisational level. The regulation and governance of platforms within organisational contexts often result in confusion around blurred lines of legal accountabilities, core responsibilities for governance decisions, as well as the realisation that the organisation has very limited control over many of these decisions. For example, if an organisations platform constellation (or ecosystem) enables the use of OpenAUTH[39] logins and its related Application Programming Interfaces (APIs), which immediately introduces deep dependencies upon the design decisions of the owners.

The owners of particular APIs can introduce (often without any meaningful consultation with its users) changes to its design, structure, features and availability, for example, recent changes in the Facebook API ecosystem after the Cambridge Analytica scandal (Perez, 2018). In emerging contexts, there may be significant dependencies on linking to API ecosystems of the mega-platforms (which will typically be designed, operated and owned by mega-platforms such as Facebook, Google or Microsoft)[40] (see Huhtamäki et al., 2017 on the interlinked nature of the global API ecosystem).

Platforms have changed the nature of competition within markets, as De Reuver, Sørensen and Basole (2017) state: "Competition no longer revolves

[39] OAuth is an industry standard protocol for authentication. See https://oauth.net/2/

[40] Another example of this is the way the European Union's GPDR privacy regulations have implications for the designers of digital platforms across the world, while same could also be said of any update in the API of a global platform provider such as Google, Facebook or Twitter. In general, the significantly more advanced regulatory capacity of developed-world governments- such as the EU or US- creates the *de facto* legal frameworks that are then transplanted to developing world contexts, often without limited input of these countries, such as South Africa.

around how to control the value chain but around attracting generative activities associated with a platform". This has dramatic implications for business and society, also in as much as the platform effect tends to lead to few but powerful and dominant platforms emerging (Schwab, 2016).

However, it is necessary to nuance the potential of digital platforms. Concerns have been voiced about the potential impact of these technologies on deepening inequality (Hawking, 2016). It has been suggested that the next wave of technological development, including digital platforms, may increasingly result in middle-class job destruction (Hawking, 2016), even in career paths traditionally thought of as *"future-proof"* knowledge work (Frey et al., 2016). There is also increasing awareness of these technologies leading to disconnect and isolation (Mariën & Prodnik, 2014), as well as the creation of a *second digital divide* (Zhao & Elesh, 2005).

Digital platforms seem to be creating and deepening various "unfreedoms" to use the concept introduced by Amartya Sen in *Development as Freedom* (Sen, 1999). An interesting example of how Sen's capabilities approach retains its relevance in the digital age and in a developing world context) is found in the work of Gigler (2015). The platform debate should be focused on addressing these societal and global risks and may need to focus on societal regulation of digital platforms (De Reuver, Sørensen & Basole, 2017), including the investigation of new types of legal and regulatory tools such as the right to reasonable inferences (Wachter & Mittelstadt, 2019).

In response to the potentially exploitative nature of the digital platform economy, there are various initiatives focused on getting a better understanding of the issues and suggesting alternative models of design and ownership, for example:

- The Fairwork Foundation and their analysis of the gig economy and labour exploitation, resulting in their suggested new principles for fair labour practices (Fairwork, 2019)
- The Platform Cooperatives movement, for example, the *Platform Cooperativism Consortium* and its research arm, the *Institute for the Cooperative Digital Economy* (The New School, 2019)
- Various research reports have also suggested cooperatives as an alternative model, for example, NESTA (Borkin, 2019)
- The inclusion of platform cooperatives within the context of the typology of digitally facilitated crowd work (Howcroft & Bergvall-Kåreborn, 2019)

- Cooperatives have been suggested as alternative platform ownership designs that may create a more inclusive platform economy than the current investor-owned structures that currently prevail (Hernando, 2013)

The platform cooperatives follow mainly an inclusive design model. See the Inclusive Design Guide (Inclusive Design Research Centre, n.d.), with the following key principles (Treviranus, 2018a, 2018b):

- Recognise, respect and design for human uniqueness and variability
- Use inclusive, open and transparent processes, and co-design with people who have a diversity of perspectives, including people that cannot use or have difficulty using the current designs
- Realise that you are designing in a complex adaptive system

A challenge that non-profit cooperatives face in scaling their initiatives in the platform society is the strong dependence they often have on commercial infrastructural platforms with built-in mechanisms that are well suited for global scaling and cross-sectoral data-sharing (Van Dijck, Poell & De Waal, 2018). These mechanisms hamper efforts at centralisation of data traffic and attempts at local sovereignty or personal ownership of data flows (Van Dijck, Poell & De Waal, 2018)[41].

It is our opinion that the potential of the platform cooperative model has not been adequately explored as a potentially different design approach in HEIs. There seems to be some alignment between the design values espoused in the cooperative platform movement and the core design tenets of the LL approach (see Schaffers et al., 2010).

3.6. Platforms and Co-creation

From the start of the internet and the digital era, its use has often been equated with increasing diversity and enhancing inclusion and democratisation.

> "When computers are properly used, they increase individual diversity. A worldwide network of computers will make all of mankind's factual knowledge available to students everywhere in a matter of minutes or

[41] In the words of Van Dijk et al: "Democratic control indeed seems a heavily contested public value in the current global ecosystem where local sovereignty or personal ownership over data flows is rarely an option offered by the dominant platforms" (Van Dijck, Poell & De Waal, 2018).

> seconds. Then, the human brain will not have to serve as a repository of specific facts, and the uses of memory will shift in the new education, breaking the timeworn, rigid chains of memory may have greater priority than forging new links (McLuhan & Leonard, 1967:25, cited in Logan, 2011).

The popular and commercial narrative around digital platforms has often lauded the fact that platforms are empowering users and leading to a democratisation of information. Castells argues that there is increasing evidence of a direct relationship between the Internet and the rise of social autonomy (Castells, 2014). Castells further argues that "(f)rom this Internet-based culture of autonomy has emerged a new kind of sociability, networked sociability and a new kind of socio-political practice, networked social movements and networked democracy" (Castells, 2014). The New York Times has even called the Silicon Valley-fuelled narrative the *Church of Techno-Optimism* (O'Mara, 2019).

It is our opinion that the techno-utopian narrative may be underestimating the new dynamics and constraints that intelligent automation brings to the role of the designer and design as a human-focused endeavour. Most of the recent advances in artificial intelligence (AI) and machine learning (ML), in particular, have been driven by deep learning. This approach has made it possible for machines to match or surpass humans in certain types of tasks, especially those involving image and speech recognition, natural language processing and predictive analytics (Brynjolfsson, Mitchell & Rock, 2018).

However, human designers admit that they often do not understand how the technologies they designed actually work (Knight, 2017). This problematises mindful design (Grove, 2018). These technologies also add new risks of discrimination and fairness to design processes (Crawford & Joler, 2018; West, Whittaker & Crawford, 2019).

In contrast to this, an increasing number of studies have found that these new digital platforms, despite seemingly active and engaged users, have disempowering effects and may lead to increases in inequalities (Graham et al., 2014; Graham, Hjorth & Lehdonvirta, 2017; Whittaker et al., 2018; Fairwork, 2019; Graham, 2019; Ricaurte, 2019).

It is foreseeable that the deeper evolution of the *fourth industrial revolution* will also entail convergence between humans and the various hybrid human-digital manifestations (in all its complexity, as discussed at length in Gladden, 2018, which positions the organisation as the locus of future advances in post-humanist technologies). It should serve HEIs well to not remain stuck in popular (mis)conceptions of the fourth industrial economy only being about clearly recognisable non-human actors. In this regard, refer to our work around the convergence of planetary-scale computation and post-humanism within an organisational context (Grove, 2018).

In our engagements with the role of users in digital platforms, we should therefore be careful in balancing the more techno-utopian perspectives of platform owners, platform designers and even platform users with the real power dynamics that the infrastructuralisation of platforms bring (especially when positioned within the meta-framework of planetary-scale computation). These tensions have the effect of potentially limiting design freedom. We should be mindful that co-creation is also not a panacea for all HEI platform design challenges, as it has its own perils and risk (Verhoef, Van Doorn & Beckers, 2013). In order to minimise or avoid some of the co-creation risks, it is critical to focus on creating collaboration processes with perceived fairness and a sense of community (Gebauer, Füller & Pezzei, 2013).

To facilitate fairer and more equitable user participation in design processes, we believe that some friction in the design process is the desired outcome, especially if friction means more human interaction with the value creation mechanisms of emerging platforms and not just (as what we suspect may often happen in user co-creation processes) dealing primarily with interface level design input. Therefore, we believe that the LL process needs to add deeper friction to design processes.

3.7. Emerging Digital Platforms

It is necessary for our study to arrive at a clear **operational definition of what we started calling "emerging platforms"**: the concept of platform emergence, in our minds, refers to the developmental changes and evolution of platform elements, architecture and governance over time.

3.8. Defining Emerging Digital Platforms (EDP) and its Drivers

Our view is that platform emergence is inextricably linked to platform scaling and consists of two elements: one is the design decisions deliberately made to create and facilitate scaling. Secondly, some aspects of the emergence process will be externally dictated by changes in contexts, ecosystems, actors or technologies. Even though the response of designers still entails making a design decision in response to externally dictated factors, the *freedom of design* in these cases may be (sometimes severely) limited due to externally imposed constraints.

The issue of platform evolution (or platform emergence, as we have been referring to it), has been specifically analysed in detail by Tiwana Konsynski and Bush (2010) and Tiwana (2014). In much of the other platform literature, the issues around and dynamics of platform development, growth and evolution have often been sub-themes (Bakos & Katsamakas, 2008; Gawer & Cusumano, 2008, 2013; Gawer, 2009, 2010, 2014; Boudreau, 2010; Thomas, Autio & Gann, 2011; Parker & Van Alstyne, 2013; Frattini et al., 2014).

It is necessary to delve much deeper into the nature of digital platforms and the dynamics that affect their emergence. The work of Tiwana Konsynski and Bush (2010) and Tiwana (2014) is particularly relevant in this regard (see **Figure 6**). The nature of digital platforms themselves also seems to be subject to the continuous evolution of change. The process of nurturing platforms to realise their connective and generative potential requires thinking at the intersection of software design and business strategy (Tiwana, 2014). These decisions need to be balancing both operational and strategic dimensions over various time horizons to develop scalable and sustainable platforms (Tiwana, 2014).

However, despite growing research interest in platform evolution, it still remains largely unclear under what conditions platforms evolve and why they do so (Sandberg, Holstrom & Lyytinen, 2014). Platform evolution does seem to be impacted by platform design decisions and deliberate orchestration of their evolution (Tiwana, 2014): "Orchestrating their evolution requires that their architecture and governance interlock and subsequently coevolve, which is biologically inspired business design" (Tiwana, 2014).

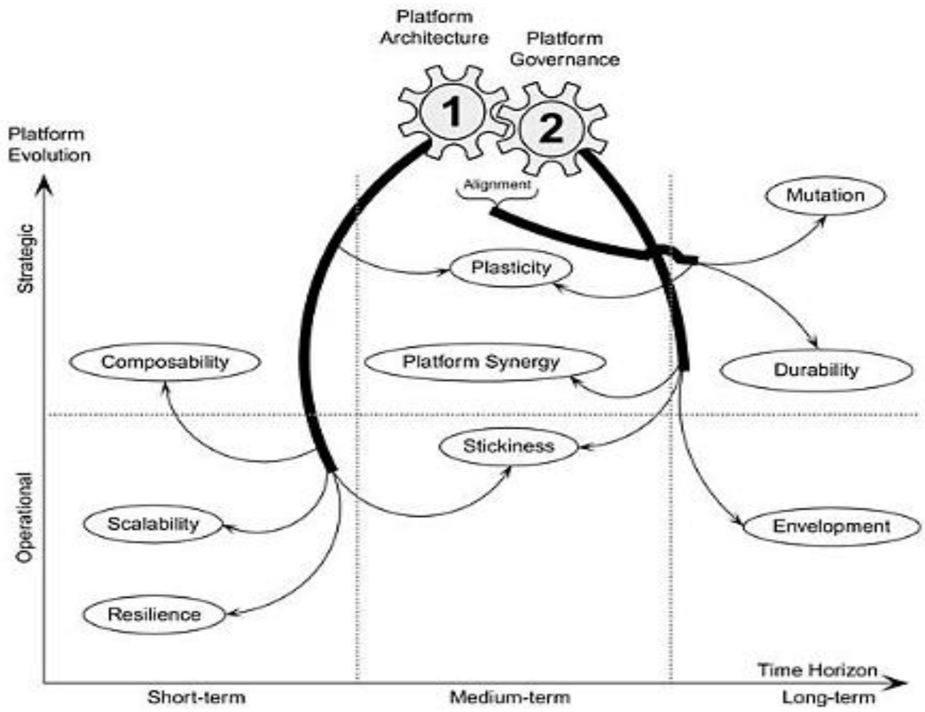


Figure 6: Primary Drivers of Nine Metrics of Platform Evolution (Tiwana, 2014)

Baldwin and Woodard emphasise the importance of platform architecture within the platform evolution process: "Therefore a platform's architecture is expected to be evolvable in that it can adapt to unanticipated changes by re-using and re-arranging its components, while allowing its peripheral components to vary. By doing so, the platform allows increased functional variety and thus becomes evolvable – two characteristics sorely needed to compete during the age of customisation and market uncertainty" (Baldwin and Woodard, 2009).

Tiwana also identifies platform governance as a key aspect of platform evolution. For example, the manner in which decisions about pricing, control and decision rights impact the evolution of the platform (Tiwana, 2014).

When investigating platform emergence, various design questions need to be answered to understand this process better:

- **Scaling design** - How is the emergence of the platform deliberately designed in each phase?
- **Scaling evolution** - How is the design of the emergence of the platform externally influenced by contextual factors?
- How does **Architecture-governance alignment** shape evolution?
- How is **Architecture-governance alignment** designed?

Our suggested framework in **Chapter 5** therefore integrates the phases of the Design Science Research Process (Peffers et al., 2006) and applies what we call the *Emerging Digital Platform Design Lenses (EDP Lenses)* to it. This creates the first attempt at a conceptual framework that can be utilised to view the case study analysed. Through a review of literature, we refined and adapted the EDP Lenses to arrive at a comprehensive yet practical framework for analysis of design decisions and design propositions that could be investigated and evaluated in our case study to answer our research questions.

Our **operational definition of emerging digital platform design** is therefore formulated as follows:

> Emerging Digital Platform Design is the integrated design decisions made by platform designers (in whatever role they play within the platform ecosystem) to inform the intention, realisation, implementation and evaluation of a new digital platform as it emerges through deliberate design decisions and the evolution of its context over time.

4. Living Labs: Definition and Contextualisation

As stated in **Chapter 1**, LL can be defined as a design research methodology with the purpose of co-creating innovation through the involvement of aware users in a real-life setting (Era & Landoni, 2014).

According to Era and Landoni (2014), this definition aligns with one of the original proponents of LL, namely William Mitchell from MIT (Boston), Medialab, School of Architecture and City Planning. This definition is also referred extensively by Schuurman, De Marez and Ballon (2015). This definition describes LL as “a user-centric research methodology to sense, prototype, validate and refine complex solutions in multiple and evolving real-life contexts”.

Era and Landoni (2014)[42] further describe LL as “an emerging public–private partnership (PPP) concept, in which firms, public authorities and citizens work together to create, prototype, validate and test new services, businesses, markets and technologies in real-life contexts, such as cities,

[42] See Era and Landoni (2014) for a comprehensive summary of various other definitions of the concept of LL.

city regions, rural areas and collaborative virtual networks between public and private players".

In the innovation research landscape, LL can be positioned as a methodology between the user-centred design approach and the participatory paradigms (Era & Landoni, 2014). The positioning and value of LL as a structuring mechanism for user involvement in innovation development have been investigated by Schuurman (2015). The necessity to create clearer conceptual models around LL that are grounded in existing, more established innovation theories have been expressed by Schuurman (2015). For a comprehensive literature review of the LL field, see Schuurman, De Marez and Ballon (2015).

Within specifically the European and American contexts, LL has been developing rapidly over the last few years as a method and approach for enabling user-co-designed open innovation processes (Schuurman, 2015). LL in so-called developing countries has also been investigated (Weiss, 2012), also in South Africa (Gumbo et al., 2012; Gumbo, Jere & Terzoli, 2012).

LL is informed by various fields, including human computer interaction (Sauer, 2013), social shaping of technology (Pierson & Lievens, 2008), user innovation and open innovation (Schuurman, 2015), co-creation (Pierson & Lievens, 2008; Rits, Schuurman & Ballon, 2015; Schuurman, De Marez & Ballon, 2015), lead user innovation (Von Hippel, 1986, 2005) and various others. LL and its gradual evolution from user centred design and user experience toward user co-creation have been positioned within the landscape of innovation methodologies by Pallot et al. (2010). For a detailed overview of the concept of co-creation, see Voorberg et al. (2015).

Our **operational definition of Living Labs** for the purpose of this study is as follows:

> A Living Lab, in the context of Emerging Digital Platform Design, is a process of making, facilitating and enabling design decisions by aware platform designers, stakeholders and users in the co-creation of the intention, concretisation, implementation, evaluation and adaptation/ re-design of digital platform artefacts (including object-design, realisation-design and/or process-design).

In this study, we therefore specifically emphasise the way LL informs design decisions rather than its structural or infrastructural elements.

5. Living Labs and Design Science Research

It may be argued that LL can be viewed as a subset of the DSR approach (Thapa et al., 2014). Also, see Sanders and Stappers (2008) for a positioning of LL within the context of the Design Research landscape, specifically Human Centred Design. LL maturity level evaluation has been suggested based on a domain mapping of existing LL projects (Salminen et al., 2011). For a recent and comprehensive Living Labs (LL) literature review, see Schuurman, De Marez and Ballon (2015).

LL has been applied within the context of supporting innovation within HEIs in South Africa (Callaghan & Herselman, 2015; Baelden et al., 2016). It has been argued that LL has utility in addressing *wicked problems* (Steen & Van Bueren, 2017), also with potential applicability in developing countries (Weiss, 2012).

Within the South African context, there are various challenges in evaluating LL (Adam et al., 2011). Attempts have been made to create universal/general principles to evaluate the impact of LL projects and interventions (Ståhlbröst, 2012). LL has been applied within the South African context (Pitse-Boshomane et al., 2008; Herselman, Marais & Pitse-Boshomane, 2010; Adam et al., 2011; Smit et al., 2011; Botha et al., 2012; Coetzee, Du Toit & Herselman, 2012). For a recent report on LL application within the South African context, see Cunningham, Herselman and Cunningham (2011). For a critical discussion of the limitations of the Cunningham, Herselman and Cunningham (2011) report, see Weiss (2012).

LL has also been applied within the international HE context (see Graczyk, 2015), and in a South African context (see Van Audenhove et al., 2014). LL as a mechanism for innovation has drawn significant attention, and it has been applied through various organisational and innovation ecosystems (Almirall et al., 2012). However, LL has received limited attention in the literature (Era & Landoni, 2014), and therefore, LL is not a panacea for linking the quadruple helix of business, universities, society and communities. LL presents a potentially valuable innovative approach. Burbridge (2007) states that “they are a highly flexible, simple and adaptable model for knowledge based innovation” and offers the potential for creating shared benefit opportunities for the various actors in the innovation process and ultimately it can offer universities a more central role in society, as their impact would be more widespread and visible.

LL is furthermore an exemplar of “the growing interest in conceptualizing the artefact in socio-technical terms, where the artefact is regarded not only as a stand-alone piece of technology, but also as something that is significantly interwoven with organisational and social elements and related logics” (Rossi et al., 2013). LL is based on principles such as openness, innovation, sustainability, reality and co-creation with knowledge production (Bergvall-Kåreborn & Ståhlbröst, 2009). To this background, LL has been defined as an environment, a methodology and a system (Almirall & Wareham, 2011; Thapa et al., 2014).

The intersection of LL – open innovation and user innovation – has been examined by Følstad (2008) and Schuurman (2015), for example. LL has been emphasised as a milieu for open innovation (Følstad, 2008). Other important elements of LL are experimentation and co-creating with real users in real-life environments, where users, researchers, companies and government institutions collaborate to develop new solutions, products, services or new business models (Krogstie, 2012).

The work of Krogstie (2012) is one of the few attempts that have been made to identify the common elements between DSR and LL directly. It has been argued that LL includes various aspects of DSR, such as innovation, artefact, evaluation and design principles. Yet, it still needs further conceptual grounding to proclaim it as a valid DSR methodology (Thapa et al., 2014).

If LL is compared to DSR, it differs in terms of its openness, co-creation, and evaluation of IT artefacts beyond organisational context (Thapa et al., 2014). The five key principles of LL are openness, influence, realism, value and sustainability (Bergvall-Kåreborn, Eriksson et al., 2009). The main goal of DSR is the creation of utility (value) (Hevner et al., 2004). Both DSR and LL focus on iterative processes that involve various stakeholders in designing and building artefacts (Thapa et al., 2014).

Within the perspective of DSR, researchers build their theory based on practice, whereas LL is more focused on finding theoretical underpinnings for their practices (Krogstie, 2012). Most DSR research is done with a rigorous and well-defined theoretical underpinning, whereas LL researchers “seek to articulate novel and innovative use patterns of ICT based on end-user knowledge and interaction” (Krogstie, 2012).

Since the seminal work by Hevner et al. (2004), DSR has been viewed in IS as viable alternative to behavioural science research (Thakurta et al., 2017). Within the context of Information Systems, both practice and theory grapple with the rather blurry intersection between design, implementation, utilisation and evaluation of these digital platforms. There seems to be a gap between the seemingly ample opportunities that these socio-technological systems seem to offer and the practical realisation thereof. This gap also seems to exist on the implementation level, but it also needs to consider the complexities around the evaluation of DSR, as highlighted in Venable, Pries-Heje and Baskerville (2016).

Design Science is, at its core, focused on developing knowledge for the design and creation of artefacts to solve new problems or to solve improvement problems (Van Aken, 2004), as summarised: "A design-science is not concerned with action itself, but with knowledge to be used in designing solutions, to be followed by design-based action" (Van Aken, 2004). Artefacts imply the application of information technology to particular organisational tasks (March & Smith, 1995).

DSR combines both description-driven and prescription-driven approaches with the ultimate shared goal of developing tested and grounded rules with direct applicability in the field (Van Aken, 2004). Digital platform design, however, has been informed by ex-post studies of successful cases rather than failure cases; it has not yet revealed much direct design knowledge (De Reuver, Sørensen & Basole, 2017).

LL has been viewed predominantly as a milieu for open innovation. Yet, its conceptual underpinning within DSR still seems to be vague (Thapa et al., 2014). In order to understand the potential complementarities between DSR and LL, we have compared the predominant DSR process suggested in the literature Peffers et al., 2006) with the most widely applied LL process phases (Pierson & Lievens, 2008).

Table 4: Alignment between DSR and LL (Author)

Design Science Research process (Peffers et al., 2006)	Living Labs process phases (Pierson & Lievens, 2008)
Problem identification and motivation	Contextualisation
Objectives of a solution	Objectives of a solution
Design and development	Concretisation
Demonstration	Implementation

Evaluation	Feedback
Communication	Feedback

We have found significant alignment between these processes (see **Table 4**). This alignment between DSR and LL will be further investigated in the next Chapter, with specific reference to the current state of the art at the intersection of DSR and LL literature around EDP design within HEI contexts.

6. Chapter Conclusion

The focus of this chapter was on defining and contextualising, from a multi-disciplinary perspective, some of the key concepts analysed in this study, namely DPs, EDPs and LL.

DPs as design artefact digitally facilitate the exchange of value between multiple ecosystem actors in a market. EDP design can be described as the process of design decisions taken by platform designers (which may include various role-players in the platform ecosystem) to determine or influence the intention, concretisation, implementation and/or evaluation of the digital platform as well as the socio-technical end-product/s of such processes. Platform design decisions include both the implicit and explicit decisions taken to meet certain design objectives; it also includes decisions brought about by external factors (sometimes by force, sometimes by convenience or resource constraints) and the evolution of its context over time.

DPs are complex to study and have been viewed as disruptive to conventional research approaches within various academic disciplines. DPs furthermore present disruptive effects on society, resulting in complex tensions between its empowering and disempowering possibilities. Increasing concerns around immense power concentrations with large platform actors (commercially driven) have been raised. Similarly, the blurring of boundaries between commercial platforms and structures of government has also been observed. This leads increasingly to risks to vulnerable users and organisations in the Global South. HEIs in South Africa are particularly vulnerable due to DPs' systemic inequality challenges and often prevalent lack of institutional resource capacity, internal depth of skills and *capacity to design* (object design, realisation design and process design capabilities).

It is useful to position the design process of EDP within the context of planetary-scale computation (*The Stack,* as advanced by Bratton, 2015), as platforms represent a third institutional form along with states and markets. DPs also display a specific convergence of architectonic and computational forms, which, although still designable entities (at least in part), presents more complexity to platform design decisions than what may be visible at first glance.

Design choices of EDP designers influence the trajectory towards its intended objectives, value realisation and value capture potential. However, in EDP design contexts, the seamless convenience offered by mega-platforms (introducing external dependencies into EDP design processes), and their control of the extraction of user data, coupled with the emergence of automated design technologies, may be decreasing the *Freedom to Design* platform designers in HEI contexts. The increasingly post-human nature, automated decision-making, artificial intelligence design tools and re-casting of the role of human designers problematises the assumptions we make around the utility of co-creation approaches such as LL.

It is important for EDP designers to have a better understanding of the specific barriers they may be presented with in terms of design processes, particularly as they aim to ensure meeting the objectives of empowering potentially vulnerable and resource-constrained online HEI communities. It is also important to realise that these barriers may be largely invisible or hidden between the veneer of “simplicity”, yet hiding black boxes filled with complexity and entrenched design values built on “data colonialism” (Couldry & Mejias, 2019), “surveillance capitalism” (Zuboff, 2019) and “platform imperialism” (Jin, 2013).
The empires and powerbases of these (often highly) exploitative business models mentioned above expand through largely invisible fleets of ships (ubiquitous digital tools and applications) visiting every harbour on the globe and selling their wares at no visible cost to often vulnerable users and design decision-makers under pressure to digitally transform their own organisations to remain competitive in global marketplaces. The emerging world and its institutions often have often limited capacity to regulate, govern and make these invisible ships visible and their impact on local societies clear and manageable.

HEIs are not immune to this process and competitive tensions and often lack the capacity to harness the predictive power of collected data and create generative entrenchment and network effects on a scale that can competes with mega-platforms. Furthermore, ethics rules concerning Data Chain of Custody, and the national Protection of Personal Information Act, 2013 makes data sharing highly complex. This must be further studied in this context.

Although DP design can be positioned as a potential driver of innovation within HE, the scaling decisions required are different from those underlying profit-driven DPs. This creates serious challenges for HEIs to design EDPs with an internal economy that can scale and become sustainable. Often the introduction of external dependencies may erode the value creation potential of these internal economies being designed.

An operational definition of LL in the context of EDP design was suggested and focused on the making, facilitating and enabling of design decisions by aware platform designers and users in the co-creation of the intention, concretisation, implementation, evaluation and adaptation/re-design of digital platform artefacts (including object-design, realisation-design and/or process-design).

In the application of a design approach such as LL in an EDP context, it needs to be recognised that digital platforms present a new organisational form with its own instrumentality and increasing agency of its own. It is also critical to recognise that platform design decisions are affected by mechanisms and tensions external to the digital artefact being designed and built.

The potential tensions between different role-players in the LL process would need to balance the possible techno-utopian perspectives of platform owners, platform designers and even platform users with the complex power dynamics that the infrastructuralisation of platforms within the context of *The Stack* introduces. These tensions and potential barriers the LL approach may face in EDP design processes can be analysed by focusing on the explicit and implicit design decisions taken during an EDP design process.

The complementarities of design processes in DSR (specifically Peffers et al., 2006) and LL (specifically Pierson & Lievens, 2008) were compared, and the alignment is highlighted in **Table 4**.

In **Chapter 4**, the research methodology utilised will be discussed. In **Chapter 5**, the complementarities of design processes in DSR and LL referred to in **Table 4** will be extended to propose a comprehensive yet practical approach to investigating the intersection of these concepts in practice. The *Emerging*

Digital Platform Design Lenses, as a set of conceptual tools, will be introduced, where after it will be applied to our case study under investigation in **Chapter 6**. We will conclude in the subsequent chapters with the analysis and findings (**Chapter 7**) and recommendations (**Chapter 8).**

In the next chapter (**Chapter 3**), the focus moves to the intersection between DPs, EDPs and LL in the form of a structured literature that reviews and analyses the current discourse within the IS field. While LL, as a subset of the DSR approach, has presented itself as a potentially useful tool to empower users involved in technology design processes in South Africa, the mechanisms by which LL influences the design of emerging platforms, and design decisions specifically, are under-investigated at present.

Chapter 3 – Structured Literature Review

"People ignore designs that ignore people".

–Frank Chimero

1. Introduction

In **Chapter 2**, key concepts analysed in this study, i.e., Digital Platforms (DP), Emerging Digital Platforms (EDP), and Living Labs (LL), were defined and contextualised from a multi-disciplinary perspective. In this chapter, the focus changes to the intersection in literature between these three concepts, specifically within Information Systems.

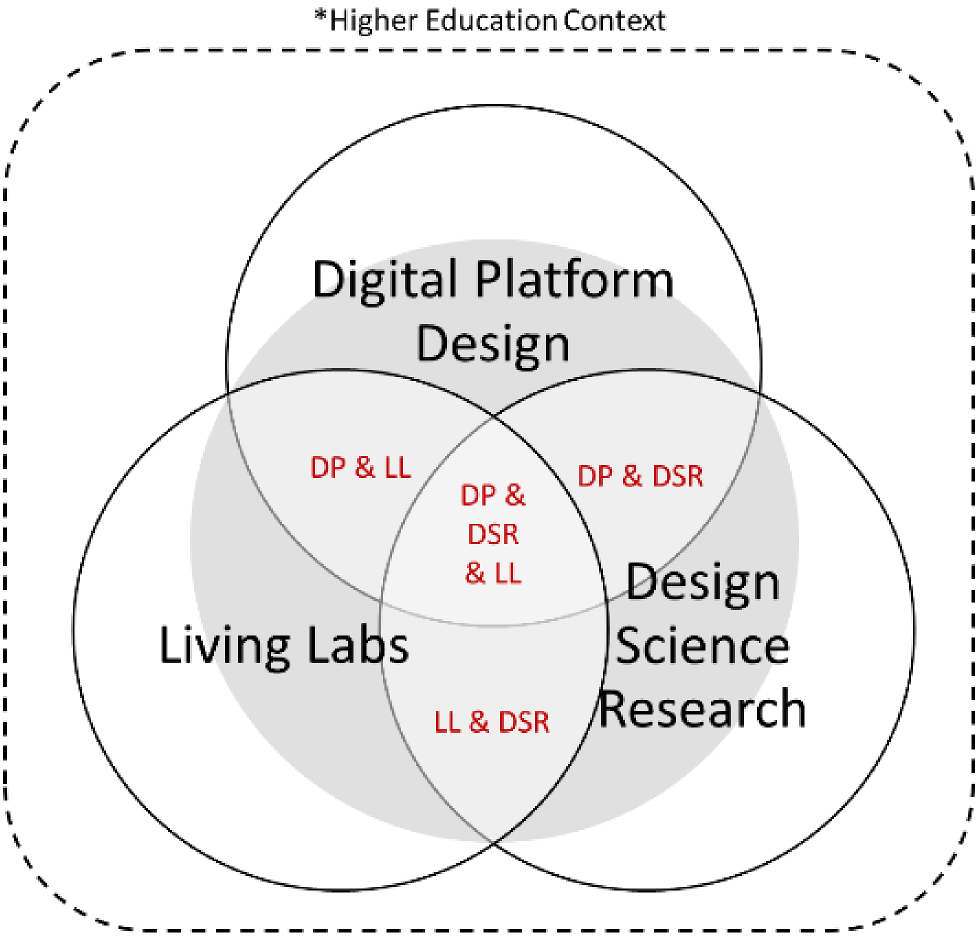


Figure 7: Focused Intersections of Structured Literature Review (Author)[43]

To understand the current intersection of emerging platform design and LL within the HE context in South Africa, we need to investigate the current state of the art by examining, in a structured but pragmatic manner, the literature at these intersection points within its context (See **Figure 7**).

[43] LL=Living Labs; DSR=Design Science Research; DPs=Digital Platforms

As argued in **Chapter 1**, engagement by higher education (HE) in South Africa around the emerging issue of digital platforms has generally been lacking so far. The current weaknesses in our understanding of platforms, as socio-technical systems and artefacts, as well as the design within this context, are also evident by the lack of focused research in this regard.

In our evaluation of key concepts in **Chapter 2**, it became evident that the intersections of platform design and LL as a potentially useful approach to creating more meaningful user participation in this process, have been under-explored and are quite fragmented in terms of multiplicity of disciplinary focus areas. Although this holds true for the general context of Higher Education, it is particularly clear upon examination of the Higher Education context in South Africa.

We will now (**Chapter 3**) detail and critically discuss our structured literature review approach, search strategy and search results. Thereafter we will proceed to focus on a more in-depth discussion of the intersection points between Design Science Research, Digital Platform Design (focused on Emerging Digital Platforms) and Living Labs.

2. Literature Review Approach

According to Fink (2014), a research literature review is a systematic, explicit and reproducible method for the identification, evaluation and synthesis of the existing body of completed and recorded work reproduced by researchers, scholars and practitioners.

To anchor our study, focusing primarily on the intersection of the academic discourse within and between the research communities working in Living Labs (LL), Design Science Research (DSR) and Digital Platforms (DPs), the aim of our structured literature review, and specifically our literature search strategy, is therefore an attempt to identify the sources of critical and important discourse in each of these fields.

Once we have better clarity on the *loci* of these discourses, we will explore the intersection points between each of these broader fields as it specifically pertains to our defined area of focus. We will also aim to anchor our literature review to the context of Higher Education in South Africa.

Our approach to the review of the literature has been informed by best practices, as suggested by Okoli and Schabram (2010) as well as Bandara et al. (2015). Specific to our Critical Realist analysis approach (see **Chapter 4**), we were also cognisant of the approach and methodological suggestions advocated by Okoli (2015) as it pertains to our theory-oriented systematic review.

In producing a literature review with theoretical value, it is necessary to have a firm grasp on how we define "theory" and focus on synthesising theory from the reviewed literature. Therefore, as Okoli states, our aim should be to "dig it out from dozens of research studies they might be reviewing, not merely to summarise what they find, but to synthesize it in a way that develops new theory beyond the mere sum of the collated studies" (Okoli, 2015).

We realise the challenges inherent within this type of systematic review and aim to build on the methodological approach to ensure structure and rigour in our approach, also aligning our literature review strategy with our Critical Realist approach.

Table 5 summarises of the general steps in a standard systematic review.

Table 1: General Steps of a Systematic Review (adapted from Okoli, 2015)

Steps	Focus
Purpose of the review	Specify general objectives, research questions and dissemination strategy
Protocol and training	Prepare a protocol (plan) for the review and train the review team
Practical screen	Decide on which kinds of articles to search for and which not to consider
Literature search	Conduct actual search for relevant articles
Data extraction	Read articles and extract pertinent information from them as material for the review
Quality appraisal	Evaluate the quality of articles identified
Synthesis	Use a chosen approach to combine and analyse studies and synthesise composite meanings from them
Writing the review	Write up the review and draw conclusions from the synthesis

In terms of the Critical Realist (CR) paradigm, "theory" is defined specifically in terms of the three domains of reality (emphasis added):

> "Theory in CR is closely tied to its view of the three domains of reality: there is a ***domain of the real*** which includes generative mechanisms and laws that have powers to effect causes in the world. The events which are in fact caused by real mechanisms lie in the ***domain of the actual***; these events might or might not be detectable by human observers. Those that are sensed or detected belong to the ***domain of the empirical***. CR theory aims to go beyond merely documenting the relationships between observed empirical events; it focuses very much on explanations of what brings about these events" (Okoli, 2015).

In Critical Realism, the process of theorising focuses strongly on the underlying mechanisms that can affect actions (emphasis added):

> "CR theorizing focuses not merely on the relationship between empirical observations, nor even on proposed relationships among actual events, whether observed or not, but squarely on the ***underlying mechanisms*** **that have the *ability to effect actions***. The basic CR formula for theory is: ***real mechanisms have the potential to sometimes cause actual events in the world, which might or might not be empirically observable.*** **The central element is usually the actual events**. Scientific study of these events involves *identifying or creating circumstances or environments that permit both their occurrence and their empirical observation*; this observation permits theorizing about the *underlying mechanisms or laws that cause the observed events*" (Okoli, 2015).

Okoli (2015), aiming to integrate Critical Realism principles as well as generally accepted processes of theory building in IS (specifically Gregor's five types of theory), contextualises *theory* as follows:

> "A theory is an integrated collection of explanations about the relationship between one or more pairs of concepts that represent *real-world phenomena under specified conditions*; such explanations might be accompanied with *predictions and implications for intervention and action*" (Okoli, 2015) (emphasis added).

Our literature review will therefore follow the process, informed by Okoli (2015), detailing the purpose, search protocol, literature screening, quality appraisal and eventual synthesis of search results.

In terms of conducting a theory-oriented systematic review, Okoli suggests the following elements to guide the process (**Table 6**) (Okoli, 2015):

Table 2: Elements of a CR Theory-Oriented Systematic Review (Okoli, 2015:6-7)

Eight steps of a systematic review	Theory-oriented systematic review	Critical Realist systematic review
Purpose • **Objectives** • **Research questions** • **Dissemination targets**	Objectives and research questions: One of three theory-oriented objectives: • Theory landscaping • Theory contending • Theory testing Dissemination targets: peer-reviewed and practitioner conferences for protocol; peer-reviewed journal and practitioner conference for final results	Objectives and research questions: • Theory landscaping: Document empirical phenomena; take note of actual and proposed real phenomena • Theory contending: Conjecture new real phenomena to explain hitherto unexplained empirical phenomena • Theory testing: Validate the real mechanisms offered for horizontal explanations • Dissemination: Because of the practical relevance of rich understanding, CR results are appropriate for practitioner dissemination targets
Protocol and Training • **Protocol** • **Training**	Protocol: Necessary for designing a theoretically rigorous study Training: • Theoretical training: Basic education in theoretical paradigms employed • Practical training: Basic education in systematic review methodology guides	Introduction to CR is valuable to appreciate the role and value of multiple paradigms that bear on the question
Search	Decisions must be justified based on the theoretical objectives. No decision is acceptable that arbitrarily might exclude studies that could be theoretically relevant.	CR appreciates multi-paradigmatic, multiple-level research, both empirical and conceptual; it appreciates interdisciplinary research; thus, broad disciplinary databases and overlaps are preferred
Data Extraction	Zeroes in on extracting concepts, relationships, explanations, and boundary conditions	Extraction of theoretical explanations is critical
Synthesis	Choose appropriate approach based on review objectives and research questions: • Theory landscaping: Builds nomological network that defines concepts and links them by relationships • Theory contending: Focus is on precise defining and refinement of concepts, precise specifications of relationships, and strong justification for explanations • Theory testing: Clear defining and measurement of concepts and relationships; rigorous empirical synthesis approaches should be used to verify relationships or justify explanations	CR advocates the unity and commensurability of multiple research paradigms; CR also values conceptual studies, which are often rich in explanatory theory

Eight steps of a systematic review	Theory-oriented systematic review	Critical Realist systematic review
Discussion and conclusions (completion of writing)	• Theory landscaping: Clear situation of nomological networks in related and referent theories • Theory contending: Justifying definitions of concepts and specifications of relationships, with strong explanations for propositions • Theory testing: Affirmation of general summary of studies, with clear explanations for general findings and for context-based differences	• Theory landscaping: Observe and verify the existence of some empirical phenomena; summarise possible explanations • Theory contending: Answer the retroductive question: what actual phenomena (events) produced the empirical observations, and what real underlying mechanisms or structures must exist to generate the actual and empirical ones? • Theory testing: Test for the existence of real mechanisms by testing for independent empirical phenomena that might be expected

3. Purpose of the Structured Literature Review

Our purpose is the development of a literature review, focusing on theory that explains underlying mechanisms in which LL informs the design of emerging platforms, specific to our context of focus. We can classify our literature review as having a *theory landscaping review* focus (Okoli, 2015). We aimed to be deliberately broad in the academic fields included in our database search efforts.

Furthermore, we validate from the literature that the research questions proposed in our study are, in fact, valid and relevant. Through our structured literature review, we also confirmed our potential contribution in addressing an area of intersection in the literature that is both important, but which has still not been addressed with sufficient clarity, as it is under-researched at present.

The targets of dissemination of our completed review are both academics and practitioners grappling with issues around the design of emerging platforms. We recognise that platform design touches on multiple knowledge domains. We are also aware of the fact that the dynamic nature of interactions between the concepts is an important element in our analysis, hence our specific focus on the analysis of intersection points of these academic discourses.

4. Literature Search Protocol

In terms of our search strategy, our first aim was to get a comprehensive overview of the current discourse in the main fields we are investigating. Our initial search process focused on *Google Scholar* [44] and *Web of Science*[45] databases to get an initial overview of general activity and trends in each of the (overlapping and/or intersecting) fields. Thereafter, we focused on searching the specific areas of intersection.

Our preliminary overview of the key concepts in the literature (see **Chapter 2**) indicated that we are dealing with intersecting fields with different academic maturity levels. A standard search protocol for each field may therefore not have generated an accurate reflection of the discourses. In terms of our search strategy, we therefore attempted to adapt, where necessary, the search strategy for each of the fields of LL, DSR, and DP, as these fields can be viewed as being at different maturity levels as academic research areas.

In our literature searches, we used 2006 as anchor point, as that is the year when the European Network of Living Labs (ENOLL) was established. This approach is similar to that suggested and applied by Schuurman, De Marez and Ballon (2015) in their review of literature in the Living Labs field. As we are particularly interested in how LL informs emerging platform design, this anchor point is self-evident. Our literature review was generally informed and inspired by the approach of Schuurman, De Marez and Ballon (2015).

In each of the three literature searches, we followed the following process steps (informed by the process suggestions of Okoli and Schabram (2010), Bandara et al. (2015) and Okoli (2015:

- Creation of citation database and extraction of relevant literature
- Construction of sample
- Coding
- Analysis

The specific search strategies for each of the intersecting bodies of literature will now we described in more detail.

4.1. Search Strategy: Living Labs

[44] https://scholar.google.com
[45] http://webofknowledge.com

The search strategy for *Living Labs* literature was as follows (**Table 7**):

Table 3: Living Labs Literature Search Strategy

Phase	Approach
Creation of citation database and extraction of relevant literature	In our proposed study, the literature review will be conducted based on a general review of the Google Scholar and Web of Science databases[46]. We also aimed to focus specifically on the discourse within ENOLL, as well as TIM Review[47] (as a publication that carries significant LL discourses).
Construction of sample	Title search *("allintitle")* using the specified keywords between 2006 and May 2020).
Coding: Selective coding of title and abstracts of selected literature sample	Coding criteria (aiming to focus on intersection points only): All results >2006 >10 Citations
Analysis	Evaluate most cited articles.

[46] Specific emphasis was be placed on the so-called "Senior Scholar's Basket of Journals" in Information Systems, as suggested by the Association for Information Systems (2011) namely:

- European Journal of Information Systems
- Information Systems Journal
- Information Systems Research
- Journal of AIS
- Journal of Information Technology
- Journal of MIS
- Journal of Strategic Information Systems
- MIS Quarterly

[47] https://timreview.ca/

4.2. Search Strategy: Digital Platforms

The search strategy for *Digital Platform* literature was as follows (**Table 8**):

Table 4: Digital Platform Literature Search Strategy

Phase	Approach
Creation of citation database and extraction of relevant literature	In our proposed study, the literature review will be conducted based on a general review of the Google Scholar and Web of Science databases[48].
Construction of sample	Title search *("allintitle")* using the specified keywords between 2006 and May 2020): Sample: All results >2006 >10 Citations
Coding: Selective coding of title and abstracts of selected literature sample	Coding criteria (aiming to focus on intersection points only): All results >2006 >10 Citations
Analysis	Evaluate most cited articles.

[48] Specific emphasis was be placed on the so-called "Senior Scholar's Basket of Journals" in Information Systems, as suggested by the Association for Information Systems (2011) namely:

- European Journal of Information Systems
- Information Systems Journal
- Information Systems Research
- Journal of AIS
- Journal of Information Technology
- Journal of MIS
- Journal of Strategic Information Systems
- MIS Quarterly

4.3. Search Strategy: Design Science Research

The search strategy for *Design Science Research* literature was as follows (**Table 9**):

Table 5: Digital Platform Literature Search Strategy

Phase	Approach
Creation of citation database and extraction of relevant literature	In our proposed study, the literature review will be conducted based on a general review of the Google Scholar and Web of Science databases[49].
Construction of sample	Title search *("allintitle")* using the specified keywords between 2006 and May 2020).
Coding Selective Coding of Title and Abstracts of selected literature sample	Coding criteria (aiming to focus on intersection points only): All results >2006 >100 Citations[50]
Analysis	Evaluate most cited articles.

5. Literature Screening

The following sections will detail our literature screening approach.

5.1. Google Scholar Database Search

Date of Search: 2020/06/04

Database: Google Scholar[51]

Method: Title Search *("allintitle")* using the specified keywords

Data extraction: The Google Scholar citation search was conducted by means of the *Publish or Perish* software[52]. Thereafter, it was loaded into MS Excel

[49] Specific emphasis was be placed on the so-called "Senior Scholar's Basket of Journals" in Information Systems, as suggested by the Association for Information Systems (2011) namely:
- European Journal of Information Systems
- Information Systems Journal
- Information Systems Research
- Journal of AIS
- Journal of Information Technology
- Journal of MIS
- Journal of Strategic Information Systems
- MIS Quarterly

[50] We included only articles with more than 100 citations, as the DSR field is more mature than LL and DP literature.

[51] https://scholar.google.com/

[52] The Google Scholar citation search was conducted by means of the Publish or Perish software: Harzing, A.W. (2007) Publish or Perish, available from https://harzing.com/resources/publish-or-perish after which it was loaded into MS Excel for sorting according to number of citations. In terms of the Publish or Perish program's coding structure the "+" normally used in a Google Scholar search to denote AND, was changed to "AND" in the Publish or Perish searches.

for sorting according to number of citations. In terms of the Publish or Perish program's coding structure, the "+" normally used in a Google Scholar search to denote AND, was changed to "AND" in the *Publish or Perish* searches. **Quality appraisal:** All results exported to MS Excel were verified for errors and irrelevant publications (from unrelated disciplines, for example, Chemistry) removed prior to numerical analysis based on number of citations within the period. Our initial overview of the literature through the Google Scholar database yielded the following results (**Table 10**):

Table 6: Google Scholar Literature Search Results

Keywords: Title Search ("allintitle")	Time span	No. of results total[53]	No. of results after 2006	>100 citations	Key articles/authors
Design Science	All	7630	5650	61	Hevner et al. (2004); Van Aken (2005); Hevner and Hevner (2007); Peffers et al. (2007); Gregor and Hevner (2013); Hevner (2016)
Design Science Research	All	1180	1030	41	Hevner et al. (2004); Van Aken (2005); Hevner and Hevner (2007); Peffers et al. (2007); Gregor and Hevner (2013); Hevner 2016)
Digital Platform + Design	All	24	17	3	Dykstra and Sherman (2013); Choudary (2018)
Living Lab	All	1240	1200	163	Bergvall-Kåreborn and Ståhlbröst (2009)
Living Lab + Design	All	69	67	12	(Bergvall-Kåreborn, Holst, et al. (2009); Pallot et al. (2010); Pallot and Pawar (2012); Era and Landoni (2014)
Living Lab + Design Science	All	4	4	0	(Bergvall-Kåreborn et al. (2010); Botha et al. (2012)
Living Lab + Platform	All	15	15	2	Tang et al. (2010); Brodt & Hopfgartner (2014)
Living Lab + South Africa	All	8	8	4	Meraka Institute; Siyakhula Living Lab
Living Lab + Higher Education	All	5	4	0	Luojus and Vilkki (2013)

For the search term **"Design Science" and "Design Science Research"**, the most cited articles on Google Scholar were the work of Hevner et al. (2004), Van

[53] The "All results" searches were done directly on Google Scholar.

Aken (2005), Hevner and Hevner (2007), Peffers et al. (2007), Gregor and Hevner (2013) and Hevner (2016). The utilisation of Hevner's work on the process of design science may therefore be viewed as a solidly grounded basis to anchor our perspectives (see **Chapter 5** for discussion of the digital Platform Design Lenses) on the process of Digital Platform Design within the broader DSR discourse. The work of Hevner was further extended from a three-cycle view with a fourth cycle (change and impact cycle) to capture the more dynamic nature of IS artefact design and the iterative nature of continuous design evolutions (Drechsler & Hevner, 2016). This partly informed our suggested "emergence lens" on the EDP design proposed in **Chapter 5**.

The prominence of the work of van Aken within the broader DSR discourse provides us with some confirmation that our extension built on his conceptualisation of *object design, process design and realisation design* (Van Aken, 2004) is anchored within the broader debate around the role and mission of design science.

As van Aken (2005) states:

> "The core mission of an explanatory science is to develop valid knowledge to understand the natural or social world, or – more specifically – to describe, explain and possibly predict. The core mission of a design science, on the other hand, is to develop knowledge that can be used by professionals in the field in question to design solutions to their field problems. Understanding the nature and causes of problems can be a great help in designing solutions."

For the search term **"Digital Platform" and "Design"**, the most cited articles on Google Scholar were the work of Dykstra and Sherman (2013) and Choudary (2018). The work of Dykstra and Sherman conforms to the important role of platform architecture and external dependencies as well as APIs in the design of sustainable platform solutions.

Choudhary's key business model considerations for digital platforms position two of the key design goals for all platforms to be:

i) Attracting and retaining the ecosystem, and
ii) managing successful and repeatable transactions, with the design considerations that each entails (See **Figure 8**).

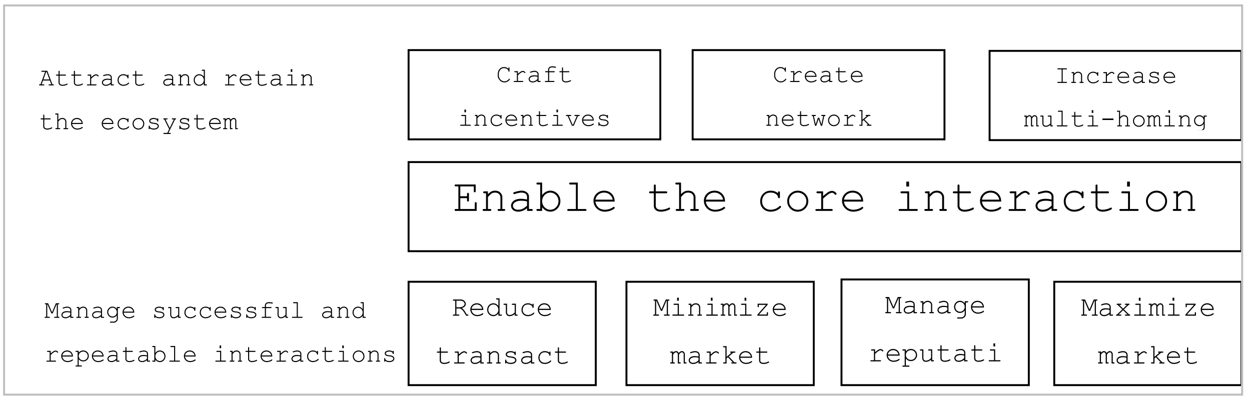


Figure 8: Key Business Model Considerations in Platform Design (Choudary 2018)

For the search term **"Living Lab AND Design Science"** the most cited works at this intersection was that of Thapa et al. (2014), aiming to position LL as a Design Science Research (DSR) methodology. Thapa cites the other most cited article on Google Scholar at this intersection, namely that of Krogstie (2012), as being one of the few other attempts that have been made to identify the common elements between LL and DSR. Again, there seems to be increasing practitioner interest in the field of Living Labs. Yet, it still appears to suffer from a lack of theoretical grounding within the broader Design Science Research field.

For the search term **"Living Lab AND Design"**, the most cited articles on Google Scholar were Bergvall-Kåreborn, Holst et al. (2009). This article positions LL as a *"rather new research phenomena"* and focuses on concept design in LL. The work of Bergvall-Kåreborn and Ståhlbröst (2009) and Bergvall-Kåreborn et al. (2010) details the FORMIT process for systems development (see **Figure 9**), which aligns broadly with the DSR process. The article comments on the differences between LL and system development, specifically relating to realism. LL aims to create as authentic use situations as possible (Bergvall-Kåreborn, Holst et al., 2009).

Furthermore, this paper identifies continuity, openness, realism, empowerment of users and spontaneity as key principles in LL, as suggested by Corelabs (2007). They highlight as specifically important three key LL principles, namely openness, realism and empowerment of users. This is useful as a design consideration when creating user-centric innovation processes, and can also be used in our determination of the LL impact on design processes (**Chapter 6**).

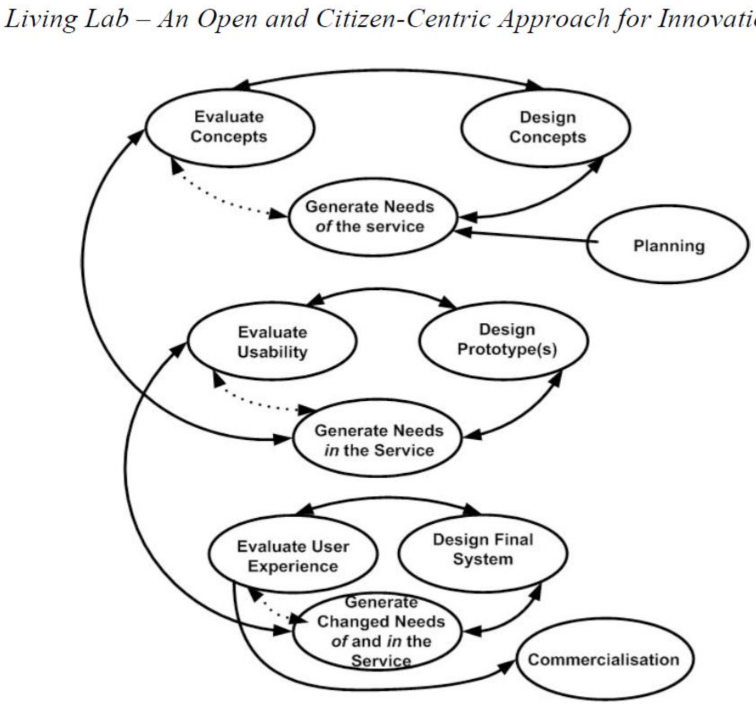


Figure 9: FormIT Process (Bergvall-Kåreborn & Ståhlbröst, 2009)

The work of Bergvall-Kåreborn et al. (2010), which focuses on LL and the process of participation that took place during the design of a health project for the elderly (again including the FormIT case study), highlights the difference in Participatory Design between *designing for users, designing with users,* and *designing by users*. The study also mentions that most Living lab projects have a practical focus and have been largely neglected in the wider academic literature, which we have also found in our literature review.

Bergvall-Kåreborn et al*.'s* (2010) definition of a Living Lab is as follows:

> "The purpose of a living lab is to create a shared arena in which digital services, processes and new ways of working can be developed and tested with users who can stimulate and challenge both research and development."

They also highlight the challenge of bridging the communication gap between users and developers and their "concerns how to communicate the needs of users in such a way that developers can understand them while developers need to be able to feed back their understanding of system requirements in a manner such that the users can make sense of it".

Another aspect they highlight is the fact that it is critical to developing strong ongoing relationships with users to build quality of interaction within the process.

The second most widely cited article (Pallot et al., 2010) aims to position LL within and amongst existing research domain landscapes (see **Figure 10**). Pallot's definition of LL is as follows:

> "A Living Lab is an Open Innovation ecosystem frequently operating in the context of competitiveness clusters and public development agencies within social innovation environments engaging local authorities in territories such as cities, agglomerations and regions. A Living Lab can operate with a research and innovation platform for providing access to science and innovation services allowing enterprises and users/citizens either as entrepreneurs or communities. The main objectives consist to explore new ideas and concepts, experiment new artefacts and evaluate breakthrough scenario that could be turned into successful innovations" (Pallot et al., 2010).

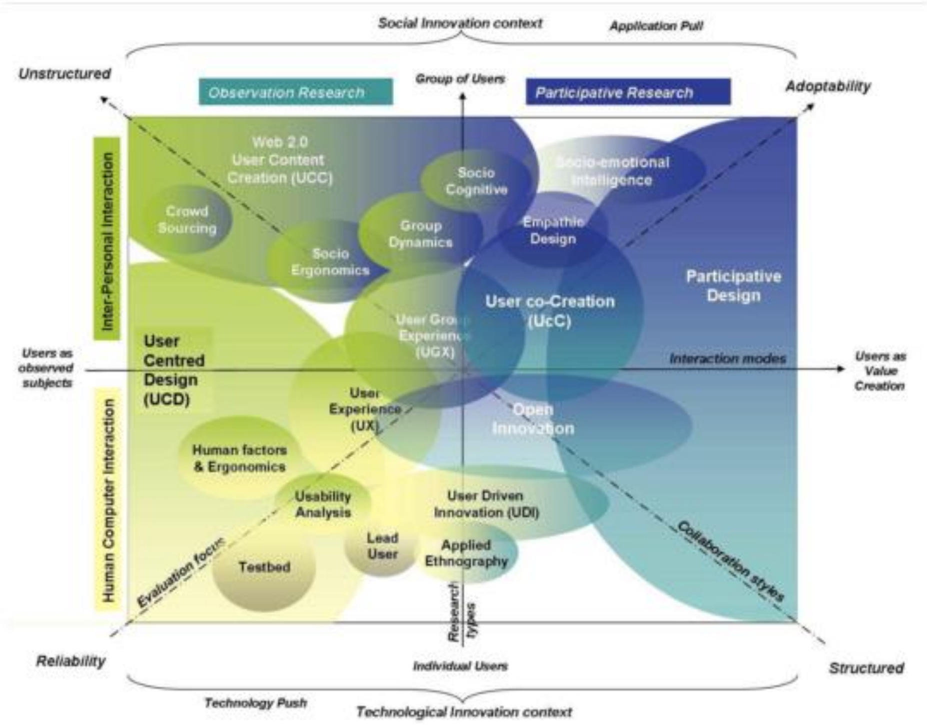


Figure 10: Domain Landscape of Living Lab Research Map (Pallot et al., 2010)

The third most cited article on Google Scholar was the work of Era and Landoni (2014), aiming to position LL as a methodology between User-Centred Design and Participatory Design. Again, the comment was made around the limited attention given to LL in the literature, despite the diffusion of its application across Europe in particular.

Another prominent study is that of Pallot and Pawar (2012), which suggests a holistic model of user experience that can assist us in structuring the user experience design of a platform in a more nuanced manner, detailing *perceptual*, *cognitive*, *reciprocal*, *social*, *emotional*, *cultural*, *empathetic*, *technological*, *economical*, *legal* and *ethical* factors of user experience.

See **Table 11** for a simplified summary of the holistic view of user experience (Pallot et al., 2012).

Table 7: Simplified Summary of User Experience (Pallot et al., 2012, adapted by author)

Experience type	Elements
Perceptual	Sensory (Sensitivity)
	Perceptive Appreciation (Perceptivity)
Cognitive	Cognitive Ergonomics
Reciprocal	Distributed Cognition
	Situated Cognition
Social	Interpersonal relationships
	Social Interaction
	Group Dynamics
	Group Enhancement
	Group Confidence
Emotional	Psychological State
	Emotional Connection
Cultural	Habits and Conventions
Empathetical	Caring
Technological	Innovativeness
	Performance
	Friendliness
Economical	Satisfaction
	Inclusion
Legal and Ethical	Ownership
	Privacy
	Security

For the search term **"Living Lab AND Platform"**, the most cited articles on Google Scholar were Tang et al*.* (2010) and Brodt and Hopfgartner (2014). The work of Tang et al. (2010) highlights the need for a better understanding of digital ecosystems, and they proposed an ecosystem architecture specific to a LL innovation platform. Although their work focused on the combining of user communities and sensor systems via mobile applications and social media, it is relevant to us that all their case study projects had an HE focus, and some of them were envisaged as online resource exchange social network services.

The ***UDUBSit*** case study we investigate in this study (see **Chapter 6**) was also conceptualised as a campus-based social network service. The "ubiquitous campus Living Lab innovation platform architecture" suggests a useful conceptualisation of the role-players within a HE digital platform and includes end users (students; faculty; staff), researchers and developers (end-user service developer; core service developers; 3rd party developers focusing on API integrations).

The other most-cited work at this intersection was that of Brodt and Hopfgartner (2014), detailing a case of the use of LL in the refinement and design of a recommender system, often a critical aspect of platforms. A more in-depth look at the application of LL within the realm of platform design was not found in this work. This study applied, for example, AB testing, a user research technique often utilised, but not one considered or suggested by any of the LL co-design processes during the ***UDUBSit*** case we analyse in **Chapter 6**.

For the search term **"Living Lab AND South Africa"** the most well-researched project was undoubtedly the *Siyakhula Living Lab,* which was the subject of ten out of the 17 articles at the intersection. The Living Lab initiatives of the Meraka Institute, CSIR, are specifically relevant in the role of positioning both the promise and difficulties in establishing collaborative contexts with multiple role-players. It will misrepresent the realities around LL initiatives if we do not refer to the comprehensive overviews of the LL landscape in South Africa that have been done by Pitse-Boshomane et al.(2008), Adam et al. (2011), Smit et al. (2011), Botha et al. (2012), Coetzee, Du Toit and Herselman (2012), Callaghan and Herselman (2015) and Cunningham, Herselman and Cunningham (2011). Specifically, the work of Botha (et al., 2012) on linking Design Science Research and the LL approach is very relevant to our study and its context, as is the exploration of LL in

HE contexts conducted by Callaghan and Herselman (2015). The work of Callaghan and Herselman specifically investigates the application in Higher Education of LL as an innovation platform and a catalyst to address complex challenges in education.

Some key success factors for LL application identified included (Callaghan & Herselman, 2015):

- Co-creation of a commonly owned vision
- Strong, focused leadership
- Self-sustainability from inception
- A strong sense of challenges and the ability to be nimble and responsive to stakeholder needs
- Regular face-to-face interactions
- Hosting or co-locating the LL network within an existing strong organisation
- Support for sustainability (including for example, funding, capacity-building, knowledge sharing, monitoring and evaluation and content creation)

In general, the Google Scholar search confirms our view that the intersection points of LL and DP are still under-explored in South Africa.

For the search **"Living Lab + Higher Education"** at this point of intersection, no articles received more than ten citations in Google Scholar. The most cited article was Luojus and Vilkki (2013), suggesting Living Lab as a potentially useful starting point for developing and informing ICT Studies in Higher Education.

Although none of the publications in this search received more than ten citations, it deserves mention that we view the discourse around LL taking place within the ENOLL ecosystem as very relevant to our study. In this regard, we conducted a separate keyword search within the 2019 Open Living Lab Days conference proceedings for "Higher Education" as well as "Digital Platform".

For the "Higher Education" search, the work of Axelsson, Eriksson and Berglund, (2019) was relevant to our context, as it emphasised the potential of LL to increase co-creation capacity on a regional and international level to improve quality in higher education. Their conclusions were that success in co-creation between universities and society/organisations requires mutual contribution, knowledge sharing as well as engagement from all involved. They also suggest a "co-creation model for Higher Education" (See **Figure 11**) that aligns with our approach to LL.

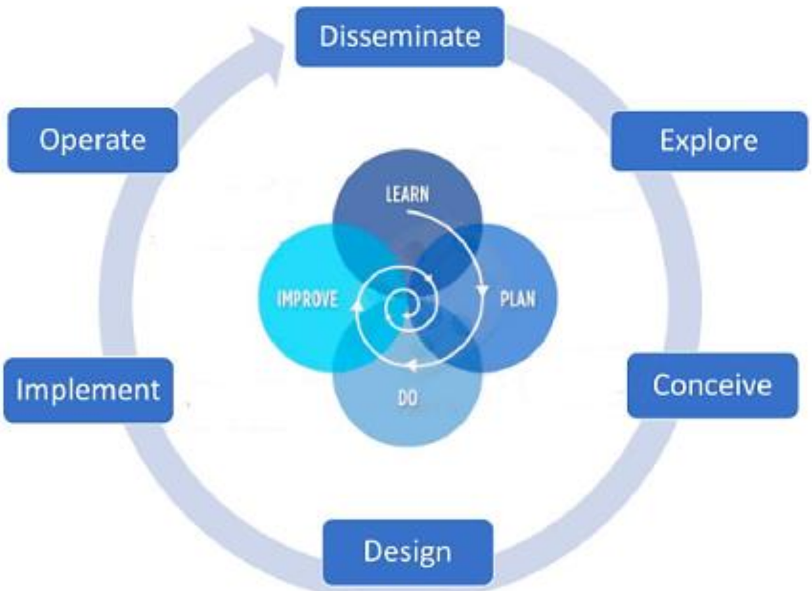


Figure 11: Proposed Cyclic Approach of Co-creation Process (Axelsson, Eriksson & Berglund, 2019)

The keyword search for both "**digital platform**" and "**platform design**" within the ENOLL Open Living Labs 2019 Conference proceedings yielded no results. The only article that expressly dealt with platform design of a social entrepreneurship eco-village application (or app in short) using a LL approach was that of Priftis et al. (2019). The app was developed in two days using a social hackathon approach in a high digital-skills environment (Switzerland) when compared to the South African context.

We concur with Schuurman, De Marez and Ballon (2015) that the Living Labs field has predominantly gained momentum after 2006, the year in which ENOLL was founded. The areas of intersection of this study, namely Living Labs and Platforms, as well as the intersection of Living Labs and Design Science, are yet under-explored. Similarly, within the South African and Higher Education contexts, these areas have not been explored by many academics.

Against the background of the increasing dominance of the digital platform as business model, the changing role of HEIs, as well as the other realities faced by African digital platforms, this may be of concern. Therefore, there may be a need to contribute to the refinement and deepening of this discourse at the intersection points. The design of local platforms should be receiving more emphasis, as well as optimising the potential utility of user empowerment, such as Living Labs.

5.2. Web of Science Database Search

Date of Search: 2020/06/04

Database: Web of Science[54]

Method: Title Search using the specified keywords[55]

Data extraction:

Analysis results from the Citation Analysis Report generated by Web of Science for each search were exported to MS Excel

Quality appraisal: All results exported to MS Excel were verified for errors and irrelevant publications (from unrelated disciplines, for example, Chemistry) removed prior to numerical analysis based on number of citations within the period.

Our initial overview of the literature through the Web of Science database yielded the following results (Table 8):

Table 8: Web of Science Literature Search Results

Keywords for title search	Total number of results	Number of results after 2006	>100 citations[56]	Key articles/authors
TITLE: (Design Science)	2921	2059	55 (more than >100 citations)	Hevner et al. (2004); Peffers et al. (2007); Van Aken (2004)
TITLE: (Design Science Research)	407	343	13 (more than >100 citations)	Hevner et al. (2004); Peffers et al. (2007); Van Aken (2004, 2005)
TITLE: (Digital Platform AND Design)	160	148	11	Spagnoletti, Resca and Lee (2015)
TITLE: (Living Lab)	476	448	66	De Moor et al. (2010); Almirall and Wareham (2011); Liedtke et al. (2012); Nyström et al. (2014)

[54] www.webofknowledge.com

[55] TITLE: (Specified Keywords); Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.

[56] All the searches below were done on 2020/07/25.

Keywords for title search	Total number of results	Number of results after 2006	>100 citations[56]	Key articles/authors
TITLE: (Living Lab AND Platform)	8	8	1	Evans et al. (2015)
TITLE: (Living Lab AND Design)	32	32	3	Era and Landoni (2014)
TITLE: (Living Lab AND Platform AND Design)	1	1	0	Baran (2019)
TITLE: (Living Lab AND South Africa)	1	1	0	Callaghan and Herselman (2015)

For the search term **"Design Science" and "Design Science Research"**, the most cited articles on Web of Science were again the work of Hevner et al. (2004), Peffers et al. (2007), and van Aken (2004, 2005).

For the search term **"Digital Platform AND Design"**, the most cited articles on Web of Science were several publications dealing with hardware platforms, forensic tools and robotics. However, the most relevant publication in our context is that of Spagnoletti, Resca and Lee (2015) detailing a multiple case study focused on suggesting a design theory for digital platforms supporting online communities: a multiple case study.

For the search term **"Living Lab"**, the most cited articles on Web of Science were Moor et al. (2010), Almirall and Wareham (2011), Liedtke et al. (2012) and Nyström et al. (2014). Almirall 2011 performed a comparative analysis of four working LL and led to four novel insights, namely that LL function at the low- and mid-level innovation strata. Secondly, LL is technologically agnostic. Thirdly, LL uses context-based experience to surface new, socially constructed meanings for products and services. Finally, LL is equally focused on exploration and exploitation" (Almirall & Wareham, 2011).

The work of Liedtke et al. (2012) focused on the development of a conceptual design of LL Research Infrastructure that will be used to research human interaction with, and stimulate the adoption of, sustainable, smart and healthy innovations around the home.

Nyström et al. (2014) emphasised the fact that innovation networks are shaped by their participants, positioning LL within the realm of open innovation. They suggest that scholars and practitioners of innovation learn that understanding of role patterns in LL can contribute to building, utilisation, and orchestration of open innovation networks".

De Moor et al. (2010) focused on evaluating the "Quality of Experience (QoE)" within a mobile application setting and emphasised the interdisciplinary nature of LL. They also advocate for an approach integrating technical, contextual and subjective user experience to enhance real-time experience measurements in real-life settings.

For the search term **"Living Lab AND Platform"**, the most cited articles on Web of Science were that of Evans et al. (2015). This article focuses on suggesting the potential utility of LL and co-production in the positioning of university campuses as platforms for sustainability science.

For the search term **"Living Lab AND Design"**, the most cited articles on Web of Science were by Era and Landoni (2014) that positions LL as a methodology between User-Centred Design and Participatory Design.

For the search term **"Living Lab AND Platform AND Design"**, the only article on Web of Science was an uncited conference paper positioning schools as digital LL with the purpose of creating platforms to co-create school innovations (Baran, 2019).

For the search term **"Living Lab AND South Africa"**, the most cited article (4 citations) on Web of Science were that of Callaghan and Herselman (2015), focusing on applying the LL approach to support innovation in the context of higher education in South Africa. They emphasise the necessity for LL in this context to incorporate a clear focus/vision, strong leadership, self-sustainability, a strong sense of community-owned challenges and the potential for sustainable community development. Key success factors for LL identified in the South African HE context include co-creation of commonly owned vision, strong focused leadership, focus on being self-sustainable from inception, nimbleness and responsiveness to stakeholder needs, regular face-to-face interactions, hosting or co-locating the LL within an existing strong organisation and support for sustainability.

6. Chapter Conclusion

In this chapter, a structured literature review was conducted to investigate the intersection in literature between Digital Platforms (DP), Emerging Digital Platforms (EDP) and Living Labs (LL), specifically in the context of higher education in South Africa.

Upon completion of this study's analysis, we concur with comments made by Schuurman et al. (2015) that the academic field of Living Labs is still very much a side note within the broader academic discourse as reflected on Web of Science. Only nine (9) Web of Science articles on Living Labs received more than ten citations.

The points of intersection of this study, which can be clearly seen from the structured literature review, may therefore benefit from more focused research, especially given the potential benefits to HE institutions in unlocking the benefit potential of EDP in their innovation strategies (as discussed in **Chapter 1**).

It is also clear that the Design Science Research field can be viewed as more mature, although the significant portion of studies after 2006 is interesting. (We obviously do not argue that there is any link with the establishment of ENOLL.) This increase is probably driven by an increase in digitisation, digital transformation, and the rapid pace of development within the broader IS field.

We do, however, also note that both LL literature and Design Science Research literature in IS do not position platform design within the context of the rapidly expanding role within the structures of planetary-scale computation, as advanced by Bratton (2015). Bratton posits that several design heuristics in his work that may benefit our understanding of emerging platform design and co-creation approaches (such as LL) in our HE context and, specifically, our attempts to advance our understanding of the underlying mechanisms informing it.

The convergence of platform studies and infrastructure studies is highlighted in the work of Plantin et al. (2018). This offers added support to our decision of including the work of Bratton (trained as both architect and computer scientist) in our thinking, because we believe that the infrastructuralisation of digital platforms (and the mega-platforms in particular) may lead to constriction of *freedom of design* in the context of EDP. This constriction may also become increasingly invisible as the role of automated technological systems increases within digital platform design processes.

We expect that the power imbalances and information asymmetries created by the emergent realities, for example, surveillance capitalism (Zuboff, 2019), platform imperialism (Jin, 2013), and data colonialism (Couldry & Mejias, 2019) may impact on the process of EDP design and the design decisions required of platform designers in perhaps new and unexpected ways. We also expect that LL as an approach may be affected by these emergent realities in ways that may not yet be fully explored, especially in the South African HE context. These emergent realities may create deep but sometimes almost invisible dependencies and power asymmetries that problematise the ability to emerge platform owners and/or designers to fulfil their design intentions and value capture strategies.

In **Chapter 4**, the research methodology of this study is presented, delineating the epistemological stance and theoretical perspective, the strategy of inquiry, as well as the methods and procedures followed to analyse and investigate our research questions. The conceptual model created to assist in the analysis of the ***UDUBSit*** case study **(Chapter 5)** will also be introduced and positioned within a Critical Realist approach. Thereafter, the UDUBSit case study is described (**Chapter 6**) and analysed (**Chapter 7**) to answer our research questions and suggest a set of design heuristics and further research recommendations (**Chapter 8**) to further inform the observed gaps within the current discourse in IS around EDP design and the role of LL in informing design.

Chapter 4 – Methodology

The real basis of causal laws is provided by the generative mechanisms of nature. Such generative mechanisms are, it is argued, nothing other than the ways of acting of things. And causal laws must be analysed as their tendencies. Tendencies may be regarded as powers or liabilities of a thing which may be exercised without being manifest in any particular outcome. The kind of conditional we are concerned with here may be characterised as normic. They are not counter-factual but transfactual statements.

-Roy Bhaskar: A Realist Theory of Science (2008:3)
(Originally published in 1975)

1. Introduction

A research project needs to clarify three framework elements, namely the philosophical assumptions about what constitutes knowledge (epistemological stance and theoretical perspective), the strategy of inquiry and its methods and procedures, as well as the process of data collection, analysis and communication thereof (Creswell, 2003). Recker (2013) describes research design as the blueprint for the collection, measurement and analysis of data.

Our research approach is detailed in **Figure 12:**

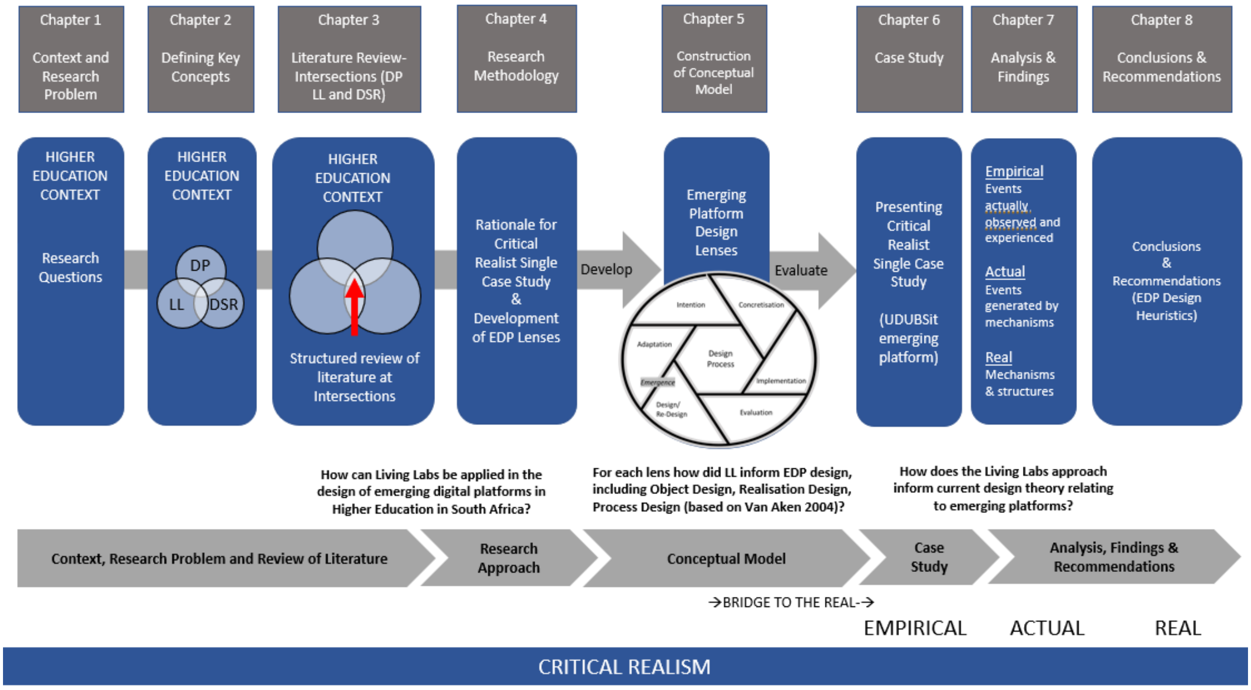


Figure 12: Research Approach (Author)

2. Theoretical Framework

Much of the research on Information Systems falls either within the behavioural science or design science paradigms (Hevner et al., 2004). As Hevner et al. (2004) state, "Both paradigms are foundational to the IS discipline, positioned as it is at the confluence of people, organisations, and technology". The behavioural science paradigm focuses on developing and verifying theories that explain or predict human or organisational behaviour, while the design science paradigm "seeks to extend the boundaries of human and organisational capabilities by creating new and innovative artefacts" (Hevner et al. 2004). The field of Design Science Research (DSR) can be viewed as both a legitimate and important IS research paradigm (Gregor & Hevner 2013).

According to Gregor and Hevner (2013), design theories can be viewed as theories of the middle range. In other words, "theories that lie between the minor but necessary working hypotheses that evolve in abundance during day-to-day research and the all-inclusive systematic efforts to develop a unified theory, that will explain all the observed uniformities of social behavior, social organisation, and social change". This contrasts with grand theories aiming to be all-encompassing.

In the study of IS it is also necessary to clearly delineate the level of abstraction from which one approaches any study of artefacts. Hevner et al. (2004) describe IT artefacts as constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices) and instantiations (implemented and prototype systems).

Our study mainly focused on the Emerging Digital Platform as instantiation while also taking cognisance of relevant constructs, models and methods.

To understand why the complex world is the way it is (ontologically engaging with the nature of reality), we need to have clarity in our approach that the question "Why?" does not aim to predict, neither does it aim to merely describe, nor does it aim to intervene (Clark, 2015). Our focus on better understanding the factors that come together in causing changes in the things we see has led us to the exploration of the applicability of Bhaskar's *Critical Realism* (CR) (Bhaskar, 2008) as the appropriate paradigmatic starting point and set of lenses for our investigation. It is widely recognised that this distinctive approach to the philosophy of science has been built on the foundational work of Roy Bhaskar (Mills, Durepos & Wiebe, 2010).

See **Figure 13** for a summary of the three domains of the real from a CR perspective. We agree with the notion of the existence of an independent reality that we are involved in the process of knowing. The process of knowing modulates what is known. In other words, that ontology determines epistemology (McGrath, 2016).

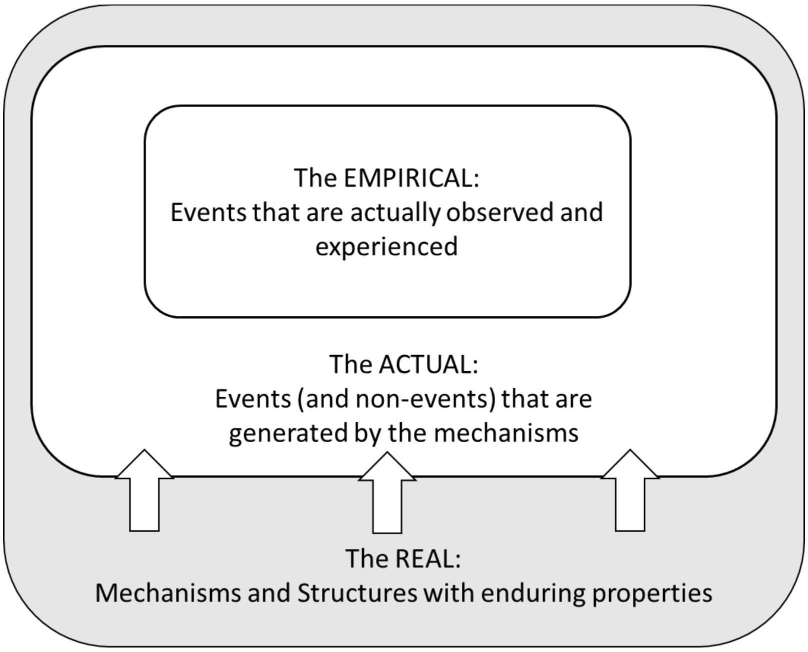


Figure 13: The Three Domains of the Real (Mingers, 2002)

The problems that we are investigating are, at first glance, exhibiting various complex and unexplained patterns, and CR seems to offer a promising approach to aid in our aim of understanding by means of developing plausible (and potentially useful) explanations[57].

Current IS research is still significantly dominated by the positivist and interpretivist paradigms (Tsang, 2014). It has been argued that information systems research conducted from the "standard" paradigms of positivism and interpretivism, suffers from persistent theory-practice inconsistencies and that the Critical Realist ontology may contribute to overcoming such often-occurring inconsistencies (Longshore Smith, 2006). Contemporary CR is also sensitive toward the fallibility of our knowledge of reality, obtained through observation and experience (Wynn & Williams, 2012).

A further objective of CR that can potentially add value to our study is the fact that CR focuses on providing "clear, concise, and empirically supported statements about causation, specifically how and why a phenomenon occurred" (Wynn & Williams, 2012). A comparison of the three families of philosophical views by Tsang (2014) can be seen in **Table 7** below:

[57] This section was loosely informed by Clark (2015)

Table 1: Comparison of Positivism, Interpretivism and Critical Realism Assumptions (Tsang, 2014)

	Positivism	Interpretivism	Critical Realism
Ontology	Objective reality with the Humean conception of causality as constant conjunction of events	Reality socially constructed by humans via subjective meanings; multiple realities possible	Objective, stratified reality (i.e., domains of the real, actual and empirical) consisting of structures, mechanisms, and events.
Epistemology	Discovering law-like relationships that have predictive power using a hypothetico-deductive approach	Knowledge generated by interpreting the subjective meanings and actions of subjects according to their own frame of reference	Retroduction used to create theories regarding the structures and mechanisms that generate the observable events, emphasising explanation over prediction.
Methodology	Tendency towards employing quantitative methods based on large samples such as surveys, experiments, and analysis of archival data	Primarily qualitative methods such as ethnographies and case studies	No preference for a particular form of research methods
Key references cited by Tsang (2014)	Ayer (1966) and Hempel (1965)	Berger and Luckmann (1967) and Schutz (1970)	Bhaskar (1978) and Sayer (1992)

Critical Realism (CR) is becoming recognised as a viable philosophical paradigm for conducting social science research (Wynn & Williams, 2012) and has been applied in various disciplines, including Information Systems (Mingers, 2002; Volkoff & Strong, 2013).

CRs' approach can be summarised as follows:

> "Critical realism provides a distinctive account of the bases of the natural and social sciences, challenging versions of empiricism and positivism. It also offers an alternative to social constructionist and postmodernist accounts of the social. Thus, it represents a distinctive approach to the ontological and epistemological underpinnings of social research, rejecting the polarised terms of much debate between these positions. In particular, it combines an ontological insistence on the existence of objective natural and social realities with recognition of the socially constructed and

fallible character of scientific knowledge" (Mills, Durepos & Wiebe, 2010).

According to some commentators, the case study as a research design has a specific affinity with the Critical Realist paradigm (Mills, Durepos & Wiebe, 2010). The affinity between the Critical Realist paradigm and the case study approach is particularly appropriate for our analysis of the design of the ***UDUBSit*** emerging platform as a complex socio-technical process (see **Chapter 6**).

Within the Critical realist epistemological approach, the causal explanation for given phenomena is inferred by identifying the means by which structural entities and context conditions interact to generate particular event sets (Wynn & Williams, 2012)[58]. Therefore, CR provides a middle ground between universal law and mere meaning, arguing in effect that although the world is socially constructed at the same time, it is not entirely so (Thapa & Omland, 2018).

The CR view of mechanisms may be graphically depicted as follows (**Figure 14**) (Sayer, 2000):

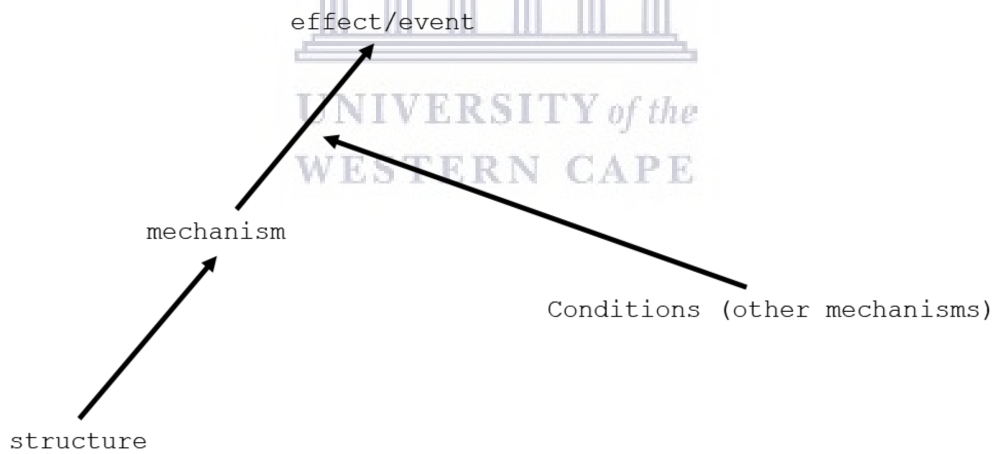


Figure 14: Critical Realist View of Mechanisms (Sayer, 2000:15)

The greatest contribution of a CR-based approach to our study is the fact that CR develops context context-specific causal explanations of socio-

[58] "CR shifts the focus to explicitly describing causality by detailing the means or processes by which events are generated by structures, actions and contextual conditions involved in a particular setting. This view of causality is reflected in the ontological and epistemological assumptions upon which critical realism is founded as well as the proposed methodological principles" (Wynn & Williams, 2012).

technical phenomena by explicating the specific mechanisms that generate them (Wynn & Williams, 2012).

3. Methodological Principles of Critical Realist Explanatory Case Study Research

Wynn and Williams (2012) suggest a set of five methodological principles (derived from the ontological and epistemological premises of CR) for conducting and evaluating CR-based explanatory case study research within the field of IS (See **Table 14**). We applied these principles in our analysis in **Chapter 7.**

Table 2: Methodological Principles of Critical Realism (Wynn & Williams, 2012)

CR Principle	Ontological and Epistemological Basis	Evaluation Criteria	Examples from CR Case Studies in Information Systems
Explication of Events Identify and abstract the events being studied, usually *from experiences*, as a foundation for understanding what really happened in the underlying phenomena.	• Stratified ontology • Mediated knowledge	• Thick description of case "story" including actions and outcomes • An abstracted sequence of events (including the experiences of participants and observers)	• Morton (2006) described a detailed sequence of five composite events associated with the strategic IS planning project. • Volkoff et al. (2007) abstracted core events from empirical observations as changes to structure associated with an IS implementation.
Explication of Structure and Context Identify components of social and physical structure, contextual environment, along with relationships among them. (Critically redescribed from actor's viewpoint into theoretical perspective.)	• Stratified ontology • Open-systems perspective • Mediated knowledge • Unobservability of mechanisms	• Description of the structural entities, constituent parts, and contextual conditions existing in the case • Identification of the relationships among the entities • Explication of changes to the structure • Description of the resulting emergent properties	• Bygstad (2010) identified various elements of the information infrastructure, and the relationships among them. • Morton (2006) identified organization units and actors as primary structural entities, and described three structural relationships with causal implications for observed outcomes. • Volkoff et al. (2007) explored elements of structure, structure changes, and contextual influences by focusing on participant activities, responsibilities, and interactions.
Retroduction Identify and elaborate on powers/ tendencies of structure that may have interacted to generate explicated events.	• Emergence • Focus on explanation • Explanation via mechanisms • Multiple explanations • Unobservability of mechanisms	• Identification of a set of plausible candidate causal mechanisms • Logical and analytical support for the existence of proposed mechanisms linking the structure to events	• Bygstad (2010) explained how the emergent higher level structures affect lower level entities and vice versa in identifying the innovation reinforcement and service reinforcement mechanisms.
Empirical Corroboration Ensure that proposed mechanisms have causal power and that they have better explanatory power than alternatives.	• Independent reality • Stratified ontology • Unobservability of mechanisms • Multiple explanations	• Analytical validation of proposed mechanism based on case data • Assessment of explanatory power of each mechanism relative to alternative explanations • Selection of the mechanism(s) that offers the *best explanation*	• Volkoff et al. (2007) and Morton (2006) demonstrated causal efficacy by using the hypothesized mechanisms to explain other events occurring in the cases. • Bygstad (2010) discussed a comparative analysis of candidate mechanisms to determine which offered the strongest explanatory power.
Triangulation & Multimethods Employ multiple approaches to support causal analysis based on a variety of data types and sources, analytical methods, investigators, and theories.	• Independent reality • Mediated knowledge • Unobservability of mechanisms • Multiple explanations	• Multiple theoretical perspectives • Multiple analytical and methodological techniques • Variety of data sources and types • Multiple investigators	• Zachariadis et al. (2010) integrated a series of studies based on interview data, econometric analysis, survey data, and historical analysis. • Volkoff et al. (2007) utilized multiple data sources, data types, and investigators.

4. Strategy of Inquiry

According to Yin, a case study can be defined as "an empirical inquiry that investigates a contemporary phenomenon (the 'case') in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident" (Yin, 2014). Yin considers single and multiple-case study designs to be variants within the same broader methodological framework (Yin, 2014). Case study research is well-suited for doing CR research on contemporary socio-technical phenomena to uncover the causal mechanisms and contextual factors that combine to generate them (Wynn & Williams, 2012).

For this study, we utilised a single-case study. Our approach is closely aligned to Easton's description of case study research, namely that "(c)ase research can therefore, be defined as a research method that involves investigating one or a small number of social entities or situations about which data are collected using multiple sources of data and developing a holistic description through an iterative research process" (Easton, 2010).

A single-case study can be described as a case study organised around a single case (Yin, 2014) and "the case might have been chosen because it was a critical, common, unusual, revelatory or longitudinal case". Tightly focused, single case studies can provide a basis for a more comprehensive understanding of specific causal mechanisms and may offer "the prospect of exploring interacting and stratified mechanisms operating in specific sequences and nested contexts to produce distinct outcomes" (Mills, Durepos & Wiebe, 2010).

According to Yin (2014), five components of a research design are especially important in case study research:

- A case study's questions
- Its propositions
- Its unit(s) of analysis
- The logic linking the data to the propositions
- The criteria for interpreting the findings

Furthermore, Yin (2014) argues that, "The second part of the definition of case studies arises because phenomenon and context are not always sharply distinguishable in real-world situations". Much of the case study research conducted is positioned within a realist perspective, allowing investigators to retain a holistic and real-world perspective on cases while making the underlying assumption of the existence of a single reality that is independent of any observer. In terms of the classification of case study approaches proposed by Yin (2014), our approach would entail an embedded single case study approach. In our approach, we would be sensitive to the principles for conducting Critical Realist case studies, as suggested by Wynn and Williams (2012). It is apparent that the case study approach may specifically assist us in better understanding specific causal mechanisms with the design process. As stated by Wynn and Williams: "The case study method is an excellent way to explore the interaction of structures, events, human actions and contexts for identifying and explicating generative mechanisms" (Wynn & Williams, 2012).

The case study approach that we have taken has a longitudinal dimension, as we are studying the same single case at two or more different points in time. About time-dimension, Yin states: "The theory of interest would likely specify how certain conditions and their underlying processes change over time. The desired time intervals would presumably reflect the anticipated stages at which the changes should reveal themselves" (Yin, 2014).

In identifying and defining the case study, our approach was informed by pragmatism and access to data relating to the case. The author was also a project manager for part of the ***UDUBSit*** application project and was therefore in a unique position to collect data and influence certain design-related elements of the case. The author is fully cognisant of the potential biases and risks this imposes on the research project and has taken active steps to limit such bias as far as possible. These steps will be declared and highlighted throughout the discussion and analysis of the case.

5. Motivation for Choice of Case

The ***UDUBSit*** mobile application is a unique instantiation of a conceptual design that originated in the field of digital anthropology. The application design is based on the concept of a geographically focused, spatiotemporal grid that mediates interactions between the user of the application to make information more locally relevant, and therefore more useful. Another explicitly stated focus of the application is the building of an inclusive local community.

In the case of the ***UDUBSIT*** location-based, goal-focused mobile application, the case was chosen because of its longitudinal and potentially revelatory nature. The case has clear boundaries even though it can be viewed as part of a three-party longitudinal research project (including the ***UDUBSit*** project at UWC, the ***Zoneit*** project at the University of Gent in Belgium, and the Mfunzi project at Mzumbe University, Tanzania). The ***UDUBSit*** application, as a bounded system, is unique in its geographic focus area, targeted audience base, technology architecture, and various other design elements.

The ***UDUBSit*** project can be categorised as a *digital social innovation* project that aims to create an engaged online campus community through the mediation and facilitation of a mobile application custom-designed for this purpose. See Baeck and Bria (2014), Anania and Passani (2014), Millard and Carpenter (2014) for a discussion of the *digital social innovation* concept. The ***UDUBSIT*** project forms part of a series of North South South (NSS) cooperation projects between Ghent University, Vrije Universiteit Brussel, Mzumbe University and the University of the Western Cape (VLIR-UOS, 2015):

> "The North South South Cooperation Programme (NSS) aims to stimulate and support joint initiatives from Institutional University Cooperation (IUC) partner universities and to deepen South-South cooperation between them and with the Flemish counterparts. NSS projects concern clearly defined activities of exchange (best practices, joint opportunities) and training in which all the project partners participate."

According to one of the initiators of the project, the project's purpose can be stated as follows (Stroeken, 2011):

> "The purpose of the larger ***Zoneit*** project, of which the ***UDUBSIT*** application forms a part, is defined as community building within the context of a university, specifically by building the student community inter alia through the announcing and sharing of activities, events, transport, jobs and other resources. Further focus areas include social inclusion and promotion of cohesion within a goal-focused, location-based social network.
>
> The project has focused on a Living lab research approach on the development and use of a location-based and community-oriented mobile app for student communities in a peri-urban South African university context.
>
> The project was conceptualised from a digital anthropological perspective."

Universities and their broader ecosystem of students and staff exemplify a trust-based community that can be viewed as goal-oriented, focusing on the broader goal of education, which contributes to stability (Stroeken, 2011).

Stroeken also highlights the opportunity for proximity-based ad hoc networking within a trusted community. A mechanism to facilitate a trusted community may be through using authenticated accounts (Stroeken, 2011) as well as mediating content (exchanging information, searching information, matching offers or requests) within a zone of spatial and temporal relevance. The principle is also to facilitate the structuration of incoming information by decreasing information overload by spatiotemporally structuring nearby transient/ephemeral messages.

Stroeken (2011) identifies the opportunities of such an application to facilitate more trusted offers and advertisements because of its higher context relevance. Stroeken also highlights the opportunities of using such an application for real-time socio-scientific research. Stroeken also suggests that such an app may be used to monitor the individual "karma" of users in exchanges and develop an alternative online currency with value within this specific trusted community.

The concept of community building in HE through virtual means has been investigated in various contexts, including virtual worlds (Gillen et al., 2009). It has also been investigated outside the HE context, for example, in business environments (Jin, Park & Kim, 2010; Spagnoletti & Resca, 2012).

In the investigation of solving the design problems inherent in online community building, and especially relevant within the HE context, is the notion suggested by Whitworth and De Moor (2003) that, although the underlying infrastructure remains an information system, the overall system is a social one. More specifically, it may be viewed as a complex and evolving socio-technical system, as Whitworth and De Moor (2003) state: "A community then, is not just a set of individuals, but a form of self-sustaining social interaction that endures".

The definition of a virtual community, as well as the concept of a Virtual community environment (VCE) proposed by Whitworth and De Moor (2003) can be viewed as particularly useful for better delineating the stated purpose of the ***UDUBSit*** application to build an online community:

> "(W)e take a virtual community to exist, when a socially self-sustaining group, with persisting social practices, acts in a common computer- mediated space. Groups are socially self-sustaining when the benefits of social interaction, such as gaining knowledge, making friends, or collective action, make members want to remain in the group

> for social reasons. A community is not just a task group that stops when the task is done, or a 'rent-a-crowd', that requires payment to meet. Temporary gatherings, like people gathered to view a spectacle, are aggregates rather than communities. A community arises from social benefits, not just economic benefits" (Whitworth & De Moor, 2003).

The definition of a Virtual Community Environment (VCE) is:

> "A VCE is an information system that supports a virtual community. A VCE is not a virtual community, nor does a VCE's existence guarantee a virtual community will arise. For a bulletin board to support a virtual community, requires that lasting and common social practices to develop" (Whitworth & De Moor, 2003).

The ***UDUBSit*** case and the ***UDUBSit*** mobile application as instantiation need to be contextualised as a complex and evolving socio-technical system rather than merely a static technological artefact. The fact that this case is implemented within a complex and dynamic context, may lend itself to particularly rich and interesting insights which could enhance our attempts at a deep understanding of the complexities of emerging platform design and the application of LL.

The CR approach assumes a transcendental realist ontology, eclectic realist/interpretivist epistemology and generally emancipatory axiology (Easton, 2010). In this regard, we are well aware of the concern often mentioned about the generalisation /generalisability of case study findings (Tsang, 2014). CR views conditions of closure as rarely attainable in social sciences, but that does not have to disparage generalisation (Tsang, 2014).

6. Data Collection and Data Sources

A mixed data collection approach was followed.

The **primary data** analysed were a combination of interviews and focus groups. In terms of data collection, the approach has been to collect data from end-users and institutional users, as well as active role players within the design process.

The data collection methods required interviews and focus groups, and therefore ethical clearance was obtained. See attached as **Annexure A**, the following documents: Samples of forms used for interviews and focus group discussions, as well as a copy of ethics clearance. All data sources of applications were readily accessible in terms of existing cooperation agreements between the Universities of the Western Cape, Ghent University, Belgium and Mzumbe University, Tanzania.

To assist with the triangulation of data, a series of structured interviews were also conducted with selected role-players within the ***UDUBSit*** platform design ecosystem. The focus groups were structured and conducted based on the participants' role within the design process. The interviewees included the following project role-players (**Table 15**):

Table 3: Demographics of Interviewees

Role	Persons interviewed (anonymised)
Project Owner	Person 1
Project Sponsor	Person 1 Person 2
Project Designer	Person 3 Person 4 Person 5
Software Developers	Person 6 Person 7 Person 8
Living Lab Practitioners	Person 9

All interviews were conducted online via the Microsoft Teams[59] platform and were recorded with the permission of each participant, and recordings were transcribed (using Otter.ai[60] as well as the actual audio recording) prior to further analysis.

The interviews consisted of the following structure and questions (**Table 16**):

Table 4: Interview Structure and Questions

1. Short presentation by the researcher of the ethics clearance information sheet, informed consent and the focus of the research project.
2. Semi-structured discussion focused on the following question structure:
In the case of the *UDUBSit* mobile application project at UWC: o What was your **role** in the design of the ***UDUBSit*** mobile application as emerging platform?

[59] https://www.microsoft.com/en-za/microsoft-teams/group-chat-software
[60] https://otter.ai/

- How would you describe the **objectives** (explicit and implicit) of this design process?
- What were the (explicit and implicit) **values** underlying this design process?
- How was the **design process** of this app **responsive to the context**?
- **How did the Living Labs approach inform** the:
  - **Design and development** of this design process?
  - **Realisation/implementation** design of this design process?
  - **Process design** of this design process?
  - **Evaluation** of this design process?
  - **Evolution (emergence)** of this design process?
- What were the **advantages** of the Living Labs approach in this design process?
- What were the **disadvantages** of the Living Labs approach in this design process?

Secondary data primarily consisted of user surveys conducted during ***UDUBSit*** user testing as well as the analysis of existing literature, platform-generated data and working documents of the ***UDUBSit*** and ***Zoneit*** (Ghent University, Belgium) instantiations of the application (where applicable).

Platform-generated data were subject to the standard terms and conditions for the use as prescribed by UWC's terms and conditions. All platform-generated data from ***UDUBSit*** have been anonymised prior to analysis.

The main sources of **secondary data** analysed are indicated in **Table 17.**

Table 5: Secondary Data Sources

Original project conceptualisation documents	Stroeken (2013); Stroeken et al. (2015); VLIR-UOS (2015)
Academic contextual documents and publications	Stroeken (2011); Baelden et al. (2014); Stroeken et al. (2015); Baelden et al. (2016); Tamassy (2016); Grove and Breytenbach (2018); Grove, Breytenbach and Van Audenhove (2018)
Various student intern bachelors' thesis documents that detailed mobile application development process, technical documentation and user testing conducted.	
User testing reports, user feedback data, reports and focus group reports (2014-2018)	
Testing portal data retrieved from the project website at https://www.***UDUBSit***-testing.info (archived version)	
App data from Android Version on Google Play Store	
Technical Documentation	Firm X (2014); Vandecandelaere (2015); Mwebaze (2016)
Internal Platform Design strategy documents	
Internal communication and project status reports	

7. Data Analysis

Data analysis of the single case study was done by means of a within-case analysis (Yin, 2014) with an analysis of the assertions or interpretation of the meaning of the case. Yin's suggested approach of using "logic models" to guide analysis was applied as we utilised the Emerging Digital Platform Design (EDP) Lenses (described in **Chapter 4**) as our logic model.

Yin argues:

> "As an analytic technique, the use of logic models consists of matching empirically observed events to theoretically predicted events. Conceptually, you therefore may consider the logic model technique to be another form of pattern matching. However, because of their sequential stages, logic models deserve to be distinguished as a separate analytic technique from pattern matching" (Yin, 2014).

We utilised the EDP lenses as framework to structure our observations of the empirical data of the case study. This analytic approach assisted in operationalising a complex chain of occurrences and events over a period,

and provided guidance on how the sequence of actions may have informed the possible accomplishment of intended design objectives.
In **Chapter 6**, the domain of the empirical events/non-events actually observed and experienced is detailed. We will then progress to delve deeper into the domain of the 'actual' and the 'real' in **Chapter 7** and develop our understanding of the structures and mechanisms underlying the domains of the 'actual' and the 'empirical'. This analysis was done cognisant of the best practice principles suggested by Wynn and Williams (2012) around conducting critical realist case studies, as well as the principles of critical realist design research highlighted by Carlsson (2006) and Longshore Smith (2006).
In **Chapter 8**, a set of design heuristics will be presented as recommendations to improve the utility of LL within the context of EDP design.

8. Chapter Conclusion

In this chapter, we positioned our research methodology and our philosophical stance within the Critical Realist paradigm. Furthermore, we motivated our choice of the single-case study as the most appropriate approach to generating insights that are both robust and useful in terms of our research questions. We discussed the multiple data sources that we used within this analysis and described our data analysis process.

To evaluate platform case studies in a structured yet flexible manner, we found it useful to create, informed by literature, a set of conceptual lenses by which we could evaluate the emerging platform design process. This is present in **Chapter 5**. In **Chapter 6**, the discussion of the ***UDUBSit*** case study through the emerging platform design lenses developed in **Chapter 5** is presented, informed by a detailed literature review (**Chapters 2 & 3**). Three identifiable design iterations of the ***UDUBSit*** mobile application's design process were analysed. Additionally, we investigated the role that the application of the LL approach played in informing design decisions made during these three iterations, with a view to better structure and analyse the observations (**Chapter 7**) to identify and understand the underlying mechanisms **(Chapter 8)** by which LL informed this design process. Recognising the limitations of a single-case study's generalisability, the focus was on identifying the underlying mechanisms in which LL was instrumental in influencing the design process in this ***UDUBSit*** case, but the aim was additionally to generate potentially useful design heuristics (**Chapter 8**) that may benefit future EDP design projects in the same type of design context.

Chapter 5 – Emerging Digital Platform Design Lenses

You have the ability to adjust the lens through which you view the world.

-Jeffrey G. Duarte

We do not see the lens through which we look.

-Ruth Benedict (American anthropologist and folklorist)

1. Chapter Introduction

The focus of this chapter is on presenting the *Emerging Digital Platform Design Lenses*. In aiming to identify a comprehensive set of design principles at work in DP design and to make sense of the way LL potentially informs such design decisions, we developed and applied a set of lenses to focus our analysis.

We developed, in an almost Marshall McLuhan-type fashion, some "probes" into platform design principles, with the aim of creating an initial framework of thinking, although we realise that our thinking is more driven by our observations than established theory. See Logan (2011) for a succinct summary of McLuhan's concept of "probes".

In this study, we applied probes to develop heuristics rather than full design propositions. This approach aligns with the case study analysis method. This is useful in explanatory case studies that Yin (2014) refers to as "Explanation Building", which is a special type of pattern matching.

> "In most case studies, explanation building occurs in narrative form. Because such narratives cannot be precise, the better case studies are the ones in which the explanations reflect some theoretically significant propositions, whose magnitudes might start to offset the lack of precision" (Yin, 2014).

In **Chapter 2** we referred to the comprehensive IT Platform definition proposed by Sun, Gregor and Keating based on a systematic literature review: "An IT-platform is defined as comprised of a technological base on which complementary add-ons can inter-operate, following standards and allowing for transactions amongst stakeholders, within the platform-centric ecosystem" (Sun, Gregor & Keating, 2016).

This definition, as well as the most cited DSR, works of Hevner et al. (2004) (see Section 5 in **Chapter 3**), formed the basis around which the *Emerging Digital Platform Design Lenses* were designed, although it was also impacted by the arguments and insights derived from both **Chapter 2** and **Chapter 3**.

2. The Utility of the Lens Metaphor

The Oxford Dictionary[61] defines a lens as "a piece of glass or other transparent substance with curved sides for concentrating or dispersing light rays, used singly (as in a magnifying glass) or with other lenses (as in a telescope)". In the physics field, it is defined as "an object or device which focuses or otherwise modifies the direction of movement of light, sound, electrons, etc."

In terms of our intended use of the lens metaphor to focus our analysis, we aim to use these lenses singly or with other lenses, and we are fully aware of the fact that none of our lenses will be without some flaws in their transparency and focus. We may also be varying our application of these lenses from microscopic to macroscopic, even telescopic views. However, we find the notion of lenses a useful tool to build our own understanding of the slippery phenomenon ("*wicked problem*") that digital platform design presents to design professionals. We also find it a useful construct to use in attempting to extract value for our study from the multiplicity of academic and applied fields currently grappling with the growing prevalence of digital platforms and their emergence and adaptation of design over time.

In our reading of the literature on platform design, we have encountered a range of typologies, and we will be utilising our lenses to create an integrative view of these varied, often overlapping, typologies and the sometimes seemingly random design insights mentioned in broader platform literature. Our usage of the lens metaphor is also to be understood as being a descriptive framework for case study analysis, the utility of which has been suggested and described in Yin (2014).

3. Proposing the Emerging Digital Platform Design Lenses

The *Emerging Digital Platform Design Lenses* align with the Design Science Process proposed by Peffers et al. (2006). Over time, various attempts have been made to position LL within the broader DSR discourse (see Pierson & Lievens, 1987; Botha et al., 2012; Schuurman, 2015). What we find particularly useful is the alignment between the most prevalent LL process views in the literature and the DSR process suggested by Peffers and widely utilised in the DSR community (for example, Gregor & Hevner, 2013; Livari, 2014).

[61] https://en.oxforddictionaries.com/definition/lens

Our proposed *Emerging Digital Platform Design Lenses* (**Table 18**) are aligned with both the DSR and LL process views:

Table 1: Mapping of EDP lenses Against DSR and LL Process Phases (Author)

Design Science process (Peffers et al., 2006)	**LL process phases (Pierson & Lievens, 2008)**	**Emerging Platform Design Lenses (Author)**	
Problem identification and motivation	Contextualisation	Intention	Emergence
Objectives of a solution			
Design and development	Concretisation	Concretisation	
Demonstration	Implementation	Implementation	
Evaluation	Feedback	Evaluation	
Communication			

Each of these lenses can also be thought of as being process phases in iterative, emergent platform design cycles (although *process phases* here are understood not as strictly linear but rather messy). There may also be overlaps between the different process phases. Therefore, we adopt a lens metaphor rather than a strict process view. This is also in line with our earlier argument that platforms should be viewed not as linearly designed structures but rather as complex, evolving rhizomatic structures[62].

Each of these emerging platform design lenses will now be discussed in more detail. We will be populating in **section 3** the expected contributions of the LL approach in informing the design process of EDPs informed by various literature sources as engaged in the discussion of key concepts **(Chapter 2)** and structured literature review **(Chapter 3)**.

[62] Therefore, the porous borders between the lenses as indicated in Figure 15.

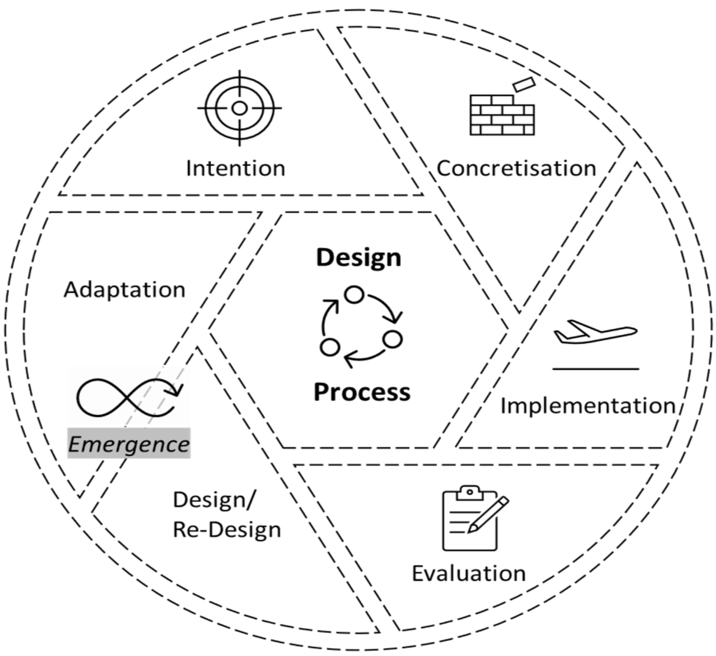


Figure 15: Emerging Digital Platform Design Lenses in Iterative Emergent Cycle (Author)

We indicate in the tables below what we see as a *Positive Expected Contribution* (indicated in *Green*); when based on literature, we expect that LL should have an observable positive contribution to informing the Emerging Platform design process, specifically in addressing what we have described as some of the *wicked problems* in emerging digital platform design. Similarly, we use *Amber* and *Red* to signify *Neutral* or *Negative* expected contributions. Within each lens, the expected contribution of LL in informing *object design, realisation design* and *process design* is also indicated by the same colour keys.

Key

+	Positive expected contribution
N	Neutral expected contribution
−	Negative expected contribution

In **Chapter 6**, we investigate to what extent the LL approach exhibited the expected contributions within the specific case study we analysed. Based on the insights developed from this process, we will answer our key research question: **"How can Living Labs be applied in the design of emerging digital platforms?"** as well as the underlying sub-questions:

- *How does Living Labs inform the object design of an emerging digital platform?*
- *How does Living Labs inform the realisation design of an emerging digital platform?*
- *How does Living Labs inform the process design of an emerging digital platform?*

3.1. Intention Lens

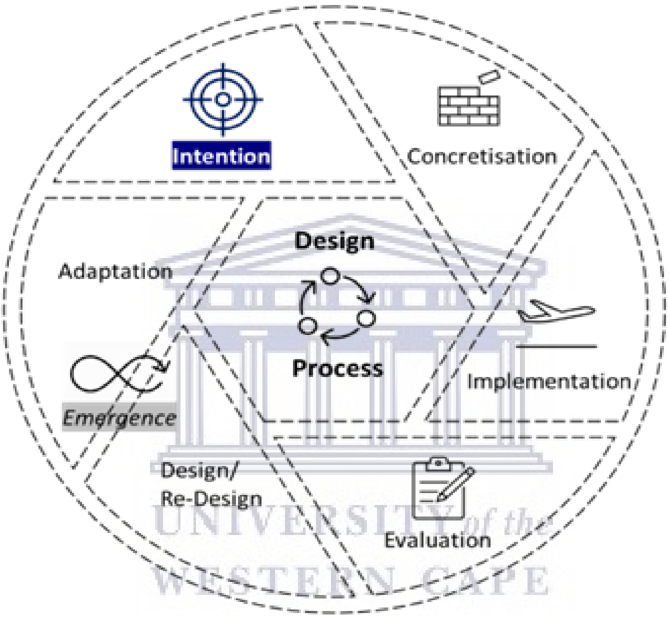


Figure 16: Intention Lens (Author)

The Intention Lens (see **Figure 16** and **Table 19**) focuses on the intended objectives of the platform owners and/or designers in creating the platform. Objectives do not, however, exist in isolation, as they are aimed at addressing a specific context (for example, socio-economic; political; legal and/or financial), and they are stated (explicitly and/or implicitly) within a framework of underlying (explicit or implicit) design values.

Design intentions are also informed by environmental scanning and evaluation of opportunities and/or threats offered by new technologies, methods, and strategies, as well as their potential risks (Kim & Yoo, 2019). Design intentions are also influenced by the assumptions designers make about the value of user data. This has been argued to have a potentially negative impact on user value capture, especially if user data is commoditised and users are recast as mere data subjects or data-extraction sources (Jin, 2013; Van Dijck, Poell & De Waal, 2018; Couldry & & Mejias, 2019; Zuboff, 2019). The LL methodology, together with the inclusion of all relevant stakeholders, is aspects that have been highlighted as important in formalising LL to achieve organisational objectives in emerging economies (Smit et al., 2011).

Further design intentions that need to be clarified include, for example, whether the platform is profit-driven or non-profit-driven. Platform openness also needs to be clarified, specifically the degree to which platform sponsors/owners are sharing platform technologies with third-party developers to build upon (Parker & Van Alstyne, 2010), as well as whether the platform is intended to serve an inclusive or exclusive audience of stakeholders. The principles upon which online community building is designed must also be clarified (Spagnoletti, Resca & Lee, 2015). The propositions that Spagnoletti et al. state as possibly useful in informing the design of online community building included the design of highly interoperable platforms at the technical and semantic level, as well as applying the use of personas to identify user categories (Spagnoletti & Resca, 2012).

Clarification of design values is particularly important in assuring value will be generated for intended local beneficiaries of EDP design projects. It is becoming more and more problematic to ensure digital platforms are sensitive to public values such as safety, privacy, transparency, accuracy, quality, accessibility, affordability, accountability, responsibility and power to control (Van Dijck, Poell & De Waal, 2018). It is important that platform design creates clarity around important value-laden issues such as decisions around datafication and commodification and selection mechanisms (Van Dijck, Poell & De Waal, 2018).

Given the deep integration of automation into digital technologies, it is becoming more important to ensure principles of equality, fairness and inclusiveness without discrimination or favouritism is included in algorithmically mediated processes in order to protect these important public values (Van Dijck, Poell & De Waal, 2018).

Table 2: Intention Lens (Author)

Intention Lens	
Key Design Problems	***Expected Contribution of Living Labs***
Objectives ***What are the objectives (explicit and implicit) of platform owners and designers?*** *Process Design* *Realisation Design* *Object Design*	+ *Clarifying explicit and implicit objectives*
Values ***What are the (explicit and implicit) values underlying this design process?*** *Process Design* *Realisation Design* *Object Design*	+ *Clarifying explicit and implicit values*
Context ***What is the context in which this design process takes place?*** *Process Design* *Realisation Design* *Object Design*	+ *Deepening stakeholder understanding of context*

Some key authors	*Some key authors*
Parker and Van Alstyne (2010); Spagnoletti and Resca (2012); Jin (2013); Bratton (2015); Parker, Van Alstyne and Choudary (2016); De Reuver, Sørensen and Basole (2017); Van Dijck, Poell and De Waal (2018); Makuvaza et al. (2018); Zuboff (2019); Couldry and Mejias (2019); Kim and Yoo (2019); Herman, Grobbelaar and Pistorius (2020); Bonina et al. (2021)	Bergvall-Kåreborn, Eriksson et al, (2009); Adam et al. (2011); Smit et al. (2011); Veeckman et al. (2013); Thapa et al. (2014); Ntawanga and Coleman (2016); Axelsson, Eriksson and Berglund (2019)

3.2. Concretisation Lens

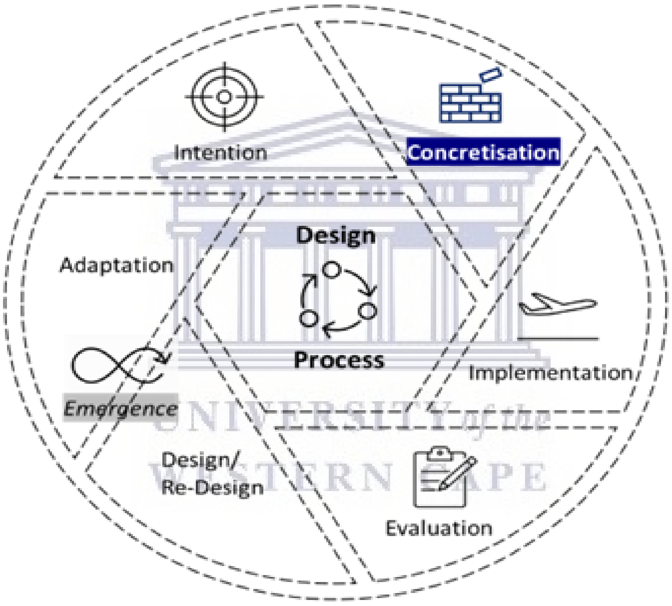


Figure 17: Concretisation Lens (Author)

The Concretisation Lens (**Figure 17** and **Table 20**) focuses on the actual building and integration of the platform's hardware, software and building and enabling socio-technical components (for example, ecosystem integration, online community development and incentivisation of different platform sides). The key design decisions in this lens focus on determining the appropriate platform type, components, value creation mechanisms and platform governance. A further critical decision is how the platform's ecosystem needs to be structured and enabled.

These design decisions may involve the platform owners and/or designers, ICT professionals, as well as ecosystem actors (such as software developer communities or end-users). It also entails the positioning of the EDP within its competitive and regulatory environmental context, both of which may be very dynamic and fluid challenges as regulators, competition authorities and governments grapple with the platform as rapidly growing new institutional forms. Platform designers are required to articulate the mechanisms of *datafication, commodification* and *selection* using the interplay of data structures, algorithms, interfaces, commercial strategies and user practices developed within and by the ecosystem (Van Dijck, Poell & De Waal, 2018).

One of the key aspects of this lens is focusing on the enablement of the platform's core interaction *(Value Creation Mechanism)*, specifically concretising and optimising the key components of the participants, the value unit and the filter (Parker, Van Alstyne & Choudary, 2016). This is the most fundamental purpose of the platform, as stated by Parker, van Alstyne and Choudary (2016): "All three must be clearly identified and carefully designed to make the core interaction as easy, attractive and valuable to users as possible".

Novel IT-enabled organisational forms, such as platform ecosystems, require a comprehensive view of governance, specifically addressing questions such as, *"Who is governed?"*, *"What is governed?"* and *"How is it governed?"* (Tiwana, Konsynski & Venkatraman, 2013).

An emerging challenge (and potential opportunity, of course) for platform owners[63] is the fact that digital platforms are increasingly subject to government regulations (often driven by regulators and/or legislators after large-scale data leaks such as the Snowden revelations of large-scale digital surveillance by government and a seemingly endless list of privacy failures and risks to the rights of citizens (see Lyon, 2014). The degree to which a platform owner can impact this external factor is, at its core, often determined by their negotiation power *vis-à-vis* governments and national or multi-national regulatory agencies.

From various perspectives, concern has been shown around the manner and scale at which the mega-platforms use (or even abuse) their market dominance and commercial power to lobby for preferential regulatory regimes for their businesses, most recently the so-called *Facebook Files* investigations sparked by the former Facebook Product Manager and whistle-blower Frances Haugen

[63] Mainly mega-platforms with extensive capacity for lobbying, legal expertise and drawn-out legal processes

(Associated Press, 2021; Wall Street Journal, 2021; Wired Staff, 2021). There are increasing concerns about self-regulation as an appropriate governance approach for digital platforms (Cusumano, Gawer & Yoffie, 2021).

What is often less explicitly focused on is the struggles of emerging platforms to compete against the mega-platforms to impact policy and regulatory environments to provide more favourable support to their very different design contexts and attempts to scale to create locally relevant benefits to their intended beneficiaries and stakeholders. Some South African examples of this are reflected in the struggles of Uber drivers and other sharing economy platform workers to assert meaningful labour rights (Fairwork, 2020). This is despite the country historically having very powerful and large labour union actors with extensive access to government functionaries. It further deserves to mention that many of the so-called cloudwork-platforms (i.e., Fiverr[64], Amazon Mechanical Turk[65], Freelancer[66], 99Designs[67]) rated rather poorly against the Fairwork cloudwork principles of Fair Pay, Fair Conditions, Fair Contracts, Fair Management and Fair Representation (Fairwork, 2021).

What was not expressly mentioned in the Fairwork reports, but what becomes very apparent once one visits each of these web platform examples cited above, is the fact that each of them requires either Google, Facebook, Apple or Amazon authentication to create an account. An effect of this is that, although these platforms may offer certain developmental benefits to local design professionals, in effect, it also limits their participation in the digital economy by introducing *de facto* standards and technology platform rules and external dependencies that aspiring design professionals must adhere to. This is one of the factors that limit their *freedom to design.*

Even a cursory glance at the mobile app service categories offered on a platform such as Fiverr[68] shows that more than 11700 application developers are offering services for *iOS/Android/Windows Phone* versus 20 in the "Other" category. Therefore, emerging digital platform (software) developers and designers need to adhere to these market forces or risk not being able to compete with their own application ideas, services and projects.

64 https://www.fiverr.com/
65 https://www.mturk.com/
66 https://www.freelancer.com/
67 https://99designs.com/
68 Search done on 2021/12/21 at https://www.fiverr.com/categories/programming-tech/mobile-app-services/custom-app?source=category_filters

Another external dependency that is often dictated by mega-platforms is entering into largely one-sided agreements and using their prescribed technology systems. For example, using Mechanical Turk requires accepting its Participation Agreement[69] , including, in Clause 11, the right of Amazon Mechanical Turk, Inc. and its affiliates that state:

> "We may terminate this Agreement, terminate or suspend your account and access to the Site, or remove any Task listings immediately without notice for any reason. Upon any termination or suspension of this Agreement, your right to use the Site will cease, and you will not be able to retrieve any information related to your account."

Participation in the *Human Intelligence Tasks* (HITs)that workers complete in exchange for a reward requires them to "write, test, and publish your HIT using the Mechanical Turk developer sandbox, Amazon Mechanical Turk APIs and AWS SDKs.[70]" Within the mobile application market dominated by Android and iOS, these *de facto* external dependencies on external SDKs and APIs provided by mega-platforms introduce *limits to freedom of design and concretise* to which emerging technology designers and developers are specifically vulnerable due to the pragmatism that their resource constraints often force on them.

It should be noted that the legislative context and regulatory environment, just like institutional policies and organisational culture, have a possible impact on the *freedom to design and concretise* digital platforms. In some autocratic governments, there are increasing direct direction on platform design forced upon platform owners and designers (see Reuters, 2021), impacting their "independence of design" and having a potentially negative impact on human rights and freedoms (for example, see Reuters, 2020; Axios, 2021; Sharma, 2021). The emerging platform designers lack the power to influence their design freedom, as they are under-represented in many regulatory and standard-setting negotiation forums. The International Standards Organisation (ISO) committee currently co-ordinating the *Standardisation in the area of Artificial Intelligence (ISO/IEC TR 24028)* is mainly managed and controlled by the *American National Standards Institute* (ANSI)[71] with no African representation in its Secretariat. This is but one example.

[69] https://www.mturk.com/participation-agreement
[70] https://aws.amazon.com/premiumsupport/knowledge-center/mechanical-turk-use-cases/
[71] https://www.iso.org/committee/6794475.html

The Concretisation Lens (see **Table 20)** aims to provide a framework to focus on these design decision categories in an EDP context.

Table 3: Concretisation Lens (Author)

Concretisation Lens	
Key Design Problems	***Expected Contribution of Living Labs***
Platform Type ***What type of platform is being designed? (explicitly and implicitly)***[72] *Process Design* *Realisation Design* *Object Design*	N *Informing appropriate type of platform to be designed*
Ecosystem ***How is the Platform Ecosystem being designed?*** *Process Design* *Realisation Design* *Object Design*	N *Informing appropriate design of platform ecosystem*

[72] For example Transaction platforms; Innovation Platforms and Hybrids thereof (Cusumano, Gawer& Yoffie., 2019).

Components ***How are the Platform Components being designed?*** *Process Design* *Realisation Design* *Object Design*	N *Informing appropriate design of platform components to realise objectives*
Value Creation Mechanism ***How are the Platform Value Creation Mechanisms being designed?*** *Process Design* *Realisation Design* *Object Design*	— *Informing appropriate design of platform's core value creation mechanisms*
Governance ***How is the Platform Governance being designed?*** *Process Design* *Realisation Design* *Object Design*	N *Informing platform governance process, principles, actors and alignment*
Platform Competition ***How is the Platform being positioned within the competitive landscape? (i.e., competition, collaboration, envelopment)*** *Process Design* *Realisation Design* *Object Design*	N *Informing platform competition analysis and appropriate positioning of EDP within competitive landscape*
Some key authors Tiwana, Konsynski and Bush (2010); Krogstie (2012); Evans (2012); Bonchek et al. (2013); Gawer (2014); Staykovska et al. (2015); Choudary (2015); Parker, Van Alstyne and Choudary (2016); Gawer and Evans (2016); De Reuver, Sørensen and Basole (2017); Tura, Kutvonen and Ritala (2018); Kim and Yoo (2019); Valdez-De-Leon (2019); Cusumano, Gawer and Yoffie (2019); Jacobides (2019); Choudary, Lamb and Marais (2020); Bonina et al. (2021)	***Some key authors*** Bergvall-Kåreborn, Eriksson et al. (2009); Herselman, Marais and Pitse-Boshomane (2010); Botha et al. (2012); Parker, Wills and Wills (2013); Coetzee et al. (2014); Thapa et al. (2014); Callaghan and Herselman (2015); Habib (2015); Hooli, Jauhiainen and Lähde (2016); Axelsson, Eriksson and Berglund (2019)

3.3. Implementation Lens

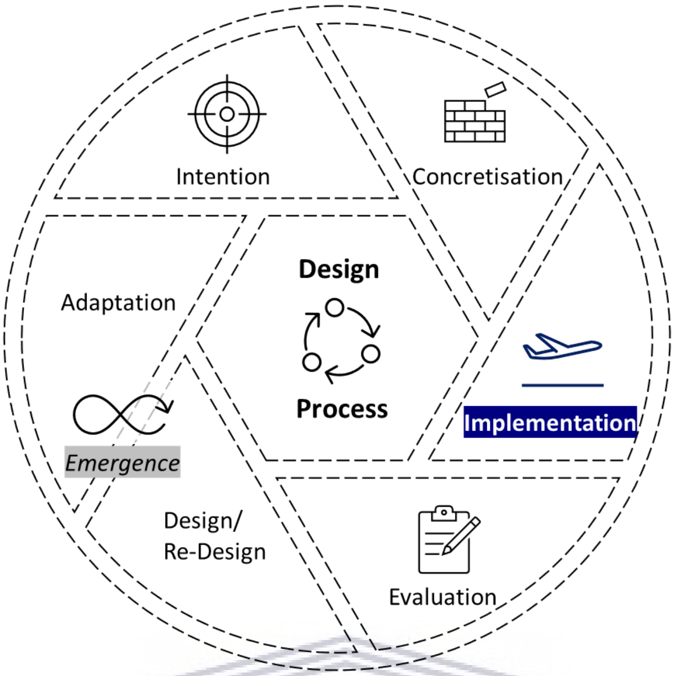


Figure 18: Implementation Lens (Author)

The Implementation Lens (see **Figure 18** and **Table 21**) focuses on the taking of the platform from a design concept to a live digital system that can be sustained over time. The four significant stages of a platform's lifecycle are entry (launch), growth, expansion and maturity, with different strategies around each phase required for the platform to remain sustainable (Kim & Yoo, 2019). Specifically relevant are design decisions around how the platform will be launched and operated on a day-to-day basis and how it will be managed in such a manner that it retains its relevance in addressing the intended objectives. These design decisions may involve multiple stakeholders, such as the platform owners and/or designers, ICT professionals, as well as ecosystem actors (for example, end-users).

To implement a platform successfully, it is crucial to stimulate network effects, build two-sided markets and design the technological and strategic elements required to encourage network effects and the attainment of critical mass as the platform expands (Kim & Yoo, 2019). To contribute to the achievement of organisational objectives in emerging economies, it has been argued that LL must be *User-centred*, embrace *Open Innovation*, be applied in a *Real Environment* and apply a *Multi-stakeholder approach* (Smit et al., 2011). We expect that LL will have a more positive impact on informing the launch phase than the more general operational management since LL is typically positioned as part of an innovation process (see Pallot et al., 2010; Schuurman, 2015) rather than informing more generic daily operational management processes.

Table 4: Implementation Lens (Author)

Implementation Lens	
Key Design Problems	***Expected Contribution of Living Labs***
Launch ***How is the platform launch being designed?*** *Process Design* *Realisation Design* *Object Design*	+ *Informing design of platform launch and ignition process*
Operations and Process ***How is the platform scaling being designed?*** *Process Design* *Realisation Design* *Object Design*	N *Informing appropriate operations and processes to scale platform in context to attain objectives*
Sustainability ***How is the platform's adaptation (sustainability/relevance) to context being designed?*** *Process Design* *Realisation Design* *Object Design*	+ *Informing object, realisation and process design to become/ remain sustainable within its process of attaining objectives*

Some key authors	Some key authors
Bonchek et al. (2013); Choudary et al. (2016); Parker, Van Alstyne and Choudary (2016); Stummer, Kundisch and Decker (2018); Kim and Yoo (2019; Choudary, Lamb and Marais (2020)	Bergvall-Kåreborn and Ståhlbröst (2009); Pallot et al. (2010); Smit et al. (2011); Grezes, Fulgencio and Perruchoud (2013); Baelden and Van Audenhove (2015) Ballon and Schuurman (2015); Mastelic, Sahakian and Bonazzi (2015); Schuurman (2015); Axelsson, Eriksson and Berglund (2019)

3.4. Evaluation Lens

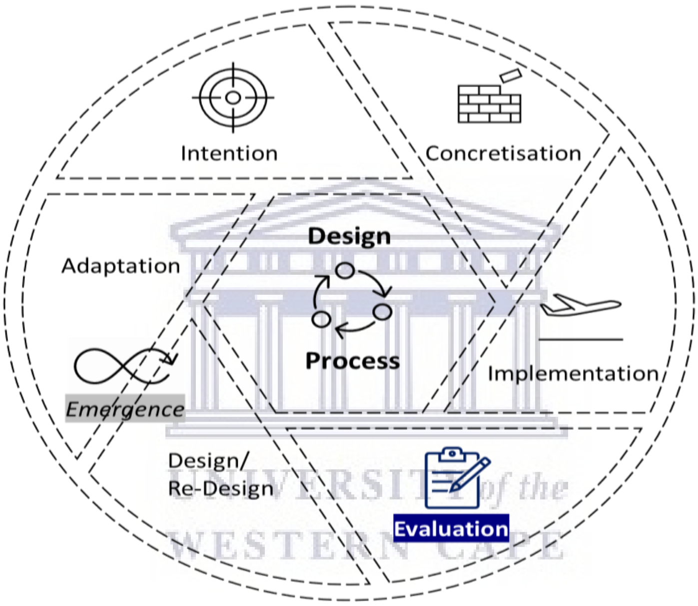


Figure 19: Evaluation Lens (Author)

The Evaluation Lens (See **Figure 19** and **Table 22**) focuses on determining whether the platform, as implemented, is meeting its designed intentions. The predominant actors in this process will be the platform owners and/or designers. However, to determine whether the platform is meeting its design objectives, the whole ecosystem and its actors (as part of a complex adaptive socio-technical system) would need to be analysed, especially if adaptions are required.

This lens aligns with the "maturity" phase of platform growth as proposed by Kim and Yoo (2019), where key decisions focus on the management of the ecosystem and maintaining critical mass through managing platform quality and revenue structure (subsidising/cross-subsidising between platform sides (or in case of a not-for-profit platform, the internal economy created by means of value units/tokens). Evaluation of the role of LL needs to be conducted consistently, eliciting regular feedback at marked intervals (Adam et al., 2011). In the South African context, some studies indicated that even though LL projects recognise the importance of monitoring and evaluation, sometimes, these evaluation criteria are not clear (Coetzee, Du Toit & Herselman, 2012).

The above study also distinguishes between internal (intra-LL) and external evaluation (feedback from users and other stakeholders): "Internal evaluation includes evaluation against LL goals, cost-effectiveness, impact assessment, research publications, programme reports, etc. while external evaluation, takes place mostly via online, questionnaire or face-to-face feedback from the external community/user" (Coetzee, Du Toit & Herselman, 2012).

Table 5: Evaluation Lens (Author)

Evaluation Lens	
Key Design Problems	***Expected Contribution of Living Labs***
Meeting Objectives ***How is the success of the design process in terms of meeting the design intentions measured?*** *Process Design* *Realisation Design* *Object Design*	*Informing whether design intentions are being met*

Value Realisation ***How is the success of the design process in terms of meeting the value realisation intentions measured?*** *Process Design* *Realisation Design* *Object Design*	*Informing understanding of whether value is being realised*
Value Capture ***How is the success of the design process in terms of meeting the value capture intentions measured?*** *Process Design* *Realisation Design* *Object Design*	N *Informing understanding of whether value is being captured*
Feedback ***How are the lessons learned (feedback) in the design process communicated and utilised to inform learning and appropriate adaptation of design to context to attain objectives?*** *Process Design* *Realisation Design* *Object Design*	N *Informing learning and appropriate generation of adapted/new design propositions to optimise attainment of objectives*
Some key authors Adam et al. (2011); Gregor and Hevner (2013); Drechsler and Hevner (2016); Venable, Pries-Heje and Baskerville (2016); Baskerville et al. (2018); Kim and Yoo (2019)	**Some key authors** Pitse-Boshomane et al. (2008); Adam et al. (2011); Salminen et al. (2011); Botha et al. (2012); Gumbo et al. (2012); Parker, Wills and Wills (2013); Hooli, Jauhiainen and Lähde (2016)

3.5. Emergence Lens

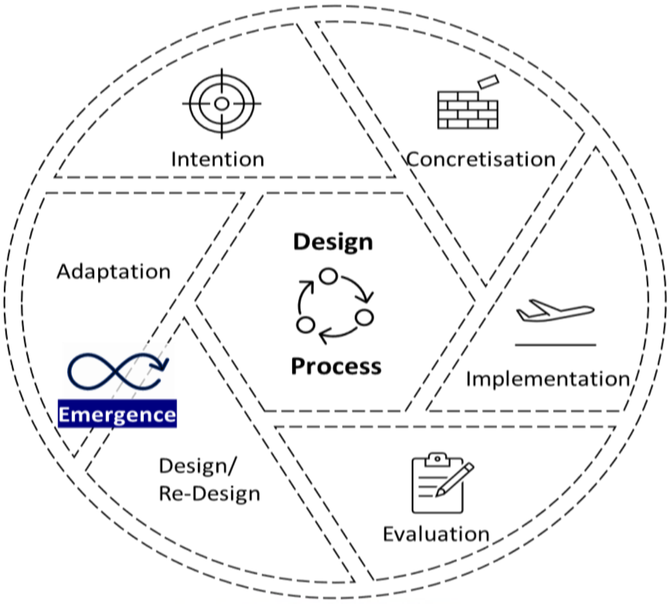


Figure 20: Emergence Lens (Author)

The Emergence Lens (see **Figure 20** and **Table 23**) focuses specifically on the designing of levers or mechanisms of emergence, such as scaling and growth through architecture-governance alignment (Tiwana, 2014), optimising of platform operations and capabilities, platform ecosystems and governance thereof; mechanisms that relate to the platform's technical features, incentive system, and boundary resources (Asadullah, Faik & Kankanhalli, 2018), as well as the iterative (re)design and adaptation of these mechanisms throughout all the previous design processes/lenses).

Therefore, it is a meta lens that recognises the interdependency and "messy" (rhizomatic) nature between the emerging platform design lenses. The researcher view this lens as particularly useful for platform owners and/or designers needing to align observed reality with intended reality. This lens also supposes a focus on the evolution of design contexts (externally dictated factors/elements/ realities that may not always be designable by the platform owners and/or designers) and the way that their strategic and design decisions may possibly inform further adaptations of the emerging platform's design.

Table 6: Emergence Lens (Author)

Emergence Lens	
Key Design Problems	***Expected Contribution of Living Labs***
Scaling ***Scaling design*** - *How is the emergence of the platform deliberately designed in each phase?* *Process Design* *Realisation Design* *Object Design*	— *Informing how scaling process is designed and aligned with platform realisation and implementation*
Scaling evolution- *How is the design of the emergence of the platform externally influenced by contextual factors?* *Process Design* *Realisation Design* *Object Design*	N *Enabling appropriate responses of design to relevant external influences*
Architecture-Governance Alignment ***How is the alignment of the platform's Architecture and Governance designed?*** *Process Design* *Realisation Design* *Object Design*	N *Informing alignment design of architecture and governance*

Some key authors	Some key authors
Thomas, Autio and Gann (2011); Bonchek et al. (2013); Gawer (2014); Tiwana (2014); Bratton (2015) Choudary et al. (2016); Parker, Van Alstyne and Choudary (2016); De Reuver, Sørensen and Basole (2017); Asadullah, Faik and Kankanhalli (2018); Tura, Kutvonen and Ritala (2018); Cusumano, Gawer and Yoffie (2019)	Pitse-Boshomane et al. (2008); Adam et al. (2011); Botha et al. (2012)

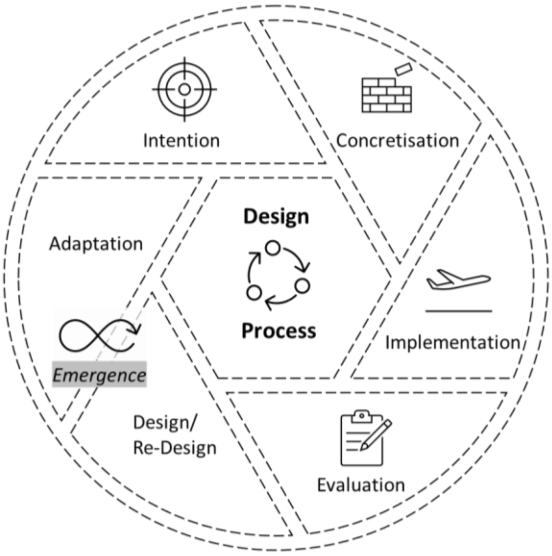
4. Chapter Conclusion

In this chapter, the *Emerging Digital Platform Design Lenses* (EDP Lenses) were presented as a conceptual framework (see **Table 24** for a summarised view of the lenses and their key design questions) to assist us in analysing the design decisions required for the process of designing and scaling a digital platform within the *wicked problem* context of Higher Education in South Africa.

In **Chapter 6**, these lenses will be applied to investigate the ***UDUBSit*** case study. The application of the EDP Lenses will assist with ensuring a comprehensive analysis of the levels through which the LL approach has informed the design process of this emerging digital platform. Thereafter, in the subsequent chapters, the analysis, findings and recommendations, specifically focusing on identifying the mechanisms by which LL may have informed (or not informed) this design process, will be presented.

Based on the structured—literature review, we expect LL to show a positive contribution to the intention of the platform designers and/or owners. We expect a more neutral or even negative impact from the LL approach on the concretisation and implementation phases of the EDP design process, as we suspect that the LL process may not be engaging in enough depth and detail with the highly specialised technical decision-making within digital platform design processes. Because of the more typical positioning of LL as part of specific innovation interventions (usually time-bound), we also expect that LL will make less of a contribution in informing the day-to-day management decisions required in the hosting, running and operationalising of an EDP.

Table 7: Emerging Digital Platform Design Lenses (summarised) (Author)



Emerging Digital Platform Design Lenses (Summarised)

Intention Lens

Objectives

What are objectives (explicit and implicit) of platform owners and designers?

Values

What are the (explicit and implicit) values underlying this design process?

Context

What is the context in which this design process takes place?

Concretisation Lens

Platform Type

What type of platform is being designed? (explicitly and implicitly)?

Ecosystem

How is the Platform Ecosystem being designed?

Components

How are the Platform Components being designed?

Value Creation Mechanisms

How are the Platform Value Creation Mechanisms being designed?

Governance

How is the Platform Governance being designed?

Platform Competition

How is the Platform being positioned within the competitive landscape?

Implementation Lens
Launch How is the platform launch being designed?
Operations and Process How are the platform operations and processes being designed?
Sustainability How is the platform's adaptation (sustainability/relevance) to context being designed?
Evaluation Lens
Meeting Objectives How is the success of the design process in terms of meeting the design intentions measured?
Value Realisation How is the success of the design process in terms of meeting the value realisation intentions measured?
Value Capture How is the success of the design process in terms of meeting the value capture intentions measured?
Feedback How are the lessons learned (feedback) in the design process communicated and utilised to inform learning and appropriate adaptation of design to context to attain objectives?
Emergence Lens
Scaling Design How is the emergence of the platform deliberately designed in each phase?
Scaling Evolution How is the design of the emergence of the platform externally influenced by contextual factors?
Architecture-Governance Alignment How is the alignment of the platform's Architecture and Governance designed?

As a result of the fast-moving and highly technical specialised nature of digital technology, as well as the constantly "moving target" of keeping up with technology vendor specifications and prescribed technical standards, these design decisions are often left to ICT departments and software developers. This is even though some of these decisions may have a significant impact on the future design freedoms of the EDP and its intended beneficiary base and stakeholders. We also expect that the deliberate design of scaling may be less well informed by the LL process, as often these processes reside within software developer teams themselves (and this may often be opaque to platform owners, or they may not recognise that these design decisions should be included within their strategic management towards their identified EDP design intentions). Although we expect positive contributions from the LL process on evaluating the success and value capture of EDP projects, we suspect that emergence as a deliberate design focus may be lacking in the LL approach.

In **Chapter 6**, the ***UDUBSit*** case study, which focuses on the events observed and experienced (thus the CR domain of the *Empirical*) will be presented, after which it will be analysed through the perspectives of the EDP Design Lenses (**Chapter 7**) to identify the *Actual* (events and non-events generated by the mechanisms in the domain of the *Real*). The *Real* domain refers to mechanisms and structures with enduring properties, which we will identify and analyse in **Chapter 7**, and then derive and present a set of recommendations and suggestions for further research in **Chapter 8**.

Chapter 6 – Case Study

If you would understand the invisible, look carefully at the visible.

-Talmud

1. Chapter Introduction

The focus of this chapter is to present our case study data, utilising the Emerging Digital Platform (EDP) Lenses developed in **Chapter 5** as a conceptual framework and logic model. We will now present the ***UDUBSit*** case study, its broad design timeline and process, as well as a description of the design artefacts created through three design iterations. We will also describe the Living Lab process as it was applied in this case's identifiable design iterations. We will be framing our case study observations from the perspectives of the EDP lenses. In **Chapter 7**, we will distil the role that the Living Labs (LL) approach played in informing the design of this emerging digital platform (EDP) before suggesting some conclusions, design heuristics and further research opportunities and recommendations in **Chapter 8**.

The aim of this study, as detailed in previous chapters, is to answer our key research questions: "How can Living Labs be applied in the design of emerging digital platforms?" as well as "How does Living Labs inform the design of an emerging platform?"

The Cambridge Dictionary defines "inform"[73] as:

- *"to tell someone about something, especially officially"*
- *"to influence something such as an opinion or decision"*
- *"to give information or to teach someone about something"*

Within the context of Design Science Research (DSR), an informing science approach entails a transdisciplinary approach to design and study Information Systems (IS) in such a manner that it contributes more effectively to informing both the internal and external clients of the studied information system (Gill & Bhattacherjee, 2009).

The required elements of an informing system, specifically in academic (and HE) contexts, necessitate a focus on two interacting informing systems – one informing clients of a discipline and one informing clients of the institution (Gill & Bhattacherjee, 2007). Therefore, we will, in **Chapter 8**, present recommendations within the IS discipline as well as for institutions in HE that engage in the design of EDP.

[73] Definition of *inform* from the Cambridge Business English Dictionary© Cambridge University Press https://dictionary.cambridge.org/dictionary/english/

Our **operational definition of "informing" in the context of this study** is as follows:

> *Informing is the act of and/or the process of influencing design decisions pertaining to the process design, object design and/or realisation design of an EDP. The aim of informing is not only to contribute to knowledge creation within the research domain of Design Science Research but also to contribute to knowledge dissemination to institutional clients and design practitioners in an institutional context.*

We will now proceed to detail the ***UDUBSit*** case and will apply the EDP Lens framework to ascertain how LL informed the EDP-designed process. We will particularly investigate the way LL influenced design decisions through its application (or non-application). This analysis will then inform our findings and recommendations on how LL may be better applied within the context of EDP design.

This chapter predominantly focuses on a presentation of the *object-design*[74] (Van Aken, 2004) of the ***UDUBSit*** EDP, which is the design of the IS intervention, namely the designed artefact (a mobile application). In terms of the realist perspective, objects in the real world have particular causal powers that can produce certain effects under specific conditions (Van Aken, 2004).

It can also be argued that the repertoire of design professionals typically contains predominantly *object* knowledge, some *realisation* knowledge and, usually, a fairly limited amount of *process* knowledge (Van Aken, 2004). Although we touch on *realisation-design*[75] (the plan for implementation of the designed artefact) and *process-design*[76] (the method to be used to design the solution to the problem through a problem-solving cycle) (Van Aken, 2004) in this chapter, those perspectives will be further expanded on through our application of the EDP Lenses in **Chapter 7**.

In evaluating the impact of design decisions on the emerging platform's relevance and usefulness, we were influenced by the proposition of Gill et

74 Therefore, focusing on addressing the research sub-question: *How does Living Labs inform the object design of an emerging digital platform?*

75 Therefore, focusing on addressing the research sub-question: *How does Living Labs inform the realisation design of an emerging digital platform?*

76 Therefore, focusing on addressing the research sub-question: *How does Living Labs inform the process design of an emerging digital platform?*

al. (2013) as further developed in Drechsler and Hevner (2016) and Gill and Hevner (2013) that the evolutionary fitness of a design artefact is more valuable than its immediate usefulness. In **Chapter 8**, we will comment on our analysis from the Critical Realist perspective in order to retain our focus on the identification of underlying mechanisms. We will present and analyse the ***UDUBSit*** case knowing that, in CR, the "…indeterminate nature of a heuristic technological rule makes it impossible to prove its effects conclusively, but it can be tested in context, which, in turn, can lead to sufficient supporting evidence (Carlsson, 2005). We will derive some design heuristics that can assist in the better application of LL to inform EDP design decisions in future design projects in similar design contexts.

2. History and Case Background

The ***UDUBSit*** mobile application at the University of the Western Cape, South Africa, developed out of a multi-university collaboration project referred to as ***Zoneit*** at Ghent University, Belgium, which was first presented in March 2011 at a workshop in Ghent on student entrepreneurship. ***Zoneit*** was conceptualised as a location-based digital notice board to build community while preserving privacy (Stroeken et al., 2015).

2.1. The *Zoneit* Mobile Application

From its initial conceptualisation, the intention of the designers was expressed in developing ***Zoneit*** as a platform (Stroeken et al., 2015). The intention of the multi-disciplinary design team was to create an application focused on goal-focused communication rather than person-focused communication to better preserve user privacy. The basic design concept was that of a virtual notice board for self-zoning, permitting the user to start location-based interactions under certain categories or spatiotemporal transient zones of trust (Stroeken et al., 2015). The ***Zoneit*** design concept also called for ephemeral communication between anonymous members of a trusted community, with communication structured within thematic zones (Stroeken et al., 2015).

The designers' intention was to create an application that could preserve privacy by making transactions less personal and less traceable (Stroeken et al., 2015). Therefore, this application was based on three ideal design parameters: 1) ephemeral communication and self-zoning; 2) three-dimensional location-based social network (temporal/spatial/ ephemeral); 3) application within a goal-oriented trusted community such as a university (Stroeken et al., 2015). It deserves to be mentioned that the conceptual designers of ***Zoneit*** were aware of the tension between the protection of privacy and generativity through personalisation and leveraging of users' personal data through analytics (Stroeken et al., 2015). As Stroeken et al. (2015) stated: "reaching a critical mass at once is a considerable challenge for ***Zoneit***".

The designers of ***Zoneit*** aimed to create an application aimed at "inverting Facebook" with the following elements (Stroeken et al., 2015):

> "To sum up, the elements of the app are that (1) it creates a virtual network of users, (2) who have an authenticated account, so they can be trusted, (3) who seek a match for their offer or request, so they engage in goal-driven interactions (4) and whose interactions are proximity-based, via LBS[77]. The network originating from this app could be coined Virtual Authenticated-account Match-oriented Proximity-based (VAMP). ***Zoneit*** is a VAMP network."

The ***Zoneit*** designers involved potential end-users within the design process from a very early stage, and initial prototypes were adapted based on user input, resulting in various attempts to capture in an ICT application design the intentions of the platform owners and design team. The application prototype was tested in 2012 at the Ghent Lichtfestival with 333 unique device users and resulted in relatively few messages and interactions within the "goal-oriented exchange in the absence of person-based communication".

After two months, the app was removed from the market for a redesign of the back end (using Google services), more interface redesigns and the inclusion of a search function. The alpha version was launched in July 2014, and the beta was planned for December 2014. It was decided to embed the university e-learning platform's notices into the application to reach more users.

See **Figures 21 and 22** for early interface designs of ***Zoneit***.

[77] LBS: Location-based services

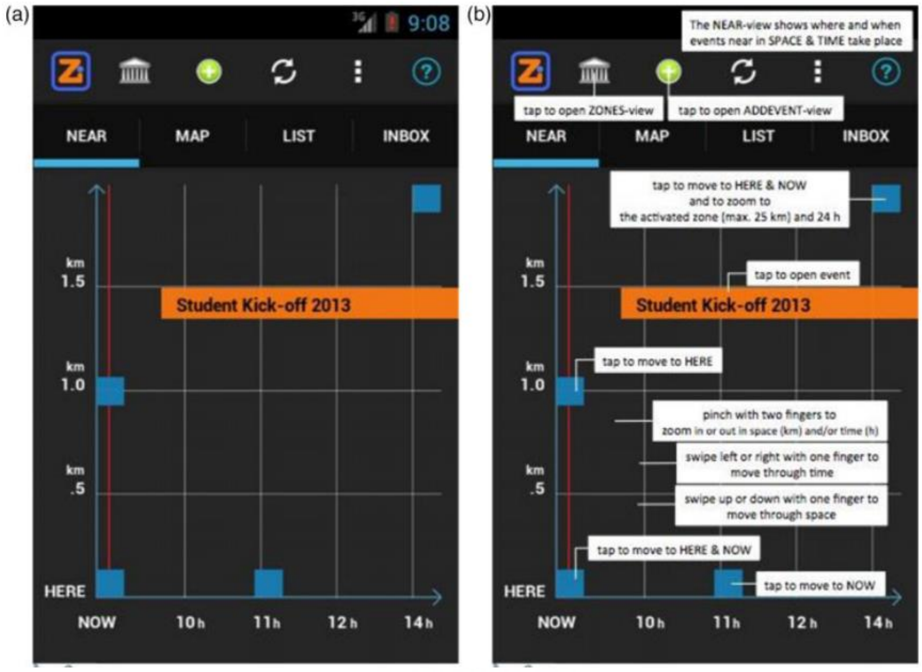


Figure 21: Zoneit: NEAR Interface featuring a) Events and b) Functionalities (Stroeken et al., 2015)

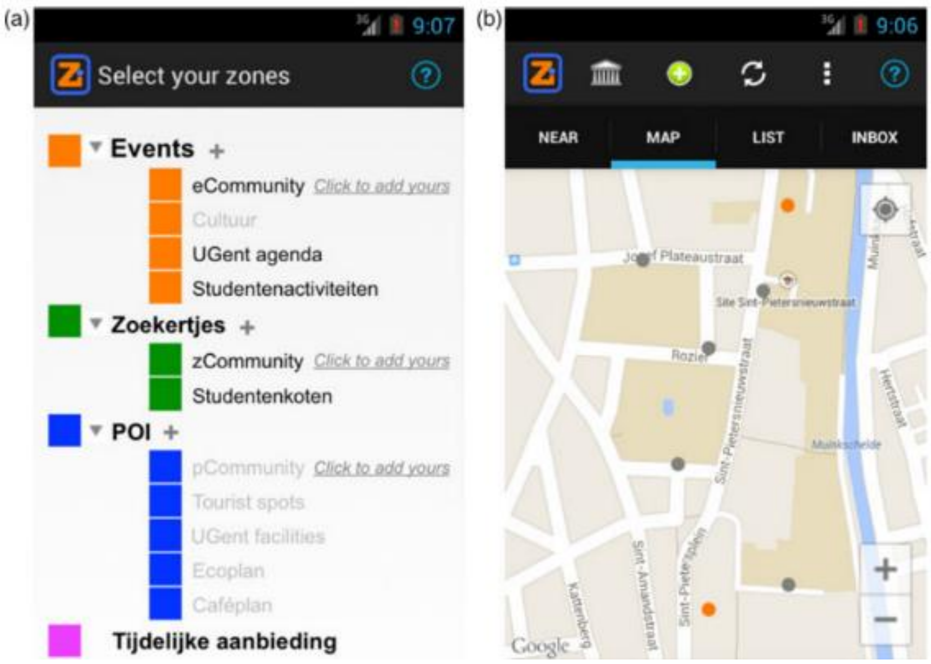


Figure 22: Zoneit: a) Zones and b) Map Interface (Stroeken et al., 2015)

3. The *UDUBSit* Mobile Application

The ***UDUBSit*** mobile application was developed from a joint project between the University of the Western Cape, South Africa and Universiteit Gent, Belgium. A third project partner, Mzumbe University in Tanzania, also developed a localised version of the ***Zoneit*** application branded as "***Mfunzi***"[78]. The collaborating parties were funded by the Flemish VLIR University Development Collaboration Fund to adapt, further develop and implement a contextualised application at the two African universities (Baelden et al., 2016) by adapting and localising the existing ***Zoneit*** application.

4. Positioning the *UDUBSit* Case as Emerging Digital Platform

From the initial conception of the ***Zoneit*** application (a pre-cursor project to ***UDUBSit***), the intention was expressed for the need to develop the application as a platform (Stroeken et al., 2015). One of the aspects that were highlighted in the co-creation process and Living Labs Needs Analysis study done around the ***UDUBSit*** application was the respondents' expressed need for a platform with more integrated, visible and accessible and relevant information (Van Audenhove et al., 2014; Baelden et al., 2016).

According to Spagnoletti, Resca and Lee (2015), the development of online communities can assist in fostering customer relationships (with students in the case of HEI), brand building, collection of customer information, improving service delivery (pre-and post-transaction) and the ongoing use of customer feedback to develop products and services more effectively and test new products.

The ***UDUBSit*** mobile application can be described as an emerging platform because its purpose has been delineated as being community-building within the campus community, and its design aim has been the gradual creation of co-created engagement features that are meaningful and significantly useful for participants. A clear intention of the platform sponsors (project initiators), in this case, has been to create an engaging platform with interactive and meaningful participation in building the campus community.
The drivers of platform evolution suggested by Tiwana, Konsynski and Bush (2010) and Tiwana (2014) may assist us in building a clearer understanding

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[78] Although we contextualise the *Mfunzi* application as part of the larger project that included the ***UDUBSit*** design process, the Tanzanian project and its design iterations does not form part of the case study we present in Chapter 6 and analyse in subsequent chapters.

of the platform emergence in the case we will be investigating (see **Figure 6, Chapter 2**). Both the ***UDUBSit*** and ***Mfunzi*** applications were still grappling with design issues around their architecture-governance alignment, scalability and resilience (in terms of Tiwana's, 2014 definition of these concepts). Both applications still show a lower level of composability, as there are still a limited number of subsystems within the application ecosystem that users can readily integrate with. Tiwana describes the properties of good platform architecture as being simplicity, resilience, maintainability and evolvability.

Both ***UDUBSit*** and ***Mfunzi*** could be classified as having evolved, but immature architectures and both applications struggled to create stickiness for their respective user bases. With the ***UDUBSit*** and ***Mfunzi*** case, for example, intensive discussions between different internal university role-players have resulted in decisions at both universities to outsource the ongoing maintenance aspects of the application (i.e., bug fixing; version maintenance; tweaking of features or user interface elements) due to internal lack of relevant and appropriate software development capacity.

In order to contextualize and locally implement the app at UWC and Mzumbe University, a Living Lab approach was used to guide and inform the process (Baelden et al., 2016). In both the co-creation process and Living Labs Needs Analysis study done around the ***UDUBSit*** application, the respondents expressed a need for a platform with more integrated, visible and accessible and relevant information (Van Audenhove et al., 2014; Baelden et al., 2016).

A clear intention of the platform sponsors (project initiators) in both cases of ***UDUBSit*** and the Mzumbe University application ("***Mfunzi***") has been to create an engaging platform with interactive and meaningful participation in building the campus community (Grove & Breytenbach, 2018). The ***UDUBSit*** and ***Mfunzi*** mobile applications have been described as emerging platforms because their purpose has been delineated as being community-building within the campus community, and the design aim has been the gradual creation of co-created engagement features that are meaningful and significantly useful for participants (Grove & Breytenbach, 2018).

Although both these emerging platforms have really struggled to attract a large enough user base for us to be able to make clear deductions about their success in creating connection, gravity and flow (Bonchek et al., 2013). We have, in previous work, found that the LL process did play a positive role in facilitating "designed serendipity" (Grove & Breytenbach, 2018) in their design processes. Upon analysis of the instances of "unsought findings" in both the cases under investigation, it became clear that in both the South African and Tanzanian contexts, ample evidence of serendipitous moments during the LL process was observed (Grove & Breytenbach, 2018). Based on the scaling challenges observed in the ***UDUBSit*** case after the aforementioned study, we may speculate that the mere observing of serendipitous moments facilitated by the LL process is not enough of a driver to drive EDP scaling. We will comment on this further in **Chapters 7 and 8.**

We will now present in more detail the ***UDUBSit*** iterations of the ***Zoneit*** application, with a specific focus on the role of the LL approach in informing its evolution and emergence as a digital platform. To present the case in a more logical manner, we will discuss **three concurrent design iterations** of the ***UDUBSit*** application, specifically focusing on underlying design decisions taken, as well as the way LL informed these decisions. We will first give a **short narrative and descriptive overview** of each iteration and then **summarise the key decision decisions in tabular format** to better enable an analysis of the evolution of different platform design decisions throughout each iteration **(Chapter 7).**

5. Design Iteration 1: Evaluating and Adapting *Zoneit* Android App

The first iteration Android App (designed in 2014) consisted mainly of the evaluation of an adaptation of the pre-existing ***Zoneit*** Android App at the University of the Western Cape (See Figures 23-25).

a) Design Process

The ***Zoneit*** software code, as received from the project partners, was adapted for the UWC context by an external software development firm (Firm X[79]), informed in part by the co-creation process as described below.

The designed artefact consisted of an Android application written in Java[80] with the Eclipse IDE[81]. A back-end "Admin panel and API" was written in PHP with Code Ignite framework[82] (a Lightweight MVC framework). This application was the only available option for students to access the ***UDUBSit*** application. The Alpha and Beta versions were designed by *Firm X*. The Alpha and Beta version's design was informed in part by the application of the LL approach, as detailed below.

79 Not the real name of the outsourced software development firm utilised.
80 https://www.java.com/en/
81 https://www.eclipse.org/ide/
82 https://codeigniter.com/

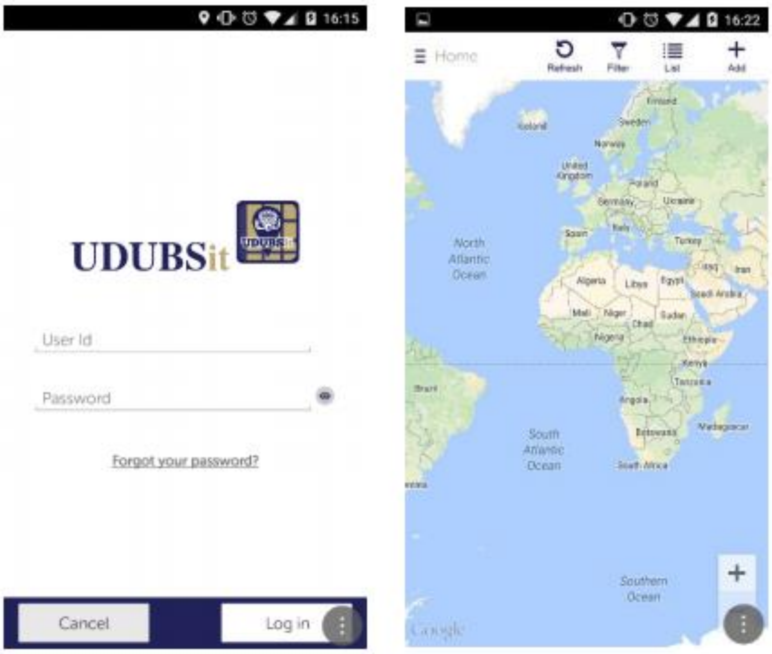


Figure 23: *UDUBSit*: Iteration 1 - Android Beta Version (log-in and map view)

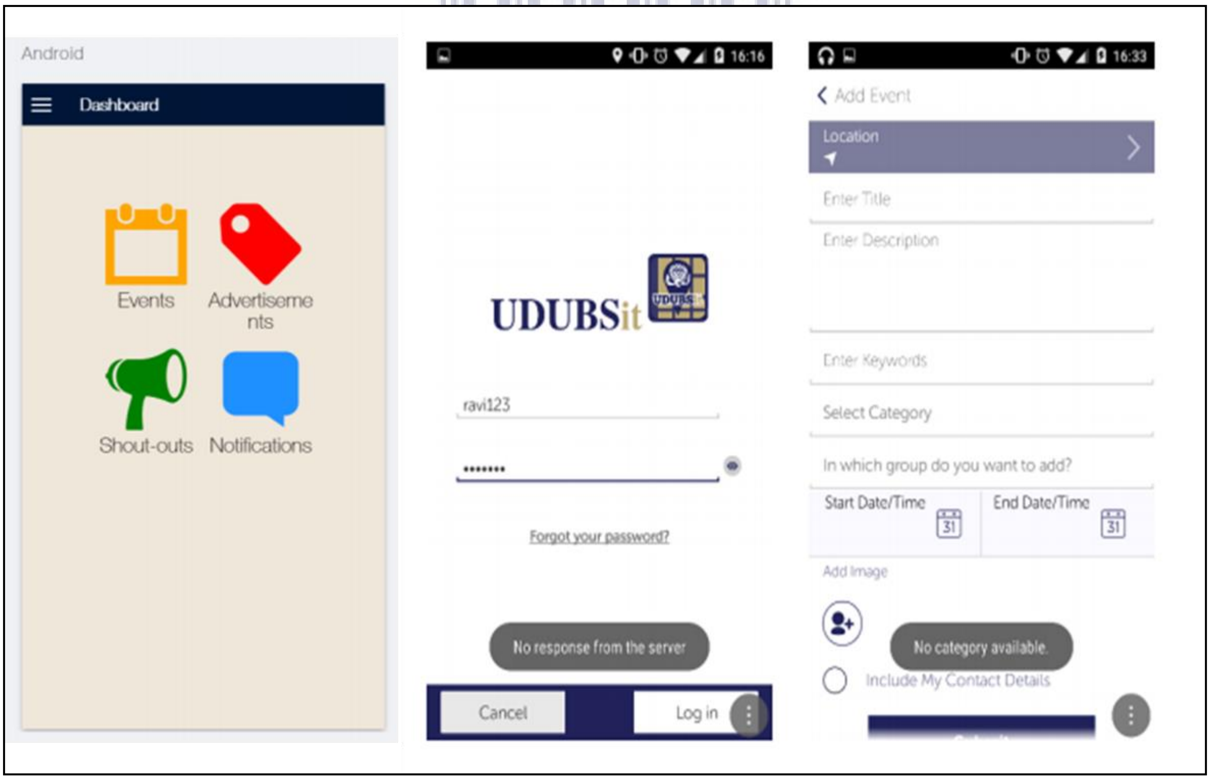


Figure 24: *UDUBSit*: Iteration 1 - Android Beta Version (dashboard and events feature)

b) Application of Living Labs Approach

The LL approach was used in needs analysis and co-design sessions at the University of Western Cape (UWC). Within the Contextualisation phase, the following role-players were included in the LL needs analysis and co-design process (Baelden et al., 2016):

- Students commuting to campus and living with family
- Students commuting to campus and living independently (i.e., in rented accommodation)
- Students living on campus
- International students
- Undergraduate students
- Post-graduate students
- Working students
- Students that do not work to finance their studies

During the needs-analysis and co-design, the following methods were used:

- One-day dairy
- In-depth interviews
- Focus group interviews and co-design sessions
- Validation focus-group interviews

Through the LL contextualisation process, the focus was on understanding student needs and student intentions with the usage of the app (both using adapted prototypes of the ***Zoneit*** application and sessions where students designed "apps" from scratch).

These sessions led to insights that students require the UWC application to address their needs in terms of the following categories:

- Accommodation
- Administrative notifications
- Detailed map of campus
- Information about UWC university services, peer (and staff) notifications on train delays
- Possibility to track security guards on campus
- Course and time management
- Information about jobs and career guidance
- Buying and selling

- Carpooling offers

Student co-design sessions focused mainly on user-experience design, such as colours, affordances, look and feel menu outlay and notifications. These co-design sessions were done based on ***Zoneit*** adapted prototype, as well as developing an app "from scratch" in the sessions. Suggestions were made that the UWC app should also include a "chat zone" for more interaction.

The LL report stated that the main finding was that "(t)his Living Lab research demonstrates that the needs and expectations of the students of the UWC community, with regard to the community-oriented and location-based mobile app, differ from how the app is currently conceptualised. These differences are caused by context and user profiles and are being taken into account when further developing and implementing the app" (Baelden et al., 2016). Although the article of Baelden et al. (2016) states that it would be dealing with the concretisation phase of the LL process as well, there was little to no information about this included in the paper. Crucially, at least from this paper's information, only one side of the platform users was included in the co-design sessions, namely students. However, the report (Van Audenhove et al., 2014) provided some additional information and stated that other stakeholders were recruited specifically so they "could also potentially benefit from the app, and… would need to use the app as well if it would be implemented using the services identified by students" (Van Audenhove et al., 2014).

These stakeholders included staff members of the university from the Health and Safety/Risk & Compliance, Institutional Planning, Student Enrolment Management and International Relations departments. Interviews were done with representatives from these functions (staff members of UWC), and they did not participate in the co-design sessions. Co-design sessions were only attended by students. As in the case of the article by Baelden et al. (2016), the report by Van Audenhove et al. (2014) did not really deal with the Contextualisation phase of the LL process in much detail.

Furthermore, it is interesting to note that the ICT department and the Marketing Department of the university were not included in either the interviews or the co-creation sessions, and neither were the academic faculties. At that time, the university did not have the internal capacity to develop mobile applications. The actual development of the ***UDUBSit*** application was outsourced to Firm X, a software development firm with headquarters in Country X[83]. They were tasked to adapt the source code from UGENT's ***Zoneit*** application for UWC context and purposes.

At the time of this initial LL, half of the UWC student respondents owned Blackberry phones and students, for example, emphasised that they valued applications that do not use too much data and which are dynamic and customisable. Some of the participants also suggested that "Instead of just being a social app for students, it can also be for academics" (Focus group interview 3)" (Van Audenhove et al., 2014). From the staff interviews, different design principles were suggested, such as:

- UWC Community Building and inclusivity
- Student retention and using the application to gather meaningful insights to provide better services
- Good governance focuses on building a community based on values such as accountability, transparency and inclusivity
- Helping to address student safety risks
- Managing general student communication through the application as a channel
- Customisation of zones for different communities (i.e., international students)

It deserves mention that the university's website owners and designers were not interviewed, and deep integration was not a design goal from the beginning of this project, given its research focus and locus in academic/ applied research units. This is often a challenge in university projects that need to cross the boundaries between institutional focus and research focus. At the time of this initial LL process, the UWC webpage was also not yet designed to be mobile-responsive and was thus not easily navigable from mobile devices[84]. Thus, excluding a large percentage of the student population from accessing resources and leading to frustrating user experience challenges.

A major finding of the first LL process was the fact that the needs analysis also showed that students would benefit from a number of services that are not necessarily supported by location-based functions (Van Audenhove et al., 2014). The underlying intention of the ***UDUBSit*** app has, therefore, shifted

[83] Name of country anonymised. This firm was not based in South Africa.

[84] The earlier versions of the UWC website can be viewed on the Internet Archive's Wayback Machine, for example on March 23, 2016, the website was not mobile responsive and looked as follows: http://web.archive.org/web/20160323093238/https://www.uwc.ac.za/pages/default.aspx

due to the LL process from being pre-dominantly location-based to being focused on the creation of "a stronger UWC community feeling", as well as the need to be more interactive (adding chat/messaging/forum functions). It was further noted that the app must be embedded in the local Cape Town community context and must clearly be identifiable as a UWC application in terms of look and feel.

c) Evaluation

Prior to the adaption and launch of the mobile app at UWC, a team of exchange students[85] from Belgium was tasked with the evaluation of the provided code and the further adaptation thereof for the local context. Their evaluation resulted in a *Technical Report* that detailed the application structure evaluated the software and made some recommendations for preparing the application for launch and scaling.
The LL approach was applied in two rounds of user testing.

Key Features of the application at this stage were:

- Advertisements
- Broadcasts
- Events
- Master (Inbox, Groups, Categories, Location, Notifications)
- User profile (user registration confirmation, user information)

[85] Final Year Undergraduate Software Development students

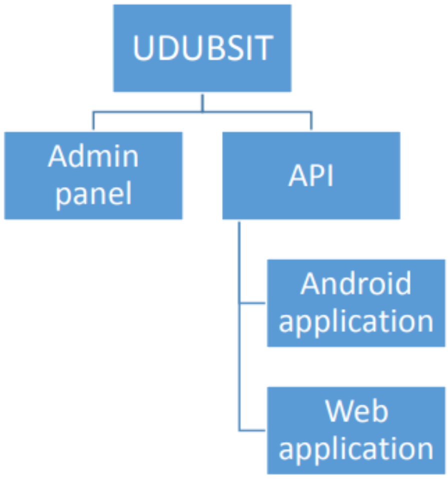


Figure 25: *UDUBSit*: Iteration 1 - Backend Structure (technical report)

During user-testing with approximately 25 students in focus groups on campus, several bugs were highlighted, including:

- Map position is not correct; it is zoomed out too far
- Login does not always work
- Slow loading times for the maps, events, broadcasts
- Categories do not always show up or cannot be selected, e.g., an event
- Location cannot be found sometimes when selecting an event location

Various positive aspects were highlighted, including:

- Being able to navigate to events on campus
- Having an overview of different advertisements, events, etc.
- Sending a broadcast message when you need help. The name broadcast is not clear though

Upon analysis of the Iteration 1 version, the development team noticed the following technical challenges:

- One of the biggest problems is the fact that the app was not written according to Google's design guidelines[86] (both visual and programmatical)
- This resulted in a very slow process of code analysis with little guarantee that all known bugs would be discovered
- Best practices in software development principles were not always used, resulting in wasted time and effort, as stated by one of the developers:

[86] https://design.google/resources/

    - "We have encountered a bunch of functions that literally do nothing or are not useful."
- The MVC[87] pattern is not followed correctly with regard to the design of the Admin Panel:
    - "The frontend of the admin panel is displaying correctly but lacks some functionality in the sense that you do not have enough control over certain aspects of the app (for example removing data that is inappropriate or managing user groups)"
    - "There is no documentation available about the code, and there is a lack of comments that explain structure of the code"
- Various challenges with the API were also noted:
    - "On first impression the flow of the API seems to be correct. However, there seems to be a lot of bloated functions that consist of code that could be separated into a certain number of repositories. There are calls to the API that do not seem to work or where it is unclear which parameters it expects and what data it will return (Lack of documentation on or feedback from the API.) The API seems to be good enough for current use, but there is certainly room for improvement in the structure of internal functions (speed) and authentication to access the API"

A mobile applications User Experience Design, as a Human Machine interface layer, should aim to provide minimum distractions and enable quick adoption by users (Zutshi & Grilo, 2019). In terms of the User Experience Design, the following specific feedback was received:

- User experience design was based on mapping as central navigation tool. This was not well-received.
- User experience described as:
    - "Useful if responsive"
    - "Complicated"
    - "I think the concept of such an app is USEFUL and BENEFICIAL, but I don't think the apps functionality (at the moment) serves the concept efficiently""
    - "To me the app seems to be based on being the intermediary between users who host events and user seek to find events but at its current moment there are critical bugs that interfere with the users experience with the app"

[87] https://dotnet.microsoft.com/apps/aspnet/mvc

- o "The app is great. However, the map idea makes it more difficult for the user to understand what is going on"
- o " …if the interface is the same as other classified (Gumtree or OLX), as most people are familiar with it, it would be easy for most users and it would take off"

Other issues highlighted included the fact that the app needs to be better designed to keep digitally (excluded/inexperienced) users in mind.

d) Adaptation and Inputs into Next Iteration

The following design decisions informed the design of the application at this stage:

- The developers defined their understanding of the application brief as follows: "***UDUBSit*** is a community app targeted towards the student community of the University of the Western Cape (+- 23000 students). The main goal is to provide students with a platform to manage events, communicate and find their way around campus in a more organised way".
- Feature Set: Events, Broadcasts, Advertisements, Notifications.
- Main interface with the application was through the Map View. Suggestions from users included adding a List view option.
- No central identification system (such as OpenAuth[88] or LDAP[89]) was used to verify student rights to access the system in this version.
- It was decided that an initial "Open log-in" system be scrapped and a "Closed log-in" implemented. This required a system administrator ("Super-Admin") to add users from a list of students.
- It was envisaged that in Phase 1, the app would only be available to a closed trusted university community (registered students).
- Phase 2 would add Vendors, Shops, Rental Agencies, etc.
  - o Super-Admin and Sub-Admin roles in back-end to manage groups, group members and content:
    - ▪ *"We will allow SA (Super Admin) to import a list of users. Because it is an app only for use within a trusted university community, there is no need for registration. The administrator should manage external community members. (Phase 2 can take care of allowing external*

[88] https://oauth.net/2/
[89] https://ldap.com/

parties to be part of the system, e.g., Vendors, shops, rental agencies etc.)" - Firm X User Testing Report- 2014

- The Front-End App was referred to in correspondence and in the Firm X 2014 User Testing Report as the "Student App".
    - User categories were "Student" or "Alumni"
    - This is noteworthy as it only addresses one half of the intended "platform" ecosystem, largely not designing for the HEI staff as a user/producer category
- Landscape view was not supported.
- This version also had a basic "ephemeral" functionality Broadcast messages:
    - Events view had slider to show events taking place in next X days
    - " Referring to broadcasts, it was agreed that we can keep Time to be 24 hours and radius to 1000 meters as it is"
    - A reported Bug was that Broadcasts that were supposed to be ephemeral did not disappear
- Various content sections had no content and had "under construction" placeholders:
    - This is an example of the "chicken-and-egg problem" often experienced by emerging platforms (See Stummer, Kundisch & Decker, 2018)
    - The seeding of content to enable the network effects required for growth and scaling never took place in this phase and a compelling reason for use of the application was lacking as there was not a critical mass of useful/desirable content available to interact with
    - User content creation by students was also not fully enabled, for example, students could not create their own interest groups
    - Uploaded user content was also limited and did not include all media types (e.g., no video uploads were possible)
- The App did not have any "memory" of what you viewed last. Users needed to re-orient themselves each time they accessed the early version of the app.
- Google Calendar[90] linking of Events was already suggested at this stage, although it was placed on roadmap as the adoption of Google Auth[91] log-in that was not yet decided upon at this stage.

[90] https://developers.google.com/calendar
[91] https://developers.google.com/identity/protocols/oauth2 is the current version of this protocol.

Based on test user feedback and a technical evaluation conducted by the student developers, the following design suggestions for the next iteration were made in their Technical Report:

- "The current functionality of the android app can be developed into a web platform that is optimised for mobile screens.
- The large benefit of this approach is that it will be accessible to everyone regardless of their operating system.
- After developing the web platform, it can be compiled to mobile apps for several mobile operating systems. To do so, we are going to use PhoneGap.
- This approach takes some time (±3 days per platform) because phone-specific functionality (camera, accelerometer and gyroscope) needs to be handled by an API (Cordova) to be accessed by the application (GPS has native JS support).
- There are two key points that need to be mentioned:
    - There could be issues running the platform in older browser. Geolocation and Angular.JS are supported from IE9 (2011), but older versions might experience some bugs
    - We depend on the API that (Firm X) has written. The database and API have been worked out and are able to run. When developing the web platform, we can receive and send data through their REST service. Developing our own backend would significantly reduce the time we have
- Further aspects that were identified as key considerations for the next design iteration were the following:
    - The ***UDUBSit*** application was generally positively accepted and valued by student testers
    - There are encouraging signs that the application, based on its underlying perceived value and core functionalities, may be well accepted by the broader student body
    - The application requires significant further debugging, unit testing, integration testing and system testing to ensure stable deployment
    - However, the developers need to give attention to the bug list and specify the items indicated as "Critical".
    - The critical aspects that need attention include:

  - Converting the current map view to a "hybrid satellite" view will greatly enhance not only visual appeal but also student's ability to better orientate themselves on campus
  - Adding more local venues (preferably down to lecture room level). A more detailed overview layer in Google maps was suggested
  - The fact that the "location search" functionality in the app does not provide "local search" is problematic. Students should be able to search on-campus venues in an easier and more user-friendly manner (i.e., at that stage, if a student typed in "UWC Library", it pointed to a library somewhere in the United States). It will not be sensible to expect students to be able to search for local venues by typing a very complicated and long search string
- It is strongly advisable to fix the complete user registration module before any large-scale implementation is attempted, as negative experiences upon sign-up strongly impact an application's perceived credibility and usefulness.
- Students are currently all using Google Apps for Education. Therefore, all have Google single-sign-on credentials. Using a "trusted sign-on" provider addresses some of the security concerns students raised.

The development team believed if these concerns are addressed, as well as the integration and stability issues, this application may develop over time into a trusted information resource for the UWC community.

During this iteration, **user-driven design suggestions** were implemented and used as primary directional motivation for implemented design decisions.

The development team that conducted this technical evaluation thereafter proceeded to lead the development of **Design Iteration 2**.

6. Design Iteration 2: Hybrid App with Original Back-End (2015-2016)

In this second iteration, a hybrid application was developed (**See Figures 26-33**). A hybrid app is an application that uses web technologies at its core but is compiled to run on native mobile platforms such as Android[92] and iOS[93].

a) Design Process

This design process was mainly driven and project-managed from an applied research unit within UWC, with software development capability provided predominantly by visiting Belgian student interns who spent four-month internships in South Africa. They engaged with the internal ICT department and some external contractors (such as for technical testing purposes). Various user testing sessions took place to validate and refine design assumptions.

Some of the key design decisions are briefly discussed below:

Front-End:

- The front-end structure used several components, the most important being Angular.JS[94], Cordova[95] and Ionic[96]. This version used Ionic as its UI framework.
- The back-end (adapted slightly from the **Design Iteration 1** version) was written in PHP[97] using the Code Ignite Framework[98], using the MVC design pattern[99].

Features:

- Events:
  - Students can post events through the app
  - Students can choose to notify whether they will attend or not
- Shout-Outs:
  - A shout-out is a small message that someone can broadcast to other users
  - They are limited in time and location (ephemeral) and will provide students with all kinds of information about the daily campus happenings
- Advertisements:

[92] https://www.android.com/
[93] https://www.apple.com/ios
[94] https://angularjs.org/
[95] https://cordova.apache.org/
[96] https://ionicframework.com/
[97] https://www.php.net/
[98] https://codeigniter.com/
[99] https://dotnet.microsoft.com/apps/aspnet/mvc

- When students have something to sell, from books to a bike, they can post these in the Advertisements section

- Points of Interest (POIs):
  - The campus is quite a large area, and often students can't find certain departments or infrastructure. This section contains a list of all campus buildings and facilities through which they can search and request navigation
  - Students will be able to submit their own POIs, which may be added to the map after vetting and review by system administrators
  - All the functionality is based on the campus location
- User Registration:
  - Institutional e-mail address required for access
  - "All the content is coupled to student's email address to prevent anonymous content"
- Link to university Learning Management System:
  - The application included a hyperlink to the university's Learning Management System (LMS) to create a more compelling reason for user adoption
- Schedule:
  - Limited functionality to view individual student class schedules was created to create a more compelling reason for user adoption
  - This integration was never fully functional

- Groups
  - This functionality was, in principle, a list of university-created groups that students may join to see their Events and Broadcasts

HYBRID APPLICATION

THE STUDENTS WILL PROVIDE THE SYSTEM WITH CONTENT AND USE IT FOR GENERAL PURPOSES.

ADMIN PANEL

ADMINS AND SUB ADMINS WILL MONITOR THE PLATFORM TO PREVENT UNWANTED CONTENT. THEY WILL ALSO BE THE ONES THAT CREATE THE GROUPS FOR EACH DEPARTMENT. THEY GAIN ACCESS TO THE APPLICATION THROUGH A WEB PANEL.

WEB PLATFORM

SOME STUDENTS MIGHT NOT HAVE ONE OF THE SUPPORTED DEVICES. TO MAKE SURE THEY HAVE ACCESS TO THE PLATFORM, THERE WILL BE A WEB APPLICATION OFFERING THE SAME CONTENT.

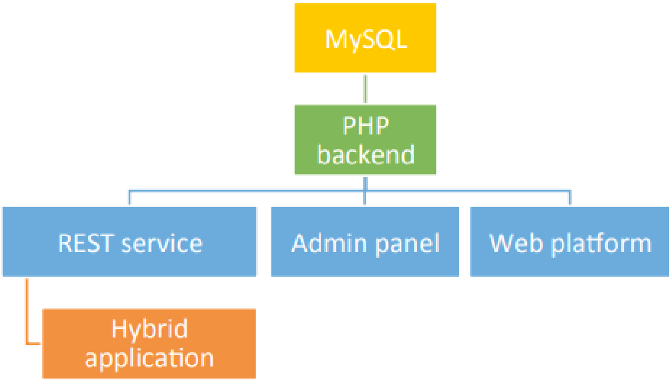


Figure 26: *UDUBSit*: Iteration 2 Application Structure

Figure 27: *UDUBSit*: Iteration 2 - Front & Back-end UX and Features Menu

Components

REST service	Connection to MySQL database
	Provides URL's to access the data
Angular.js	Two way binding between the controllers and the views
	Makes the calls to the REST service
	Provides services to route the data internally
Ionic	Themes using Sass
	Handles touch events and gestures
	Offers set of directives to display data (optimized for mobile)
Webstorm	IDE for web development
	Runs the Ionic toolset using node.js

Figure 28: *UDUBSit*: Iteration 2 - Main Components

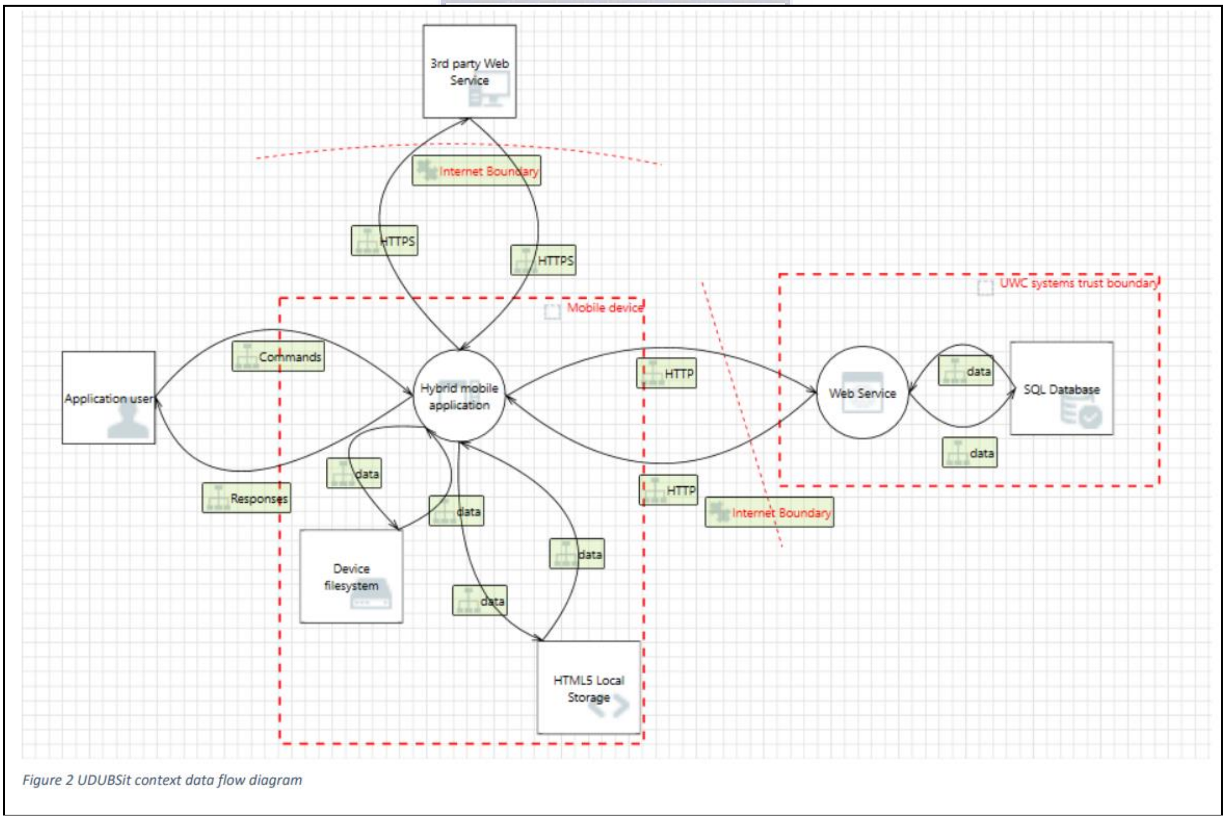


Figure 29: *UDUBSit*: Iteration 2 - Context Data Flow Diagram (Gryspeerdt, 2016)

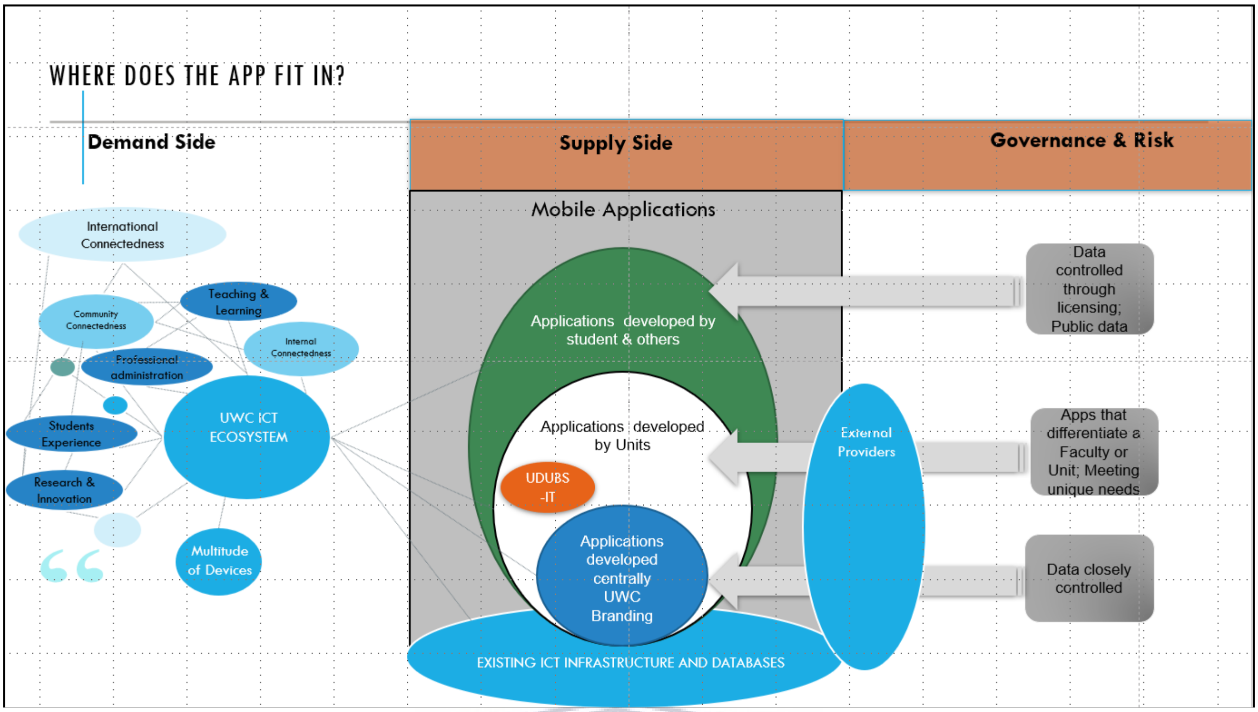


Figure 30: *UDUBSit*: Iteration 2 – Positioning *UDUBSit* within UWC Ecosystem (Author, 2017)

Back-end:

REST service built by Firm X using the Code Ignite PHP framework. The REST service was hosted on the university's servers with Apache SVN (Version Control System). For security and performance reasons, the student developers did not have direct access to the back-end hosting environment.

Stress Testing was conducted by an external contractor to assess load handling capacity:

> *"The main concern will be how the REST API will react on high amounts of generated, acquired and processed data that is stored on the server"* (Vanwildemeersch, 2017).

An external contractor conducted server load testing. The API load tests were all performed with the maximum peak load in mind (1000 concurrent users per second calling the API). The ***UDUBSit*** App, based on its current infrastructure and environment, was found to be able to perform adequately within the environment for which it was intended.

The application maintenance role was played by student developers who managed the testing and debugging of this version. Therefore, institutionalisation was limited to the Back-End hosting only and did not include front-end design or maintenance. The Helpdesk of the university's IT department did receive basic training in dealing with support requests on the ***UDUBSit*** application.

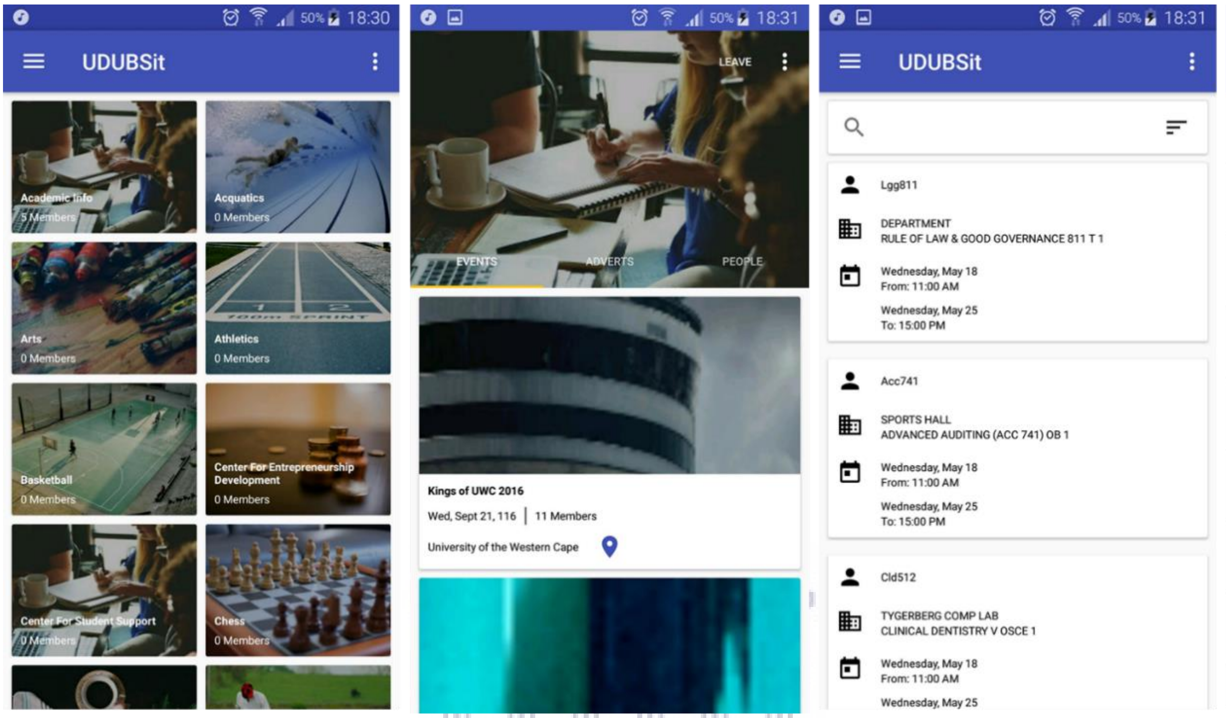


Figure 31: *UDUBSit*: Iteration 2 - Navigation of Front-End

External entities	
ID	**Description**
1	The web API for the UDUBSit app will be hosted on a virtual machine within the university's VMWare infrastructure. This will be an IIS server configured for an ASP.NET 4.5 application. This server will be hardened as per the university's server hardening standard.
2	The database for the UDUBSit app will be hosted on a virtual machine within the university's VMWare infrastructure. This will be an IIS server configured for an MS SQL database. This server will be hardened as per the university's server hardening standard.
3	The UDUBSit app will run on the user's mobile phone. This can be an Android, iOS or or a Windows phone.
4	The Web server is behind a firewall and allows HTTP(S) and WS(S) communication.

Figure 32: *UDUBSit*: Iteration 2 - External Entities *UDUBSit* (Gryspeerdt, 2016)

Trust levels		
ID	**Name**	**Description**
1	Anonymous application user	A user who has launched the application without providing valid credentials.
2	User with valid login credentials	A user who has launched the application and has logged in using valid login credentials.
3	User with invalid login credentials	A user who has launched the application and is attempts to log in using invalid login credentials.
4	Admin	The admin can create subadmins in the admin panel, delete user's posts, add users to groups, create groups, etc.
5	Database server administrator	The database server administrator has read and write access to the database that is used by the UDUBSit application.
6	Application administrator	The application administrator can configure the UDUBSit application.

Figure 33: *UDUBSit*: Iteration 2 - Trust Levels *UDUBSit* (Gryspeerdt, 2016)

b) Application of Living Labs approach

In this iteration, more limited co-creation interaction took place and only User Survey and Focus group data were analysed to evaluate the following aspects of the ***UDUBSit*** application:

- Perceived role and function
- Ease of use
- Perceived usefulness
- Most liked functionalities
- Least liked functionalities
- Biggest current pain point
- Most valued changes
- Perceived user training requirements
- Comparison with other applications used
- Application stability

c) Evaluation

The ***UDUBSit*** application was again generally positively accepted and valued by student testers. There were encouraging signs that the application, based on its underlying perceived value and core functionalities, may be well accepted by the broader student body. Students seem to strongly value the underlying feature set. The issues pointed out were more a function of execution of this feature set than criticism thereof.

Various students pointed out the dated User Experience and Design elements. Another element that was also highlighted is the slightly confusing nature of the map as a landing page.

During the focus group sessions and survey data collected in early 2015, the design was described as follows by student users:

> *The app could be a good app if certain features of it could be upgraded, especially the Wi-Fi and data connection. Also, if more icons would be added for different things like textbooks sales and not only for events.*
>
> *If this app can integrate with my calendar and email reminders, it would be useful. Alternatively, I would not make use of the application unless a Club that I belong to hosts events.*
>
> ***UDUBSIT*** *app is limited to a certain group and area of interest, whereas other apps are not limited to a certain group or areas.*
>
> *What is common between the apps I frequently use and the* ***UDUBSit*** *app is that they are all user-friendly.*

The biggest current pain point with the app was still seen as the location functionality. The ability to navigate on campus and find things was highly valued by students, but the current functionality is viewed as not quite meeting their expectations. The user experience also described some students as being frustrated. The initial map-based navigation also seemed to add to some student confusion as to which functionalities are available in the app.

d) Adaptation and Inputs into Next Iteration

According to the development team, they identified the following focus of the application redesign and adaption that is required:

- Update the look and feel of the application to be more modern and cleaner.
- Update the application logos and artwork, as well as icon sets.
- Rethink the user journey, specifically as it relates to the landing page/home page.
- Ensure stability of the sign-in process and integrate with Google Apps authentication for sign-on. This is both for ease of administration and added security.
- Ensure each of the core features (Events, Advertisements, Broadcasts) and the map navigation is stable, and the user experience flow is both logical and intuitive.
- Ensure that the back-end functionalities allow for the creation and management of groups, adding of map POIs, and user management

(including standard community management best practices and functions such as profanity filters, user blocking etc.).

- Ensuring that the process of adding POIs to the map is easy for back-end administrators.
- Ensuring "local search" is effectively implemented.
- A further focus on better defining the user data that will be collected for research purposes.
- Document the system according to application development best practices. This will ensure project continuity after the Belgian coder team has finished their internships in South Africa.

The team felt that if these concerns are addressed, as well as the integration and stability issues, this application may develop over time into a trusted information resource for the UWC community.

A very strong focus during this iteration was to modernise the front-end and create a more engaging user experience for users, focused on the student side of the platform. A further emphasis was on creating more flexible and scalable tools to create platform content, although this process was still hampered by the legacy database design structure. In general, user feedback was positive, and users continued to confirm the potential usefulness of this application to their day-to-day campus activities and social interaction. There were various attempts to better integrate the application with existing university systems (which contained various custom-built legacy systems that made this technically more challenging).

User Experience design based on more traditional menu-based navigation in the app was introduced; although there was a wide process of consultation around student user requirements, various developer-driven design decisions were implemented based on pragmatic considerations such as time and resource constraints and creating "workarounds" due to difficulty of directly integrating with legacy university ICT systems. Because the application was not fully owned by the operational units of the university, it created governance-related challenges around data-sharing, privacy and the creation of live integrations with existing IT systems.

An important point to note is that the university systems themselves were also undergoing a process of transformation as the university grappled with rapidly emerging cloud technologies, increased student connectivity requirements and the rapid emergence of students accessing university resources through their own devices, such as smartphones and tablets. Various Wi-Fi projects were initiated on the campus to provide free access to students. Out of the scope of this study, but still very relevant to our arguments in **Chapter 8**, is the fact that in 2019, the university gradually implemented free Wi-Fi/internet access initiatives provided in partnership with some mega-platforms such as Facebook[100].

The hampering inflexibility of the back-end database was identified as a significant barrier to scaling. This also necessitated the custom development of the very specific, single-function APIs to facilitate the content population of the application (for example, university events were imported from a .csv file received on a weekly basis per e-mail, rather than having dynamic, live integration. The centrality of location-based navigation (that was the key interface in iteration 1) was further reduced to create a more group-focused and feature-focused interface that was more similar to influential applications (particularly WhatsApp and Facebook) with high levels of user adoption that focus group participants and survey respondents cited in their feedback as examples of their design preferences.

7. Design Iteration 3: (2017/18) – Multiplatform with Redesigned Back-End

In this iteration, the back-end database was re-designed and updated to Google Firebase[101]. The front-end was updated to include a more flexible group management and content management structure, and location-based geofencing was integrated within application features such as events and points of Interest (see **Figures 34-42**).

a) Design Process

A key design intention expressed by the developers was location-functionality and specifically, navigation: "We can help the user to navigate around campus and provide him/her with location bound information" (Van Nieuwenhuyzen, 2018).

The front-end code was adapted for the required integration with the new back-end database. A more intuitive and powerful administrative portal (Content Management System - CMS) was created that was significantly more feature-rich than that of Iteration 2. This version of the application was clearer in identifying both students and staff as the target group: "The

[100] https://www.iol.co.za/technology/cell-c-launches-public-access-wi-fi-hotspots-at-uwc-19970416
[101] https://firebase.google.com/

application may be used by UWC students and staff only, so the user age ranges between 18 and approx. 70 years old" (Van Nieuwenhuyzen, 2018).

Geofences were applied within the application. The developers also indicated that they viewed aspects such as maintenance, expandability, cost and complexity as key factors in influencing their technology choices. Indoor navigation as a possible feature was also evaluated (inspired by the Soleway[102] project at UGENT), but this was placed on the future feature's roadmap.

b) Application of Living Labs Approach

Smaller-scale user testing was conducted due to time and developer resource constraints. Campus-wide surveys were developed and run to specifically gather user requirements around the campus navigation feature. However, "The surveys didn't get as much response as we were hoping for, but they show us which problems a variety of students are having and possible solutions they would like to see implemented" (Developer).

User Personas were developed by the developers that informed their development focus and agile development process. The following are examples of Personas and User Stories created by Developers (Van Nieuwenhuyzen, 2018):

> *User story based on Persona 2:*
>
> *Chadley has a terrible laptop and would like the local service to repair it. He doesn't know the opening hours or even where the service is located. Chadley would benefit from a map with all the locations of these services and their opening hours. Talking about services, he would also like to know which food services exist on campus and learn on a linked page what they serve. As a second year, Chadley still isn't familiar with all buildings or venues on campus. Chadley would be greatly helped if he was able to consult his personal timetable, listing all his lectures for that day with an option to show their locations.*
>
> *User Story based on Persona 4:*
>
> *Mark feels responsible for informing students about safety concerns, for example: "don't take this alley after dark". Mark also wants to provide solutions to certain temporary situations, for example:" the cafeteria has run out of water bottles. Please find the outdoor water taps here and here". As these situations are very incidental, he needs a way to communicate them ad hoc. For advertising purposes, Mark would like to know where students pass by or meet. He wants to chart these hotspots.*

102 www.SoleWay (ugent.be)

Out of the four created personas informing the developers' user stories, only one focused on the staff perspective (Persona 4), whereas the other personas continued the predominant focus on the student perspective from Iterations 1 and 2.

A single co-design session with the software development team, institutional stakeholders and some students took place on March 14, 2018, where after some key "project champions" were trained to use the Administrative Portal to manage group membership and content sharing. However, this failed to generate a significant increase in content creation and sharing on the application.

Governance discussions with relevant internal role-players resulted in the integration alignment of the application with existing institutional policies and legal terms and conditions. A challenge, however, remained in dealing with user content creation rules (i.e., balancing freedom of speech, possible online bullying or abuse and possible liability risks introduced to the institution).

The same challenges were identified around content moderation, as the development team did not have the capacity to develop and maintain automated tools to do this. Manual lists of offensive words that can be filtered were created, but UWC has multiple languages on campus and multiple "street-slang" terms that are dynamic and constantly changing. There was no capacity to moderate without appointing dedicated full-time 24/7 resources or directly integrating with external APIs to provide this service.

Another unanticipated aspect that the development team faced was the unexpected complexity of mapping locations on campus with sufficient granularity to be useful for users (for example, students used various walking paths as shortcuts between buildings on the large campus). There was no quick and efficient way for the development team to get a map for this information. Existing institutional stakeholders could also not provide a single authoritative view of all these locations at a high level of granularity, as these mapping processes took place in various departments and units ranging from Infrastructure to Insurance and Events Management. The developers had to resort to the manual process of using students to manually capture building coordinates on a third-party mobile application and import that into a static POI listing. It is interesting to note that, during Design Iteration 3, the global mapping process of Google Maps started, including the Street View of the UWC campus, and this process became much easier for the development team. In Design Iteration 2, this dependency on Google's proposed mapping process started emerging, and the application became almost fully dependent on Google Maps for the provision of accurate location information in Iteration 3.

c) Evaluation

The aim of the testing process was to assess ease of use, internal workflows, information flows and data quality, content attractiveness and user adoption.

The adoption process was slower than anticipated, but it was suggested that it might be addressed by the improvement of the data input, workflows and information flows.

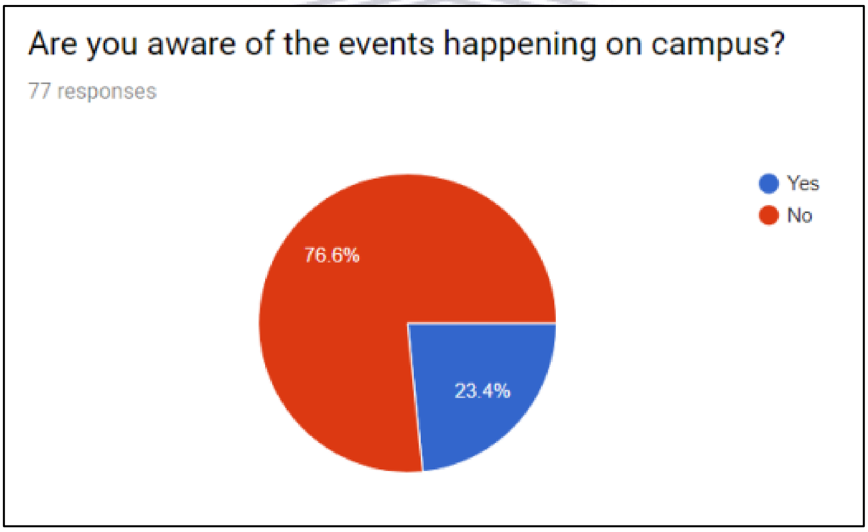


Figure 34: *UDUBSit*: Iteration 3 - Example 1 of User Testing Feedback (Van Nieuwenhuyzen, 2018)

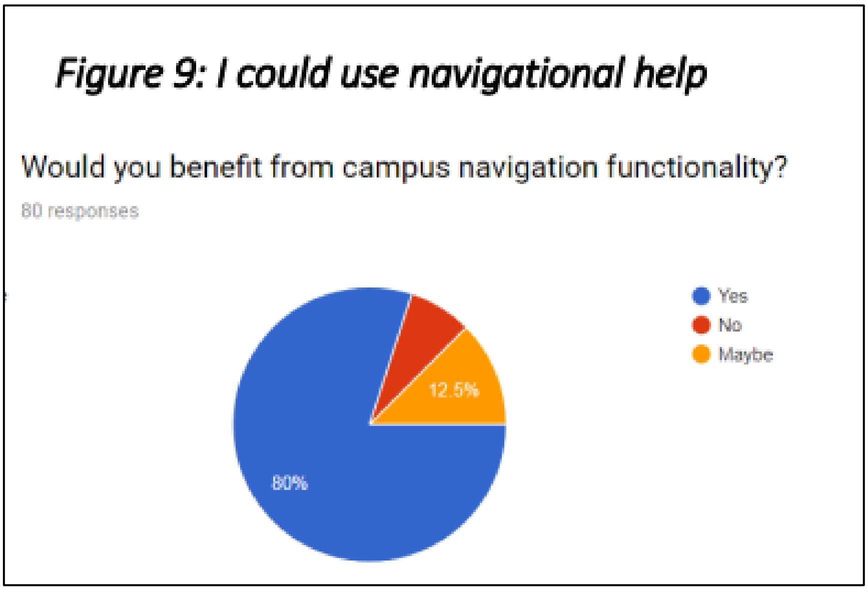


Figure 35: *UDUBSit*: Iteration 3 - Example 2 Of User Testing Feedback (Van Nieuwenhuyzen, 2018)

d) Adaptation and Inputs into Next Iteration

Based on the evaluation process, the following adaptions were suggested for improving community usage and adoption:

- Refocusing on Events as the "killer feature" as the key feature that will attract users.
- Adding student timetables further drives adoption. In this regard, full integration with the institutional student administration system (a custom-developed application) will be required.
    - Improve data flow and content
    - Data quality to be improved requiring the inclusion of GPS co-ordinates for all venues on campus
    - Data integration, management and control to be owned by the master data owners – which included various institutional departments and administrative units
- Attempt to reduce manual data upload processes by better back-end integration with institutional systems.
    - Decision was required on the back-end platform for optimal integration and elimination of manual processes (data upload)
- Attempt to onboard users more efficiently, as the authentication system still presented barriers to staff stakeholders who wanted to join the EDP.
    - Community owners needed to be fast-tracked for @myuwc.ac.za e-mail addresses as access to Google Apps instantiation of the

institution will facilitate direct engagement with their user groups via the app

- Adding automated geofencing integrated with group structures and location points/POIs, although the institution lacked the capacity to internally maintain this feature.
- Possible integration with Ghent University's SoleWay[103] platform for indoor navigation purposes was investigated and placed on the development roadmap. It must be mentioned that SoleWay relies on human capturing of indoor navigation routes.

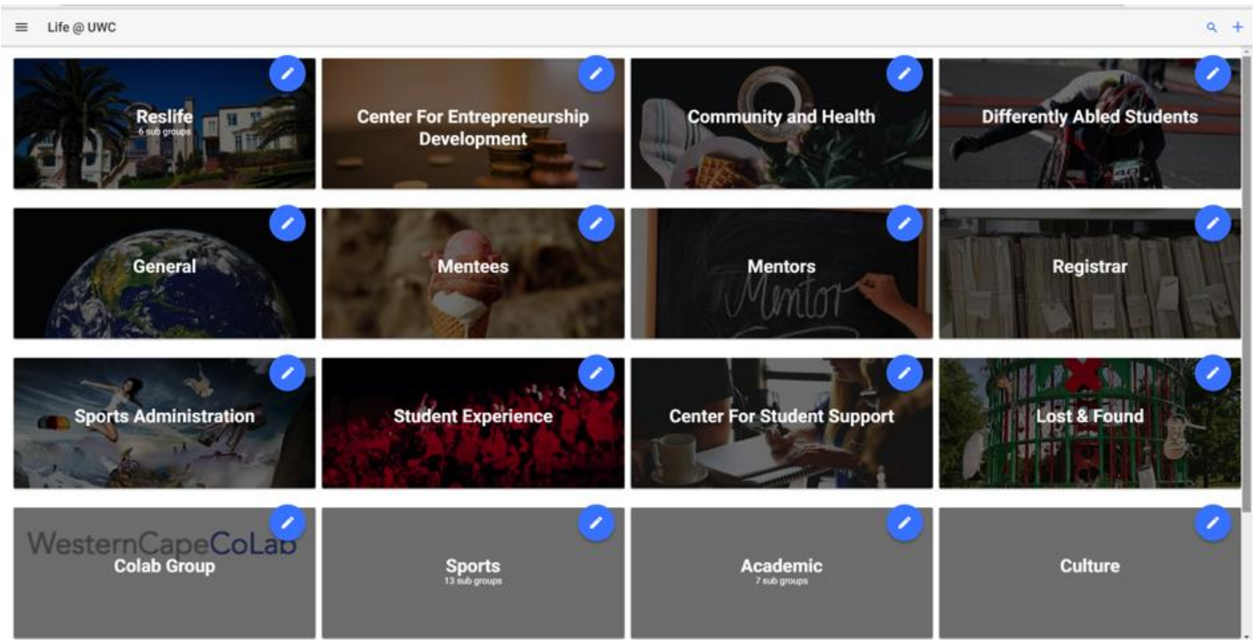


Figure 36: *UDUBSit*: Iteration 3 - Content Management System (CMS) Dashboard View

[103] https://soleway.ugent.be/

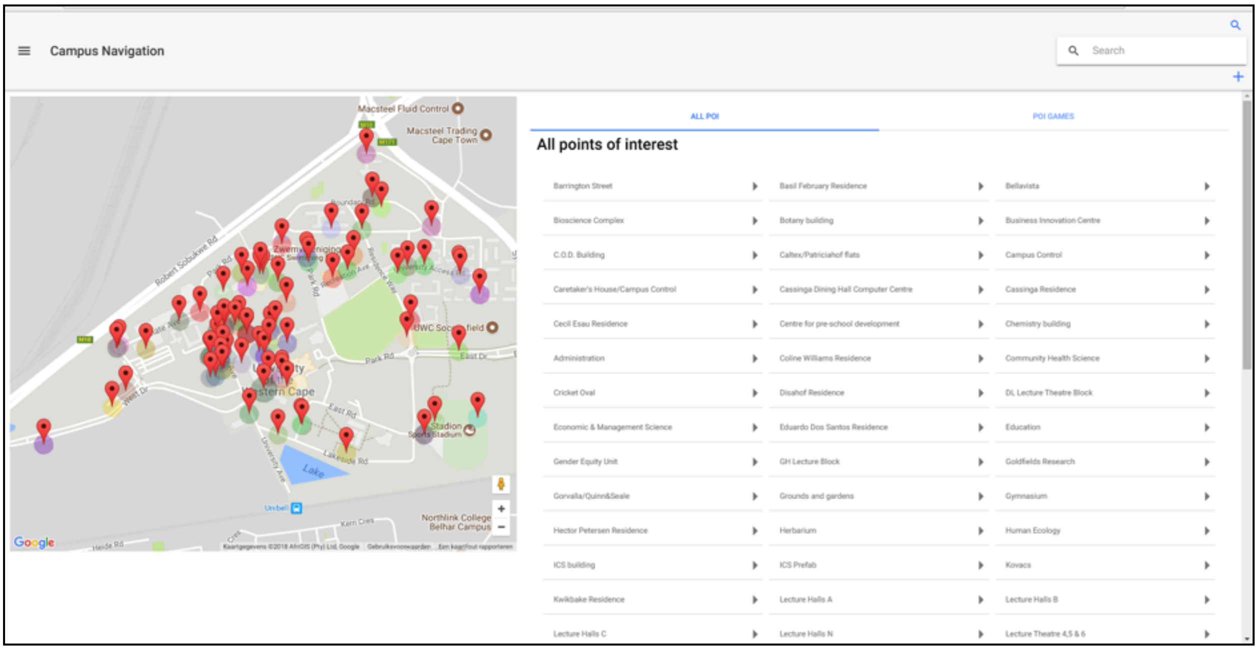


Figure 37: *UDUBSit*: Iteration 3 - Updated CMS - POI View

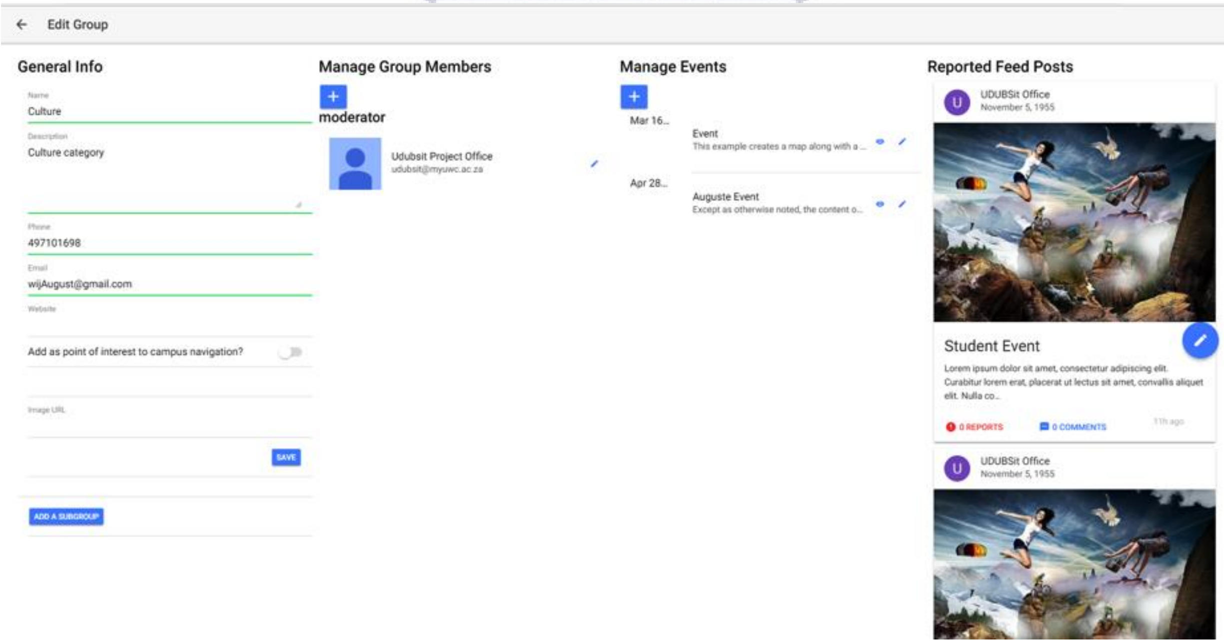


Figure 38: *UDUBSit*: Iteration 3 - CMS Group Management

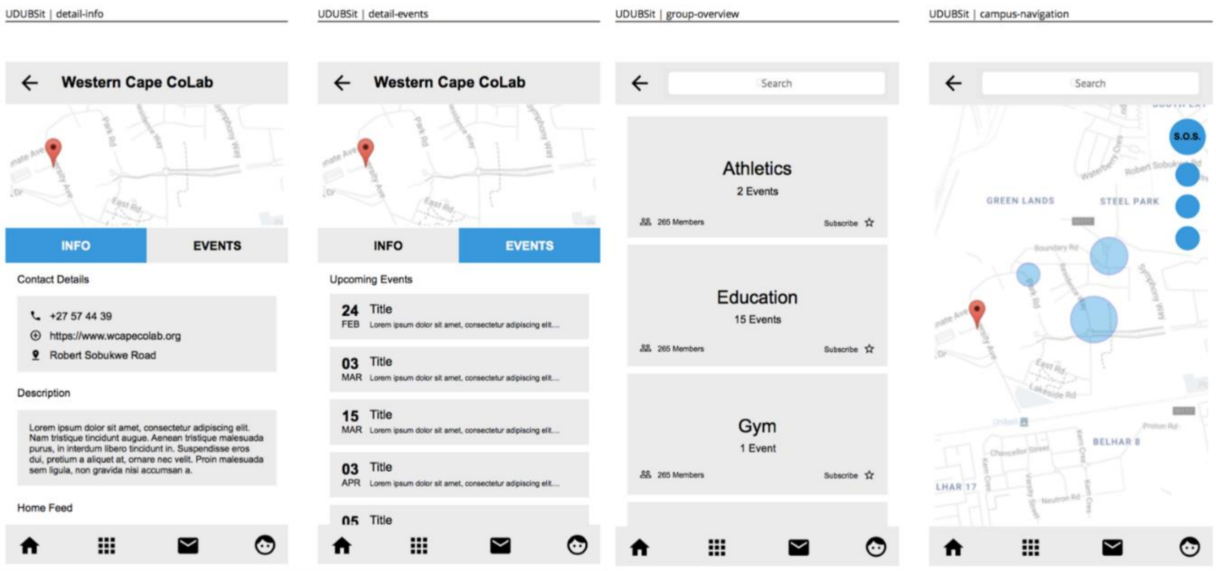


Figure 39: *UDUBSit*: Iteration 3 - Front-end Wireframes

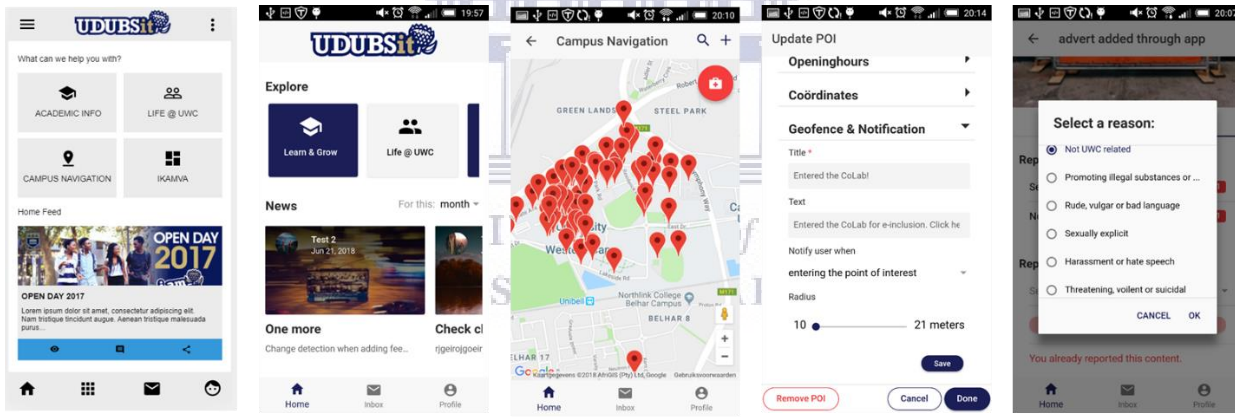


Figure 40: *UDUBSit*: Iteration 3 - Wireframe, Android App, Navigation, POI and Abuse Reporting

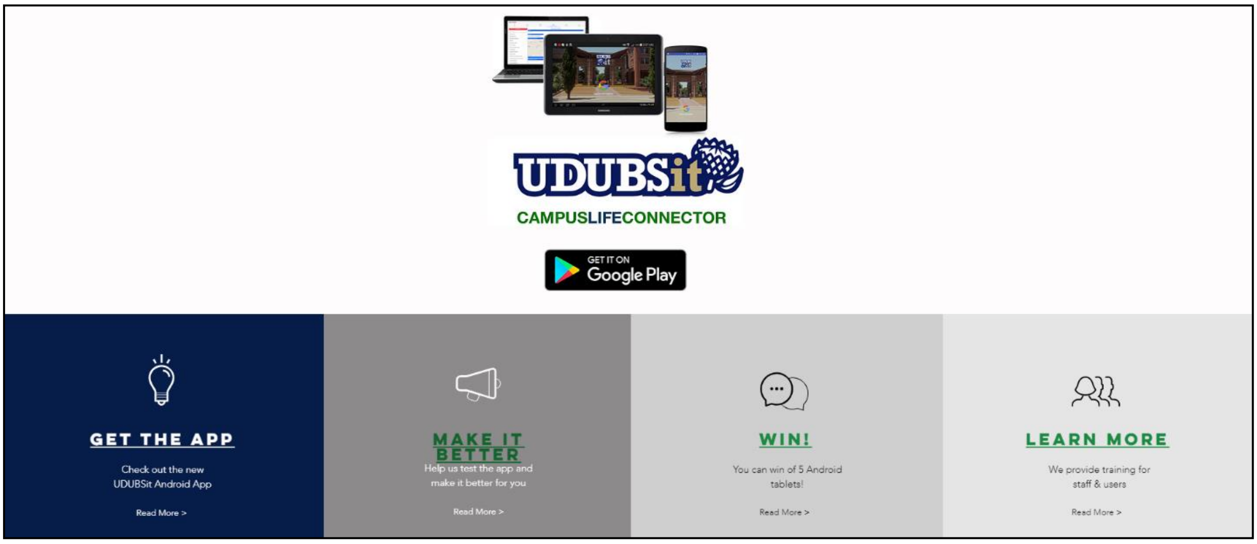


Figure 41: *UDUBSit*: Iterations 2 & 3 - *UDUBSit* Online Testing Portal

Figure 42: *UDUBSit*: Iteration 2 & 3 - Online Testing Portal Functionalities

8. Summary of *UDUBSit* Design Iterations: Key Design Decisions

In order to create a unified view of the design process and the emergence of the ***UDUBSit*** applications, we found it useful to present the three design iterations in a table format (**Table 14**) developed from adapting the Digital Platform Architecture framework and Digital Platform Ecosystem view, as suggested by Zutshi and Grilo (2019) (See **Figure 43-44**). This unified view also aligns with the key design decisions, namely *process design, realisation design and object design,* as proposed by van Aken (2004), and therefore enables the addressing of our sub-research questions (see **Chapter 1, section 5**) in a granular, but integrated manner. **Table 25's** summary of the design decisions over three design iterations of the ***UDUBSit*** EDP is also useful as empirical input of observed and experienced events into our EDP Design Lenses following in **Chapter 7.**

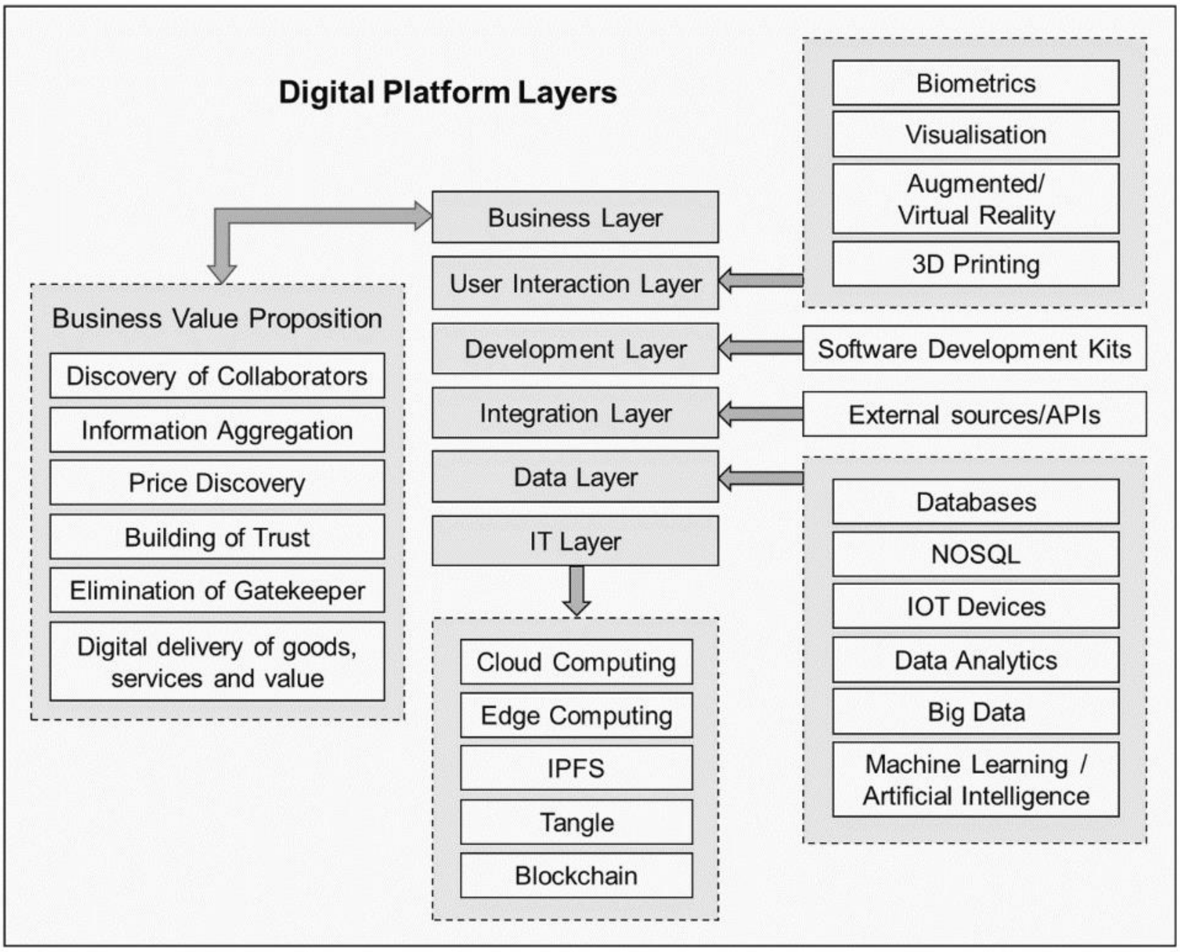


Figure 43: Digital Platform Architecture (Zutshi & Grilo, 2019:551)

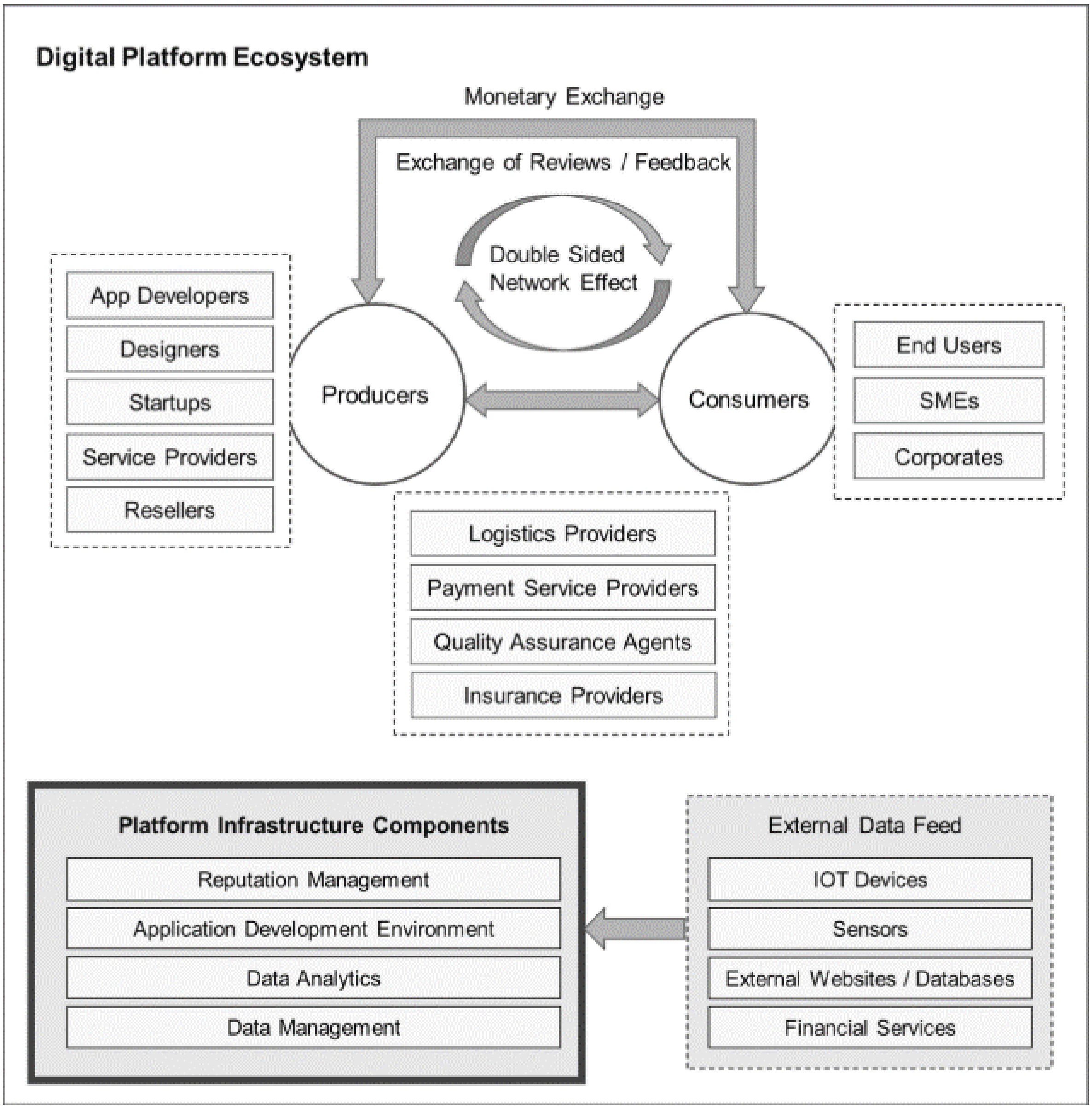


Figure 44: Digital Platform Ecosystem View (Zutshi & Grilo, 2019:548)

Table 25 below (informed by documentary review, as well as interviews conducted with key role-players of the ***UDUBSit*** case and based on an adaptation of the structure proposed by Zutshi and Grilo (2019) provides a high-level summary of key design decisions taken in each of the main iterations of the ***UDUBSit*** EDP design process:

Table 1: Summary: *UDUBSit* - Key Design Decisions over Three Iterations

Design process	Iteration 1	Iteration 2	Iteration 3
Artefact Version	Android only (2014)	Hybrid App with original back-end (2015-2016)	Multiplatform with redesigned back-end (2017-2018)
Business Layer			
Targeted users	Mainly students Highly limited staff involvement (Super Admin & Group Admins)	Mainly students (first year in particular) Limited staff involvement through staff portal & standalone data synchronisation application	Mainly students (all students) Limited Staff involvement through staff portal and mobile app
Targeted producers	Mainly official university units Very limited user content creation	Mainly official university units Limited user content creation	Mainly official university units Limited user content creation
Design intentions and business value proposition	*"To sum up, the elements the app consists of are that (1) it creates a* ***virtual network of users****, (2) who have an* ***authenticated account****, so they can be* ***trusted****, (3) who seek* ***a match for their offer or request****, so they engage in* ***goal-driven interactions*** *(4) and whose interactions are* ***proximity-based****, via LBS*[104]*. The network originating from this app could be coined Virtual Authenticated-account Match-oriented Proximity-based (VAMP).* ***Zoneit*** *is a VAMP network"* (Stroeken et al., 2015) (emphasis added). This application was based on three ideal design parameters:	*"So, I think the main goal was to inform the student about what was going on on campus"* -Platform Developer *"We were focusing with the development on the front-end part. So, keeping basically the features in the back alive and just leveraging those translating those into a user interface… I don't think there was a lot of in terms of the design process that there was a lot of thinking about the responsiveness to it all. Additional features, a future roadmap, I think that was a little bit lacking…. What are we going to do with version two, version three, four, five etc. How we want to evolve the process?"* -Platform Developer	*"This tool of the University of the Western Cape provides students with relevant information like events, schedules ... It also enables students to interact with each other and find their way around the large campus, and to raise awareness in general"* -Platform Developer Strong focus on navigation and campus POIs[105] using a combination of a list-view and mapping feature Some ephemeral elements returned through use of geo-fencing OpenAuth/Google authentication was implemented to ring-fence a "trusted community" at the university

[104] LBS: Location-based services
[105] POIs: Points of Interest locations on campus/es

Design process	Iteration 1	Iteration 2	Iteration 3
	1) **Ephemeral communication** and **self-zoning** 2) Three-dimensional location-based social network (**temporal/spatial/ ephemeral**) 3) Application within a **goal-oriented trusted community** such as a university (Stroeken et al., 2015) (emphasis added)	The self-zoning mapping feature was largely changed to a list-view The ephemeral messaging functionality was redesigned at first and eventually completely removed OpenAuth/Google authentication was implemented to ring-fence a "trusted community" at the university In this iteration, only student accounts could register (staff used separate email domain which the application did not cater for)	Both student and staff email accounts could register through Google authentication to access the application

Core Interaction facilitated/User Value Proposition	**Student←→University** interaction around feature set of:
	• Events
	• Broadcast
	• Advertisements
		Student←→ University interaction around feature set of:
		• Events
		• Broadcast
		• Advertisements
		• POIs
		• iKamva (LMS hyperlink)
		• Static Exam Schedules
			Student←→University; Student←→Student interaction around feature set of:
			• Events
			• Broadcast
			• Advertisements
			• POIs
			• iKamva (LMS hyperlink)
			• Student Schedule API
			Roadmap not implemented due to time/ resource constraints:
			• Timetable API linked with directions API
			• Key unfixed bugs:
			  o Firebase image upload bug
			  o Publishing to iOS App Store delayed due to two-factor authentication issue

Conceptualisa-tion of Platform ecosystem	Closed and internal trusted community Difficulty in creating generative network effects	Closed and internal trusted community Difficulty in creating generative network effects	Closed and internal trusted community Difficulty in creating generative network effects

Design process	Iteration 1	Iteration 2	Iteration 3
Mediating Mechanisms	No automated mediation of interactions No leveraging of user data for automated mediation/ prediction No reputation management systems Highly limited User Reporting Function of reporting offensive posts/events No automated workflows created	No automated mediation of interactions No leveraging of user data for automated mediation/prediction Very limited reputation management systems (i.e., external through Google App Store) Basic User Reporting Function of reporting offensive posts/events. No automated workflows created.	Some automated mediation of interactions (e.g., geofences) No leveraging of user data for automated mediation/prediction Very limited reputation management systems (i.e., external through Google App Store) Basic User Reporting Function of offensive posts/events with more granularity of reporting categories No automated workflows created
Monetisation/ Token economies	No token economy/ monetisation mechanisms created	No token economy/ monetisation mechanisms created	No token economy/ monetisation mechanisms created
User Interaction Layer			
Front-End	Android	Hybrid App	Hybrid App
User Experience Design	User Experience design based on mapping as central navigation tool; this was not well-received	User Experience design based on more traditional menu-based navigation in app	User Experience design based on more traditional menu-based navigation in app Automated geofencing integrated with group structures and location points/POIs. Lack of capacity to internally maintain this
Development Layer			
SDKs Platform openness to third party developers. may enable faster scaling and is a way to leverage external skillsets in ecosystem)	None provided Platform not open to third party developers	None provided Platform not open to third party developers	None provided Platform not open to third party developers
IT Layer	Offshore testing server & Local Server	Local Server	Locally hosted instance of Firebase

Design process	Iteration 1	Iteration 2	Iteration 3
Integration Layer			
External Sources/ APIs	No external APIs utilised Google Calendar integration suggested but not implemented in Design Iteration 1 No APIs created by institution	Limited External APIs used: • Ionic • Cordova • Google Maps No APIs created by institution Standalone data import tool created (backend scripts) to facilitate non-automated data import of exam schedules	External APIs used: • Ionic Geofences • Cordova • Google Maps • Pexels • Unsplash • Moment.js Single API created by institution • UWC Timetable API setup and hosted by institution to enable a personalised timetable feature in mobile application. • The API is only accessible while connected with a UWC network. • External access is denied for security purposes.
Institutional Integration layer	Very limited institutional integration Ownership outside of institutional core operations Institutional cooperation based on opt-in principle (research budget-driven)	Selective institutional integration Hybridised ownership within of institutional core operations (some uncertainty about lines of decision-making and responsibility) Institutional cooperation primarily based on opt-in principle (incl. some operational budget availability)	Selective institutional integration Hybridised and fluctuating ownership within of institutional core operations (some uncertainty about lines of decision-making and responsibility) Institutional cooperation primarily based on opt-in principle (incl. some operational budget availability)
Data Layer			
Back-End	**MySQL**	**MySQL**	**Google Firebase and Playstore**
Data Capturing & Collection Capabilities	Manual Process to capture POIs on mapping	Partly manual process to capture POIs on mapping/Some leveraging of Google Maps' available location data points	Partly manual process to capture POIs on mapping/More leveraging of Google Maps' available data points & Ionic geofencing

Design process	Iteration 1	Iteration 2	Iteration 3
Creation and Updating of User profile data	Manual process and very limited number of data fields collected Limited user control over profile data No automated, data-driven personalisation of experience	More automated process but still very limited number of data fields collected. Mainly reliant on Google OpenAuth management of profile data Limited user control over profile data Very limited automated, data-driven personalisation of experience	More automated process but still very limited number of data fields collected. Mainly reliant on Google OpenAuth management of profile data Limited user control over profile data Very limited automated data-driven personalisation of experience
Data Management	Very limited	Limited	Very limited internal/ Comprehensive external
Data Analytics	No custom reports created Data Capture→Data Storage	No custom reports created Data Capture→Data Storage→with basic descriptive reports	No custom reports created (EXTERNAL ONLY) Data Capture→Data Storage→Data Integration (Data cleaning)→Data Analysis→Predictive Analytics (Google Analytics and Firebase Analytics)
User Adoption			
Rate of Adoption	<u>Targeted:</u> 200-300 First Year students with Android devices <u>User Testing and Adoption:</u> *Dec 2014* • 14 Students • Facilitators • 1 Belgian HEI staff participant. • Bug list supplied to external developers. *Feb 2015* • Updated version • 28 Students (some of them also participated in Dec testing) • facilitators and • 1 Belgian post-graduate student	<u>Targeted:</u> 4000 First Year students with Android devices. "The take-up process has been slower than expected". <u>User Testing and Adoption:</u> *After Feb 2015* • 643 first year students visited Testing Portal website • 145 have downloaded the Android application on the Google Play Store. • Only 50 Daily Active users • University IT department requested outsourced stress testing of application which confirmed it had no	<u>Targeted:</u> 23 000 students with Android devices. <u>User Testing and Adoption:</u> *August 2017 (Android)* • Within a period of 30 days the app was downloaded by 930 students with 462 of those downloads taking place in the first week. *September 2017* • Downloads of Android App: 735 • Google Playstore Rating: 3,9 out of 5 • User uptake was lower than expected and continued engagement with the app was limited

Design process	Iteration 1	Iteration 2	Iteration 3
		significant hardware and software processing barriers to adoption • Google Analytics tracking of both the Android application, as well as the testing portal website has been setup, tested and deployed *2016* • 196 first year students visited Testing Portal website • 103 have downloaded the Android application on the Google Play Store • Only 50 Daily Active users	
Co-creation Approach			
Role Player Perceptions: Owner/s	Inclusivity as focus High dependence on developers for delivery thereof, assuming their capability to deliver technically the requirements of what was deeply a socio-technical design process *De facto* assumption that platform co-creation is inclusive because it includes mainly end-users Deep and constant engagement around platform values, but this was not effectively translated to technical design requirements	Inclusivity as focus High dependence on developers for delivery thereof, assuming their capability to deliver technically the requirements of what was deeply a socio-technical design process *De facto* assumption that platform co-creation is inclusive because it includes mainly end-users Gradual adoption of pragmatic developer-driven decisions given constrained context Challenging to balance platform's intended objectives and values with concretisation and implementation realities	Inclusivity as focus High dependence on developers for delivery thereof, assuming their capability to deliver technically the requirements of what was deeply a socio-technical design process *De facto* assumption that platform co-creation is inclusive because it includes mainly end-users Gradual adoption of pragmatic developer-driven decisions given constrained context Challenging to balance platform's intended objectives and values with concretisation and implementation realities

Design process	Iteration 1	Iteration 2	Iteration 3
Role Player Perceptions: Designer/s	Inclusivity as focus High dependence on developers for delivery thereof, assuming their capability to deliver technically the requirements of what was deeply a socio-technical design process De facto assumption that platform co-creation is inclusive because it includes mainly end-users Deep and constant engagement around platform values, but this was not effectively translated to technical design requirements	Inclusivity as focus High dependence on developers for delivery thereof, assuming their capability to deliver technically the requirements of what was deeply a socio-technical design process De facto assumption that platform co-creation is inclusive because it includes mainly end-users Gradual adoption of pragmatic developer-driven decisions given constrained context Challenging to balance platform's intended objectives and values with concretisation and implementation realities	Inclusivity as focus High dependence on developers for delivery thereof, assuming their capability to deliver technically the requirements of what was deeply a socio-technical design process De facto assumption that platform co-creation is inclusive because it includes mainly end-users Gradual adoption of pragmatic developer-driven decisions given constrained context Challenging to balance platform's intended objectives and values with concretisation and implementation realities
Role Player Perceptions: Developer/s	<u>*Outsourced developers*</u>*:* Strict interpretation of client requirements <u>*Student Developers*</u>*:* Inclusivity as focus but challenging to adapt existing artefact to address that intended objective	<u>*Student Developers*</u>*:* Perception that they were being inclusive, but lack of engagement in depth with all sides of platform) never surfaced by LL and further pragmatically focused software concretisation and implementation processes	<u>*Student Developers*</u>*:* Perception that they were being inclusive, but lack of engagement in depth with all sides of platform) never surfaced by LL and further pragmatically focused software concretisation and implementation processes
Role Player Perceptions: LL Facilitator/s	Independent facilitator of LL process, but the approach was not used from beginning of the project and some artefacts where already existing when LL was introduced	Non-Independent facilitator of LL approach, with institutional pressure to deliver workable platform within time and resource constraints Facilitator was not necessarily perceived as independent by institutional stakeholders *De facto* assumption that platform co-creation is inclusive because it includes mainly end-users	Non-Independent facilitator of LL approach, with institutional pressure to deliver workable platform within time and resource constraints Facilitator was not necessarily perceived as independent by institutional stakeholders *De facto* assumption that platform co-creation is inclusive because it includes mainly end-users

Design process	Iteration 1	Iteration 2	Iteration 3
		LL approach defined mainly from Student user perspective	LL approach defined mainly from Student user perspective
Primary User Testing/ Co-creation approach	LL approach using multiple user co-creation techniques: • One-day dairy • In-depth interviews • Focus Group interviews and co-design sessions • Validation focus group interviews	Diluted LL approach using only: • Focus Groups • User Testing Surveys	Further Diluted LL approach using: • Smaller User Testing by convenience sampling of groups within project team • Surveys (88 respondents) • Limited Google Play Store feedback
Key adaptations suggested/ adopted	Mainly User driven design suggestions were implemented	Mainly Developer-driven design decisions were implemented	Mainly Developer-driven design decisions were implemented

9. Chapter Conclusion

In this chapter, we have utilised the *Emerging Digital Platform Design Lenses* (EDP Lenses) as a conceptual framework to assist us with analysing the design decisions required in the process of designing and scaling a digital platform within the context of Higher Education in South Africa. We specifically investigated the contribution of LL in informing the emerging digital platform design process.

After the presentation of the ***UDUBSit*** case, we agree with the argument of van Aken (2004) that *object* knowledge is more explicit and structured (thus easier to codify and capture and more easily transferred and shared)[106], whereas *realisation* and *process* design knowledge are more tacit (thus more subjective and harder to document, capture and share). Often process knowledge is obtained by design professionals in a craftsman-like manner, with knowledge developed through iterative own experience and imitation of perceived experts and peers.

In **Chapter 7**, the application of the EDP lenses, populated with empirical case study data, will aim to better understand this tacit design knowledge

[106] See the Table 14 in Section 3 as example.

created and applied during the ***UDUBSit*** EDP design process to analyse in depth how LL informed this design process.

The ***UDUBSit*** emerging digital platform failed to scale. The application failed to be integrated into its intended organisational context and role, grappling with discontinuity in resource allocation, shifts in intention, concretisation and implementation of its digital artefacts. It also failed to create continuity of an online community of interested and engaged users. The application was lacking in content, lacking in the interaction between users, and suffocated due to the lack of an extendable infrastructure that enables network effects and generative energy.

In the case of the ***UDUBSit*** platform, there were several external dependencies on mega-platform technologies that were gradually introduced over the three design iterations detailed in **Table 14**; for example, Google's FireBase[107] database and various APIs/OpenAUTH were introduced and gradually deeper entrenched in the EDP's architecture and governance structures.

Over the three design iterations, the application of the LL approach seems to have been diluted in terms of how it was implemented, and a general weakening of methodological rigour was observed. Increasing challenges in the absorption capacity of the HEI were also observed over the three design iterations, coupled with a lack of internal institutional capacity to design and embed the EDP within the organisational ecosystem.

It is interesting to note that the ***UDUBSit*** project did not successfully create any commercialisable IP, despite its stated intentions and a couple of potential commercial partner requests. The lack of control over own IP rights forced external dependencies and/or failure to exploit IP effectively often becomes barriers to design freedom in the context of emerging platform design.

In this chapter we focused mainly on events (or non-events) actually observed or experienced. In the next chapter (**Chapter 7**) we will focus on analysing from a Critical Realist perspective (in CR parlance, the "Actual" level) events generated by the underlying mechanisms and structures. In **Chapter 8**, we will aim to identify and discuss these underlying mechanisms and structures and the way the LL approach (and its less-than-ideal

[107] https://firebase.google.com/

implementation) informed (or failed to inform) design decisions within the emerging digital platform design process of the ***UDUBSit*** case.

Chapter 7 – Analysis and Findings

Everything that originated from the tree of knowledge carries in its duality.

-Zohar (mystical Jewish text)

1. Chapter Introduction

A key objective of Critical Realism(CR) research in Information Systems (IS) is to provide clear, concise and empirically supported statements about how and why certain phenomena occurred (causality) (Wynn & Williams, 2012). The focus of this chapter is on analysing our case study data utilising the *Emerging Digital Platform Lenses* (proposed in **Chapter 5**) as a conceptual framework and logic model. The purpose of this analysis is to use the case study method to explore the interaction of structures, events, human actions and contexts to identify and explicate generative mechanisms, as it has been suggested that the case study method is especially appropriate for this role (Wynn & Williams, 2012).

Although tacit *object design knowledge* (Van Aken, 2004) was predominantly presented in **Chapter 6**, that chapter also presented more implicit *realisation knowledge* and *process knowledge.* In this chapter, the focus shifts to applying the EDP lenses from a CR perspective, to focus on events actually observed and experienced (Empirical), the events generated by the mechanisms (Actual), and the underlying mechanisms and structures (Real) that influenced the role LL played in informing (or non-informing) the design processes and decisions of the ***UDUBSit*** case study.

Our analysis process, influenced by Carlsson (2005), will be conducted with a solution focus from the perspective of the researcher as experimenter (player), with the nature of the research product being a set of design heuristics to generate both practical and abstract IS design knowledge around possible alternative IS interventions (including adapting the LL approach) for the design problem of EDP design in the specific design context of the ***UDUBSit*** case. Our resultant "heuristic theorizing" (Gregor & Muntermann, 2014) will aim to create design knowledge from our problem-solving experiences in analysing the ***UDUBSit*** case, as well as prior theoretical insights, as we are constantly iterating between our attempts at heuristic search.

We will integrate our heuristic synthesis process into our *analysis and findings* (**this chapter**) and then into our *conclusions and recommendations* (**Chapter 8**).

2. Contribution of Living Labs to Emerging Platform Design

Each of these emerging platform design lenses will now be discussed in more detail, and we will specifically focus on the actual observed and experienced contribution of Living Labs (LL) to informing the design process, as observed in the ***UDUBSit*** failure case study. Our focus will be on addressing (or non-addressing) some of the *wicked design problem*s in EDP design that we have highlighted in previous chapters.

3. Analysis of Data Applying the Emerging Digital Platform Lenses

By application of the CR methodological principles (Wynn & Williams, 2012), we will identify and abstract the events being studied as a foundation for a clearer understanding of the underlying phenomena (Explication of Events). We will identify the components of the social and physical structure and contextual environment, as well as their interrelationships, by re-describing it critically from the actor's viewpoint into a theoretical perspective (explication of structure and context). Through retroduction will identify and expand on powers, tensions, and tendencies of structure that may have interacted to generate these events. We will aim to present empirical corroboration that these proposed mechanisms have better explanatory power as causal powers than alternatives. Throughout this process, we will apply triangulation and multiple approaches to support this causal analysis, cognisant of the fact that our structured literature review (**Chapter 3**) indicated an existing knowledge gap at the specific intersection we are investigating.

We will be presenting in a tabular format for each EDP lens the following:

- Key design problems
- Expected contribution of LL
- Observed and experienced contribution of LL in the ***UDUBSit*** case
- Actual contribution of LL
- Mechanisms and structures

In **Chapter 8**, we will propose *design heuristics* for each EDP lens as recommendations on how LL may potentially be applied and adapted to better address the key design problems presented by EDP.

The key below indicates what we see as *positive expected/observed and experienced and actual contributions* (indicated in green) when based on the case study analysis. Similarly, we use amber and red to signify *neutral* or *negative expected/observed and experienced and actual contributions*.

Key:

	Expected contribution of LL	Observed and experienced contribution of LL	Actual contribution of LL
+	Positive expected contribution	Positive observed/ experienced contribution	Positive actual contribution
N	Neutral expected contribution	Neutral observed/ experienced contribution	Neutral actual contribution
—	Negative expected contribution	Negative observed/ experienced contribution	Negative actual contribution

We will also indicate, using the same green, amber and red keys, the expected impact of LL in informing *process design*, *realisation design* and *object design* from the perspective of each of the *EDP Design Lenses* we proposed in **Chapter 5**.

3.1. Analysis from Perspective of Intention Lens

The Intention Lens (as presented in **Chapter 5**, **Table 9**) focuses on the intended objectives (explicit and implicit) of the platform owners and/or designers in creating the platform within a specific design context, including their design values.

Analysis and findings of the UDUBSit case study data from the Intention Lens perspective are summarised in **Table 26 to 28** and discussed thereafter.

3.1.1. Objectives

Table 1: Intention Lens - Case Study Analysis

Intention Lens: Case Study Analysis					
Objectives					
Key Design Problem: *What are the objectives (explicit and implicit) of platform owners and designers?*					
Key Design Problems	***Expected contribution of Living Labs***	***Observed & experienced contribution of Living Labs***	***Actual contribution of Living Labs***	***Mechanisms & structures[108]***	***Heuristic[109]***
	+	N	N		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

Whereas we expected LL to contribute positively to informing this EDP design process, the observed and experienced contribution was neutral. Clarifying explicit and implicit objectives through the LL process was inconsistently applied and achieved through the three design iterations.

[108] We will further investigate and comment in Chapter 8 on underlying structures and structure categories identified in this Chapter

[109] See Chapter 8 for discussion of Design Heuristics

The LL approach did not:

- Surface or rectify the imbalance in platform sides involved in the design objective setting process.
- Succeed in clarifying and validating specifically implicit objectives due to the increasingly technical focus of iterations 2 & 3.
- Surface or rectify pragmatic compromises due to resource constraints.
- Mitigate or clearly surface the shifting of objectives within and over the three design iterations.
- Address differing perceptions of priorities between different stakeholder roles within and over the three design iterations.

Findings:

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as a new institutional form*** **leads to *design blind spots*. The LL approach did not:**
    - Surface or rectify the imbalance in platform sides involved in the design objective setting process, specifically the fact that student users were over-represented and key institutional stakeholders under-represented in co-creation processes (*platform stakeholder blind spot*)
    - Clarify platform ownership resulting in a lack of clarity about platform institutionalisation and embedding of ownership (*platform ownership blind spot*)
- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leads to:**
    - Inconsistent application of LL approach
    - Lack of platform developer continuity
    - Shifting of objectives within and over the three design iterations
    - Increasing technocratisation of the design process
- **Failure to surface and mitigate *limits to Freedom To Design* leads to *forced design compromises, specifically:***
    - The pragmatic compromise of design objectives to attain artefact delivery within resource constraints *(forced design objective compromise)*

3.1.2. Values

Table 2: Intention Lens – Values

Intention Lens					
Values					
Key Design Problem*:* ***What are the (explicit and implicit) values underlying this design process?***					
Key Design Problems	***Expected contribution of Living Labs***	***Observed & experienced contribution of Living Labs***	***Actual contribution of Living Labs***	***Mechanisms & structures[110]***	***Heuristic[111]***
	+	N	N		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

Clarifying explicit and implicit design values through the LL process was inconsistently applied and achieved through the three design iterations. The LL approach did not:

- Surface or rectify the imbalance in platform sides involved in the design value setting process.
- Validate design values on all platform sides within and over the three design iterations resulting in under-participation of key platform sides in the LL process.

[110] We will further investigate and comment in Chapter 8 on underlying structures and structure categories identified in this Chapter

[111] See Chapter 8 for discussion of Design Heuristics

- Surface or rectify pragmatic design value compromises due to resource constraints, therefore pragmatic compromises of design values were made to attain artefact delivery within resource constraints (*forced design value compromise*).

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as a new institutional form* leads to *design blind spots*. The LL approach did not:**
  - Clarify platform ownership resulting in a lack of clarity about platform institutionalisation and embedding of ownership (*platform ownership blind spot*)
  - Ensure that all relevant and appropriate sides of the platform participated in and informed the EDP design process. This platform stakeholder blind spot resulted in under-participation of key platform sides in the LL process (*platform stakeholder blind spot*)
- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leads to:**
  - Inconsistent application of LL approach and inconsistent facilitation of co-creation processes
  - Shifting of core design values within and over the three design iterations from less- techno-centric to more techno-centric.
- **Failure to surface and mitigate *limits to Freedom to Design* leads to *forced design compromises, specifically:***
  - LL did not surface or rectify pragmatic compromises of design values to attain artefact delivery within resource constraints (*forced design value compromise)*

Findings:

Whereas we expected LL to contribute positively to informing of this EDP design process, the observed and experienced contribution was neutral.

3.1.3. Context

Table 3: Intention Lens - Context

<table>
<tr><th colspan="6">Intention Lens</th></tr>
<tr><th colspan="6">Context</th></tr>
<tr><td colspan="6">Key Design Problem:
What is the context in which this design process takes place?</td></tr>
<tr><td>Key Design Problems</td><td>Expected contribution of Living Labs</td><td>Observed & experienced contribution of Living Labs</td><td>Actual contribution of Living Labs</td><td>Mechanisms & structures[112]</td><td>Heuristic[113]</td></tr>
<tr><td></td><td>+</td><td>N</td><td>N</td><td></td><td></td></tr>
<tr><td></td><td>Process Design
Realisation Design
Object Design</td><td>Process Design
Realisation Design
Object Design</td><td></td><td></td><td></td></tr>
</table>

Analysis:

Clarifying through the LL process the context in which this design process takes place was inconsistently achieved through the three design iterations. Translating contextual understanding into applicable design requirements for the context was also not positively and consistently informed by the LL approach.

[112] We will further investigate and comment in Chapter 8 on underlying structures and structure categories identified in this Chapter

[113] See Chapter 8 for discussion on design heuristics

The LL approach did not:

- Surface or rectify the imbalance in platform sides involved in the design process. This resulted in a lack of/diluting contextual relevance over design iterations.
- Deepen stakeholder understanding of the context for all sides of the EDP.
- Surface or mitigate differing contextual perceptions (and design priorities within the context) between platform roles.
- Consistently and appropriately inform the translating of contextual understanding into applicable design requirements for the design context.

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as a new institutional form*** **leads to** ***design blind spots*****. The LL approach did not:**
  - o Ensure all relevant and appropriate sides of the platform participated in and informed the EDP design process. This platform stakeholder blind spot resulted in the under-participation of key platform sides in the LL process. Platform stakeholder blind spot resulting in under-participation of key platform sides in LL process (*platform stakeholder blind spot*)
  - o Clarify platform ownership resulting in a lack of clarity about platform institutionalisation and embedding of ownership *(platform ownership blind spot)*
  - o Surface or mitigate pragmatic compromises in the EDP design process due to resource constraints and the seamless convenience and invisible/cloaked interfaces of ubiquitous and "free"/low friction availability of mega-platform technical solutions to platform designers *(invisible/cloaked convenience blind spot)*
- **Failure to surface and mitigate** ***limits to Capacity to Design*****, and specifically institutional capacity constraints, leads to:**
  - o Inconsistent application of the LL approach resulting in a shifting of the design response to contextual factors within and over the three design iterations
  - o Inconsistencies in the translating of contextual understanding into applicable design requirements for the context

    - Increasing technocratisation of the design process over the three design iterations
- **Failure to surface and mitigate *limits to Freedom to Design* leads to *forced design compromises, specifically:***
    - The LL approach did not surface or rectify pragmatic compromises due to resource constraints and ubiquitous, and "free"/low friction availability of mega-platform technical solutions *(invisible/cloaked Convenience blind spot)*, and this led to the pragmatic adoption of technologies due to resource constraints *(forced technology adoption compromise)*.
    - Surface the introduction of these external dependencies that reduced the EDP's control over its user data collection, ownership, processing, and the leveraging of data analytics to inform value realisation and value capture in its resource-constrained context (forced user data control compromise)

Findings:

Whereas we expected LL to contribute positively to informing of this EDP design process, the observed and experienced contribution was neutral.

3.2. Analysis from Perspective of Concretisation Lens

The Concretisation Lens (as presented in **Chapter 5, Table 10**) focuses on the building and integration of the platform's hardware and software, as well as building and enabling socio-technical components (i.e., ecosystem design and enablement, integration, online community development, and incentivisation of different platform sides). Key design decisions in this lens focus on deciding on the appropriate platform type, components, value creation mechanisms, and platform governance, as well as responding to platform competition.

Analysis of the UDUBSit case study data from the Concretisation Lens perspective is presented in **Tables 29 to 34** and discussed thereafter.

3.2.1. Platform Type

Table 4: Concretisation Lens - Platform Type

Concretisation Lens: Case Study Analysis					
Platform Type					
Key Design Problem: *What type of platform is being designed (explicitly and implicitly)?*					
Key Design Problems	*Expected contribution of Living Labs*	*Observed & experienced contribution of Living Labs*	*Actual contribution of Living Labs*	*Mechanisms & structures*	*Heuristic*
	N	—	—		
	Process Design Realisation Design Object Design	*Process Design Realisation Design Object Design*			

Analysis:

Clarifying through the LL process the platform type to be concretised was not clearly informed by the LL approach through the three design iterations. The LL approach did not:

- Inform the appropriate type of platform to be designed.
- Contribute to challenging initial design assumptions and recognise the object to be designed as a platform (as well as the different realisation design and process design it requires).

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

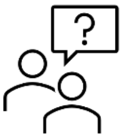
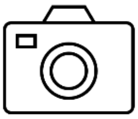
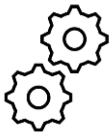
- ***Failure to recognise EDP as a new institutional form*** **led to** ***design blind spots*****. The LL approach did not:**
    - Assist in surfacing the different nature of a platform business model and its unique design requirements as it pertains to object design, realisation design, and process design *(platform business model blind spot*) and the unique challenges it poses to co-creation approaches such as LL.
- **Failure to surface and mitigate** ***limits to Capacity to Design*****, and specifically institutional capacity constraints, leads to:**
    - Inconsistent application of the LL approach and application of one-sided imbalances in the co-creation process due to *stakeholder blind spots.* There was a *de facto* assumption that platform co-creation is inclusive because it includes mainly end-users. This may have created a false sense of inclusive design principles being followed, which was further strengthened due to capacity constraints within the institutional context *(illusion of co-creation-inclusivity blind spot)*
    - Increasing technocratisation of the design process over the three design iterations, as well as a high dependence on developers for delivery of an inclusive platform design (in terms of *object, realisation,* and *process-design*), assuming their capability to deliver technically the requirements of what was deeply a socio-technical design process (*developer over-reliance blind spot)*
- **Failure to surface and mitigate** ***limits to Freedom to Design*** **leads to** ***forced design compromises, specifically:***
    - The LL approach did not surface or mitigate the pragmatic compromise due to resource constraints and ubiquitous and "free"/low friction availability of mega-platform technical solutions, which were viewed as "quick wins" to attain artefact delivery within resource constraints due to developer capacity and continuity constraints and lack of internal mobile software development capacity *(forced technology adoption compromise)*

Findings:

Whereas we expected LL to contribute neutrally to informing of this EDP design process, the observed and experienced contribution was negative.

3.2.2. Ecosystem

Table 5: Concretisation Lens - Ecosystem

Concretisation Lens					
Ecosystem					
Key Design Problem: ***How is the platform ecosystem being designed?***					
 ***Key Design Problems***	 ***Expected contribution of Living Labs***	 ***Observed & experienced contribution of Living Labs***	 ***Actual contribution of Living Labs***	 ***Mechanisms & structures***	 ***Heuristic***
	N	—	—		
	Process Design Realisation Design Object Design	Process Design Realisation Design Object Design	Process Design Realisation Design Object Design		

Analysis:

The LL approach did not inform the appropriate design of the platform ecosystem through the three design iterations. The LL approach did not:

- Surface or rectify the imbalance in platform sides involved in the EDP design process. This resulted in a lack of/diluting contextual relevance over design iterations, as well as an imbalanced development of the platform ecosystem because all actors were not included and/or involved in the design process.
- Succeed in ordering actors into more ordered alliances/groups according to platform role.

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as a new institutional form* leads to *design blind spots*. *The LL approach did not:***
    - Empower all sides of the platform to have a meaningful impact on design decisions regarding the platform ecosystem (*platform stakeholder blind spot)*
    - Ensure all relevant and appropriate sides of the platform participated in and informed the EDP design process. This platform stakeholder blind spot resulted in the under-participation of key platform sides in the LL process. This platform stakeholder blind spot resulted in under-participation of key platform sides in the LL process (*platform stakeholder blind spot) that negatively impacted the ability of the EDP to build the architecture and components to facilitate and scale value-creation between platform sides*
    - Assist in surfacing the different nature of a platform business model and its unique design requirements as it pertains to object design, realisation design, and process design and the unique challenges it poses to co-creation approaches such as LL *(platform business model blind spot*)
    - Clarify platform ownership resulting in a lack of clarity about platform institutionalisation and embedding of ownership and accountability relating to the design of the platform ecosystem *(platform ownership blind spot)*
- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, *leads to:***
    - Inconsistent application of the LL approach and application of one-sided imbalances in the co-creation process due to the *stakeholder blind spot.* This may have created a false sense of inclusive design principles being followed, which was enforced due to capacity constraints within the institutional context *(illusion of co-creation inclusivity -blind spot)*
    - Increasing technocratisation of the design process over the three design iterations. Due to varying levels of technical knowledge between platform owners, designers, and users' technical aspects were largely left to developers to decide, although it entailed high levels of complexity *(trust the developer's black box – blind spot)*

- **Failure to surface and mitigate *limits to Freedom to Design* leads to *forced design compromises, specifically:***

- o Forced pragmatism in including certain external actors in the platform ecosystem due to their *de facto* positions of competitive and standard setting power in the ecosystem *(forced ecosystem design compromise)*
- o Pragmatic compromise due to resource constraints and ubiquitous and "free"/low friction availability of mega-platform technical solutions, which were viewed as "quick wins" to attain artefact delivery within resource constraints due to developer capacity and continuity constraints and lack of internal mobile software development capacity *(forced technology adoption compromise)*
- o Pragmatic compromise of technical design to integrate with ecosystem actors (mainly mega-platforms) and thus introduce external dependencies to attain artefact delivery within resource constraints *(forced technical design compromise)*

Findings:

Whereas we expected LL to contribute neutrally to informing of this EDP design process, the observed and experienced contribution was negative.

3.2.3. Components

Table 6: Concretisation Lens – Components

Concretisation Lens					
Components					
Key Design Problem: ***How are the platform components being designed?***					
Key Design Problems	***Expected contribution of Living Labs***	***Observed & experienced contribution of Living Labs***	***Actual contribution of Living Labs***	***Mechanisms & structures***	***Heuristic***
	N	—	—		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

The LL approach did not consistently inform the appropriate design of the platform component design through the three design iterations.

The LL approach did not:

- Inform the appropriate design of platform components to the design realise objectives. Informed mainly front-end component design and did not inform the underlying architecture of the EDP over the three design iterations.
- Have a consistent impact in informing component design through design iterations, with the design process being driven more by pragmatism than strategic focus on attaining original design objectives.

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as a new institutional form*** **leads to** ***design blind spots***.
- The LL approach did not surface, clarify or mitigate:
    - Platform ownership resulting in a lack of clarity about platform component design and implementation, institutionalisation, and embedding of ownership thereof (*platform ownership blind spot*)
    - Pragmatic compromises around platform component design due to resource constraints and the seamless convenience and invisible/cloaked interfaces of ubiquitous and "free"/low friction availability of mega-platform technical solutions *(invisible/ cloaked convenience blind spot)*
    - The fact that platforms and platform component design require in-depth and critical engagement within the "black box" of platform component design. As Bratton (2015) stated: "*Platforms don't look like how they work and don't work like how they look".* This can be described as the *illusion of simplicity blind spot*
- **Failure to surface and mitigate** ***Limits to Capacity to Design*****, and specifically institutional capacity constraints, leads to:**
    - Inconsistent application of LL approach
    - Lack of platform developer continuity
    - Shifting of platform component design within and over the three design iterations, with various mega-platform components and different software development frameworks being introduced throughout the process. These decisions may be described as pragmatic more than strategic and were largely taken by software developers with little direct input from the LL process *(trust the developer's black box– blind spot)*
- **Failure to surface and mitigate** ***limits to Freedom to Design*** **leads to** ***forced design compromises, specifically:***
    - The pragmatic compromise due to resource constraints and ubiquitous and "free"/low friction availability of mega-platform technical component solutions, i.e., databases *(forced technology adoption compromise)*
    - The pragmatic compromise of technical design and introducing external dependencies to attain artefact delivery within resource constraints *(forced technical design compromise)*

Findings:

Whereas we expected LL to contribute neutrally to informing of this EDP design process, the observed and experienced contribution was negative.

3.2.4. Value Creation Mechanisms

Table 7: Concretisation Lens - Value Creation Mechanisms

Concretisation Lens					
Value Creation Mechanisms					
Key Design Problem: ***How are the platform value creation mechanisms being designed?***					
Key Design Problems	***Expected contribution of Living Labs***	***Observed & experienced contribution of Living Labs***	***Actual Contribution of Living Labs***	***Mechanisms & structures***	***Heuristic***
	—	—	—		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

The LL approach did not consistently inform the appropriate design of the platform's core value creation mechanisms through the three design iterations. In fact, a clear core value creation mechanism was never clarified for the UDUBSit EDP. The fact that the value creation mechanism was never technologically mediated and automated also hampered the scaling of the EDP to such an extent that it never reached generativity-enabling network effects.

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as a new institutional form* leads to *design blind spots*. The LL approach did not:**
  - Surface, clarify or mitigate *the illusion of simplicity blind spot*
  - engage specifically with the key role of data as a valued source within the EDP, i.e., leveraging of data collection, processing, personalisation, curation, analysis, and the prediction was not explicitly defined as prioritised design decisions throughout the three design iterations *(platform scaling mechanism/emergence blind spot)*
  - Surface or reinforce the value of automatically mediated and curated data as a key resource within a platform's information economy required to create growing platform participant value and generative entrenchment. This was inconsistently recognised by LL and not translated into appropriately designed EDP components *(platform business model blind spot)*
  - Surface or mitigate the lack of engagement around the creation of an internal information economy within the EDP design process to enable data-driven generativity and network effects *(platform business model blind spot)*
  - Focus on identifying throughout all three design iterations the key core value creation mechanisms and remaining focused on its optimisation through optimal use of user and usage data *(platform scaling mechanism/emergence blind spot)*
  - Surface or mitigate the early stabilisation of core features and re-enforcement thereof rather than deeper validation of design assumptions being made regarding underlying value creation mechanisms *(platform scaling mechanism/emergence blind spot)*
- **Failure to surface and mitigate *Limits to Capacity to Design*, and specifically institutional capacity constraints, leads to:**
  - Limiting of data collection, extraction, processing, and application for prediction purposes limited by resource constraints and capacity to design, but also further diluted by the introduction of external dependencies, lack of developer continuity, and lack of effectively concretising the technical architecture and components of the value- creation mechanism/s required to scale and grow the EDP
- **Failure to surface and mitigate *Limits to Freedom to Design* leads to *forced design compromises, specifically:***
  - Surface or mitigate the introduction of dependencies on external actors for curation, mediation, and personalisation in the design

and implementation of value creation mechanisms *(forced technical design compromise)*

- o Surface the importance of building own developer ecosystem over the three design iterations, yet various external dependencies were introduced without critical engagement around its implications *(forced ecosystem design compromise)*
- o Surface or mitigate the lack of enabling connections (i.e., APIs/SDKs) to the EDP ecosystem to drive platform growth, scaling, and generative entrenchment *(forced technical design compromise)*
- o Surface or critically examine the introduction of external mega-platform dependencies over all three design iterations, resulting in user data insights mainly being collected and used for value-generating purposes external to the EDP *(forced data ownership compromise).* External dependencies also diluted the potential value of potential value creation mechanisms and resultant data-driven value that may have been created and/or captured by the ***UDUBSit*** EDP

Findings:

The LL approach did not consistently inform the appropriate design of the platform's core value creation mechanisms through the three design iterations. In fact, a clear core value creation mechanism was never clarified for the UDUBSit EDP. The fact that the value creation mechanism was never technologically mediated and automated also hampered the scaling of the EDP to such an extent that it never reached generativity-enabling network effects.

3.2.5. Governance

Table.8: Concretisation Lens – Governance

Concretisation Lens					
Governance					
Key Design Problem: ***How is platform governance being designed?***					
Key Design Problems	***Expected contribution of Living Labs***	***Observed & Experienced Contribution of Living Labs***	***Actual Contribution of Living Labs***	***Mechanisms & structures***	***Heuristic***
	N	—	—		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

The LL approach failed in consistently informing the platform governance process, principles, actors, and alignment through the three design iterations. The LL approach did not

- Clarify governance external to existing institutional processes
- Assist in clarifying architecture/ governance alignment as process focus was skewed towards one side of the platform and did not engage deeply enough with the underlying architecture of the EDP and changes thereof in the three design iterations *(platform business model blind spot)*
- Surface or address the fact that gradually online community governance was largely determined by external actors rather than

internal design decisions *(invisible/cloaked convenience blind spot)*

- Surface or address the fact that governance decisions with significant implications made by software developers based on convenience and operational pragmatism rather than strategic governance/architecture alignment *(trust the developer's Black Box – blind spot)*
- Surface or address the fact that too much focus in the LL process was on student-user perspectives and artefact-focused minutiae and User Experience Design rather than architecture, where EDP scaling requires both architectural and governance alignment *(object fixation blind spot)*

- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leads to:**
  - Adoption of external governance principles and rules (i.e., Google OAuth Terms and Conditions[114]), diluting the HEI's capacity to design its own governance rules and principles
- **Failure to surface and mitigate *limits to Freedom to Design* leads to *forced design compromises, specifically:***
  - LL did not surface or engage with forced pragmatism around governance, which resulted in a significant dilution of EDPs own role in its own technical governance *(forced architecture/ governance alignment compromise)*
  - LL did not surface or engage with forced pragmatism around governance, which resulted in a significant dilution of EDPs own role in its own Technical Design governance *(forced technical design compromise)*
  - *LL did not surface or engage with forced pragmatism around governance, which resulted in a significant dilution of EDPs own role in its own Technology Adoption governance (forced technology adoption compromise)*
  - LL did not address the fact that platforms govern both instantaneously (real-time) & cumulatively. LL did not engage with real-time or cumulative governance as a priority & designed artefacts only enabled *ex post facto* governance via manual processes. Some community governance is done externally via mega-platform dependencies.

[114] https://www.google.com/accounts/authsub/terms.html

Findings:

Whereas we expected LL to contribute neutrally to informing of this EDP design process, the observed and experienced contribution was negative.

3.2.6. Platform Competition

Table 9: Concretisation Lens - Platform Competition

Concretisation Lens					
Platform Competition					
Key Design Problem: ***How is the Platform being positioned within the competitive landscape? (i.e., competition, collaboration, envelopment)***					
Key Design Problems	***Expected contribution of Living Labs***	***Observed & experienced contribution of Living Labs***	***Actual Contribution of Living Labs***	***Mechanisms & structures***	***Heuristic***
	N	—	—		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

Clarifying through the LL process how the EDP was being positioned within its competitive landscape was inconsistently applied through the three design iterations.

The LL approach did not:

- Consistently inform platform competition analysis and appropriate positioning of EDP within the competitive landscape
- Surface design blind spots and introduction of external dependencies
- Challenge the illusion that Platform Infrastructure is neutral.

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as a new institutional form* leads to *design blind spots*. The LL approach did not**
  - Surface or mitigate the illusion that designing and concretising technical artefacts on infrastructure provided by mega-platforms (often competing in the same market as EDP) provides a neutral impact on value generation and value capture in an EDP design process *(neutral platform infrastructure blind spot)*
- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leads to:**
  - o Underestimation of the platform envelopment risks of mega-platform dependencies. This risk was never clearly surfaced or mitigated, and therefore the mega-platforms were identified as an opportunity more than as a risk
- **Failure to surface and mitigate *limits to Freedom to Design* leads to *forced design compromises, specifically:***
  - o Forced pragmatism in including certain external actors in the platform ecosystem due to their *de facto* positions of competitive and standard setting power in the ecosystem *(forced ecosystem design compromise)*

Findings:

Whereas we expected LL to contribute neutrally to informing of this EDP design process, the observed and experienced contribution was negative.

3.3. Analysis and Findings from perspective of Implementation Lens

The Implementation Lens (as presented in **Chapter 5, Table 12**) focuses on the design decision required to implement the EDP from a design concept to a live digital system that can be sustained over time and over the platform lifecycle. Key design decisions include its launch, operations on a day-to-day basis, and how its operations and processes will be managed in such a manner that it retains its relevance in addressing the intended objectives within its institutional and broader societal context and remains sustainable.

Analysis of the UDUBSit case study data from the Implementation Lens perspective is presented in **Tables 35 to 37** and discussed thereafter.

3.3.1. Launch

Table 10: Implementation Lens: Launch

Implementation Lens: Case Study Analysis					
Launch					
Key Design Problem: ***How is the platform launch being designed?***					
Key Design Problems	***Expected contribution of Living Labs***	***Observed & experienced contribution of Living Labs***	***Actual Contribution of Living Labs***	***Mechanisms & structures***	***Heuristic***
	+	N	N		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

The design of the EDP launch and "ignition" process was inconsistently informed by the LL approach through the three design iterations.

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as a new institutional form* leads to *design blind spots*. The LL approach did not**
    - Surface, address or sufficiently inform the "chicken-and-egg" problem within the EDP design process as it failed in seeding or creating a generative communication economy through new content, new users and engagement by all platform sides
- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leading to:**
    - Ineffective mitigation of the resource constraints that limited the capacity of the HEI to subsidise or cross-subsidise the seeding of platform in the launch phase
    - Within the Launch design LL did not successfully surface or mitigate the *platform stakeholder blind spot;* the *invisible/cloaked convenience blind spot; the platform scaling mechanism/emergence blind spot* and the assumption was erroneously made that the Launch process is simpler than what it was *(illusion of simplicity blind spot)*
- **Failure to surface and mitigate *limits to Freedom to Design* leads to *forced design compromises, specifically:***
    - The pragmatic compromise due to resource constraints and ubiquitous and "free"/low friction availability of mega-platform technical solutions which was viewed as "quick wins" to attain artefact delivery within resource constraints due to developer capacity and continuity constraints and lack of internal mobile software development capacity *(forced technology adoption compromise)*

Findings:

Whereas we expected LL to contribute positively to informing of this EDP design process, the observed and experienced contribution was neutral.

3.3.2. Operations and Process

Table 11: Implementation Lens: Operations & Processes

Implementation Lens					
Operations and Process					
Key Design Problem: ***How is the platform scaling being designed?***					
Key Design Problems	***Expected Contribution of Living Labs***	***Observed & Experienced Contribution of Living Labs***	***Actual Contribution of Living Labs***	***Mechanisms & structures***	***Heuristic***
	N	—	—		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

The LL approach informed the operations and processes of the EDP to a very limited degree throughout the three observed design iterations.

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as new institutional form,* leading to *design blind spots*. The LL approach did not:**
  - succeed in informing appropriate operations and processes to scale platform in context to attain objectives
  - inform a consistent and coherent scaling strategy throughout the three design iterations

  - Surface the importance of defining scaling as a prioritised design decision throughout the three design iterations
  - Effectively engage with platform openness as scaling constraint through any of the design iterations, but specifically in Iteration 2 & 3 with implementation of closed authentication. It became a hard barrier to scaling. The LL process failed to recognise platforms as a different institutional form
  - Focus sufficiently on building institutional capacity to absorb and accept the designed artefact into institutional operational/process structures (innovation process fixation blind spot)
- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leading to:**
  - The EDP design process remaining situated as Innovation process and it struggled to evolve and adapt to institutionalise and embed within the HEIs existing and legacy ICT, operational and process structures of the institution
- **Failure to surface and mitigate *limits to Freedom to Design*, leading to *forced design compromises, specifically:***
  - The pragmatic compromise due to resource constraints and ubiquitous and "free"/low friction availability of mega-platform technical solutions which was viewed as "quick wins" to attain artefact delivery within resource constraints due to developer capacity and continuity constraints and lack of internal mobile software development capacity *(forced technology adoption compromise). This resulted in a loss of key operational and process related control over and ownership of data, data insights and data analysis (for example, by the usage of Google database products necessitated by resource constraints and its seamless convenience to developers).*

Findings:

Whereas we expected LL to contribute neutrally to informing of this EDP design process, the observed and experienced contribution was negative.

3.3.3. Sustainability

Table 12: Implementation Lens: Sustainability

Implementation Lens

Sustainability

Key Design Problem:

How is the platform's adaptation (sustainability/relevance) to context being designed?

Key Design Problems	*Expected Contribution of Living Labs*	*Observed & Experienced Contribution of Living Labs*	*Actual Contribution of Living Labs*	*Mechanisms & structures*	*Heuristic*
	+	−	−		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

Clarifying through the LL process the platform's adaptation (sustainability/relevance) to context was inconsistently achieved through the three design iterations. The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as new institutional form*, leading to *design blind spots*. The LL approach did not:**
    - Inconsistently informed the re-validation of platform relevance, specifically vis-à-vis emerging competitive platform (WhatsApp in particular)

  - Consistently inform object, realisation and process design to become/remain sustainable within its process of attaining objectives
- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leading to**:
  - Inconsistent application of LL approach and application of one-sided, imbalances in co-creation process due to *stakeholder blind spot.* There was a *de facto* assumption that platform co-creation is inclusive because it includes mainly end-users. There was also an unspoken assumption that this inclusion will benefit the ongoing sustainability of the EDP. This may have created a false sense of inclusive design principles being followed, which was further strengthened due to capacity constraints within the institutional context *(illusion of co-creation-inclusivity blind spot)*
  - Increasing technocratisation of the design process over the three design iterations, as well as a high dependence on developers for delivery of an inclusive platform design (in terms of *object, realisation* and *process-design*), assuming their capability to deliver technically the requirements for creating a sustainable platform, which was deeply a socio-technical design process rather than just the design of digital artefacts (*developer over-reliance blind spot)*
- **Failure to surface and mitigate *Limits to Freedom to Design*, leading to *forced design compromises, specifically*:**
  - The pragmatic compromise due to resource constraints and ubiquitous and "free"/low friction availability of mega-platform technical solutions which lead to a loss of control over and ownership of user data, data analytical insights and mechanisms to enable generativity. These "quick wins" to attain artefact delivery within resource constraints *(forced technology adoption compromise) diluted the EDPs sustainability and was exacerbated* due to developer capacity and continuity constraints and lack of internal mobile software development capacity

Findings:

Whereas we expected LL to contribute positively to informing of this EDP design process, the observed and experienced contribution was negative.

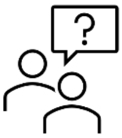
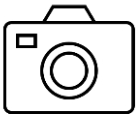
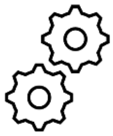
3.4. Analysis from Perspective of Evaluation Lens

The Evaluation Lens (as presented in **Chapter 5, Table 13**) focuses on determining whether the platform as implemented, is meeting its designed intentions, specifically also its intended value realisation, value capture and continuous learning and adaptation objectives.

Analysis of the UDUBSit case study data from the Evaluation Lens perspective is presented in **Tables 38 to 41** and discussed thereafter.

3.4.1. Meeting Objectives

Table 13: Evaluation Lens: Meeting Objectives

 ***Evaluation Lens: Case Study Analysis***					
Meeting Objectives					
Key Design Problem: ***How is the success of the design process in terms of meeting the design intentions measured?***					
 ***Key Design Problems***	 ***Expected Contribution of Living Labs***	 ***Observed & Experienced Contribution of Living Labs***	 ***Actual Contribution of Living Labs***	 ***Mechanisms & structures***	 ***Heuristic***
	+	N	N		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* Object Design			

Analysis:

The LL approach did not accurately and consistently inform the evaluation of whether the EDP design process was meeting its design intentions.

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- **Failure to recognise EDP as new institutional form, leading to design blind spots. The LL approach did not**
  - Engage with the deeper platform design questions, specifically related to architecture/governance alignment over the three design iterations, but only engaged with measurement of visible, conveniently accessible measures of user adoption (*illusion of simplicity blind spot)*. Institutional measures of success focused mainly on one side of platform only (*platform stakeholder blind spot)*.
  - Succeed in moving the EDP from an innovation project into an institutionalised project. LL remained situated in the innovation processes and struggled to evolve and adapt to institutionalise and embed within the existing/legacy ICT and operational/process structures of institution *(innovation process fixation blind spot).* LL did not focus sufficiently on building institutional capacity to absorb and accept the designed artefact/s into institutional operational/process structures
- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leading to:**
  - Lack of focus on addressing different institutional role-players and developing the absorptive capacity of the HEI to institutionalise the EDP. The relevant evaluation criteria meaningful to different sides of the platform was not addressed in enough depth and was informed more by easily available metrics than deeper value-creation and value capture mechanisms. Inconsistent application of the LL approach exacerbated this lack of balanced and deep focus.
- **Failure to surface and mitigate *limits to Freedom to Design*, leading to *forced design compromises, specifically:***
  - The pragmatic compromise due to resource constraints and ubiquitous and "free"/low friction availability of mega-platform technical solutions (specifically data analytical tools) which was viewed as "quick wins" to attain artefact delivery within resource constraints due to developer capacity and continuity constraints and lack of

internal mobile software development capacity *(forced technology adoption compromise)*

Findings:

Whereas we expected LL to contribute positively to informing of this EDP design process, the observed and experienced contribution was neutral.

The LL approach did not consistently and clearly inform whether design intentions were being met through the three design iterations. There were also differing perceptions observed between different platform role players on whether design intentions were successfully being met.

3.4.2. Value Realisation

Table 14: Evaluation Lens: Value Realisation

Evaluation Lens					
Value Realisation					
Key Design Problem: ***How is the success of the design process in terms of meeting the value realisation intentions measured?***					
Key Design Problems	***Expected Contribution of Living Labs***	***Observed & Experienced Contribution of Living Labs***	***Actual Contribution of Living Labs***	***Mechanisms & structures***	***Heuristic***
	+	−	−		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

The LL approach did not accurately and consistently inform the evaluation of whether the EDP design process was meeting its value realisation objectives, specifically pertaining to the intended design objectives of creating a vibrant online trusted community on campus.

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- **Failure to recognise EDP as new institutional form, leading to design blind spots. The LL approach did not**
    - Surface or effectively mitigate the *illusion of simplicity blind spot* and the *invisible/cloaked convenience blind spot*
- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leading to:**
    - The failure to develop and retain ownership of data collection, extraction, processing and application for prediction purposes. The HEI also did not build embedded internal capacity to develop the data insights and required tools to collect, manage and utilise automatically mediated and curated data as key resource within a platform's information economy required to create a growing platform. Although the value of participant data and its role in the generative entrenchment of the EDP was recognised, it was done inconsistently recognised by LL and not translated to into appropriately designed objects and processes to inform value realisation
- **Failure to surface and mitigate *limits to Freedom to Design*, leading to *forced design compromises, specifically:***
    - *Forced technology adoption compromises* that limited EDP value realisation because of the lack of control over user data and the lack of appropriate real-time data insights

Findings:

Whereas we expected LL to contribute positively to informing of this EDP design process, the observed and experienced contribution was negative.

3.4.3. Value Capture

Table 15: Evaluation Lens: Value Capture

Evaluation Lens					
Value Capture					
Key Design Problem: ***How is the success of the design process in terms of meeting the value capture intentions measured?***					
Key Design Problems	***Expected Contribution of Living Labs***	***Observed & Experienced Contribution of Living Labs***	***Actual Contribution of Living Labs***	***Mechanisms & structures***	***Heuristic***
Process Design Realisation Design Object Design	N	—	—		
	Process Design Realisation Design Object Design	Process Design Realisation Design Object Design			

Analysis:

The LL approach did not accurately and consistently inform better understanding of whether value was being captured sufficiently and appropriately by the EDP, across the three design iterations. LL failed to surface or engage with blind spots. This created a false sense of value capture, whereas the real "value sinks" were obscured and obfuscated. This informing process was being diluted gradually during the three design iterations and became more technology-centred than people-centred. LL failed to surface this or engage with it.

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as new institutional form*, leading to *design blind spots*. The LL approach did not**
    - Surface or effectively mitigate the *illusion of simplicity blind spot* and the *invisible/cloaked convenience blind spot, as well as the fact that there was an over-reliance on developers to fully understand and capture platform value through their object design attempts*
- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leading to:**
    - Inconsistent LL application
    - Technocratisation of design process
    - Institutionalisation capacity
    - Developer over-reliance
- **Failure to surface and mitigate *limits to Freedom to Design*, leading to *forced design compromises*, specifically:**
    - Forced technical design compromises

Findings:

Whereas we expected LL to contribute neutrally to informing of this EDP design process, the observed and experienced contribution was negative.

3.4.4. Feedback

Table 16: Evaluation Lens: Feedback

<table>
<tr><th colspan="6">Evaluation Lens</th></tr>
<tr><th colspan="6">Feedback</th></tr>
<tr><td colspan="6">Key Design Problem:
How are the lessons learned (feedback) in the design process communicated and utilised to inform learning and appropriate adaptation of design to context to attain objectives?</td></tr>
<tr><td>Key Design Problems</td><td>Expected Contribution of Living Labs</td><td>Observed & Experienced Contribution of Living Labs</td><td>Actual Contribution of Living Labs</td><td>Mechanisms & structures</td><td>Heuristic</td></tr>
<tr><td>Process Design
Realisation Design
Object Design</td><td>N</td><td>—</td><td>—</td><td></td><td></td></tr>
<tr><td></td><td>Process Design
Realisation Design
Object Design</td><td>Process Design
Realisation Design
Object Design</td><td></td><td></td><td></td></tr>
</table>

Analysis:

The LL approach did not consistently inform learning and appropriate generation of adapted/new design propositions to optimise attainment of design objectives. Learning opportunities were also not effectively implemented by the designers due to the slow nature of iterations as well as resource constraints. The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as new institutional form*, leading to *design blind spots*. The LL approach did not**
    - Engage with platform value generation components and optimising of learning and feedback on that, rather remaining focused on more visible front-end design input (i.e., user experience design)
    - Surface or mitigate *platform ownership blind spot* leading to limiting of the feedback and learning that could have been informed by the LL approach
    - Surface or mitigate the *platform stakeholder blind spot* limiting of the feedback and learning that could have been informed by the LL approach
    - Surface or mitigate the *illusion of co-creation inclusivity blind spot,* leading to a false sense that the design process was successfully informing design decisions because end-users were involved in the design process
    - Surface or mitigate the *illusion of simplicity blind spot* requiring a "platform-thinking" view of ongoing design feedback and adaptation
- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leading to:**
    - Inconsistent LL application
    - technocratisation of design process
    - Lack of and institutionalisation of feedback mechanisms and capacity
    - Non-engagement with developer over-reliance, and increasing of this reliance over the three design iterations
- **Failure to surface and mitigate *limits* to *Freedom to Design*, leading to forced design compromises, specifically:**
    - Forced technical design compromises, forced technology adoption compromises and forced data ownership compromises that lead to over-reliance on external data, tools and data-providers to inform ongoing learning, adaptation and re-design of the application and its realisation design
    - Forced architecture/ governance alignment compromise

Findings:

Whereas we expected LL to contribute neutrally to informing of this EDP design process, the observed and experienced contribution was negative.

3.5. Analysis from Perspective of Emergence Lens

The Emergence Lens (see **Chapter 5, Table 11**) focuses specifically on the designing of levers or mechanisms of emergence, such as, scaling and growth through architecture-governance alignment, optimising of platform operations and capabilities, technical features as well as the iterative (re)design) and adaptation of these mechanisms throughout the EDP design processes of the platform's lifecycle.

Analysis of the UDUBSit case study data from the Emergence Lens perspective is presented in **Tables 42 to 44** and discussed thereafter.

3.5.1. Scaling Design

Table 17: Emergence Lens: Scaling Design

Emergence Lens: Case Study Analysis					
Scaling Design					
Key Design Problem: ***How is the emergence of the platform deliberately designed in each phase?***					
Key Design Problems	***Expected Contribution of Living Labs***	***Observed & Experienced Contribution of Living Labs***	***Actual Contribution of Living Labs***	***Mechanisms & structures***	***Heuristic***
	−	−	−		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

The LL approach did not:

- Consistently inform and engage with the design decisions around how the scaling process was designed over the three design iterations.

- Surface or mitigate the unique requirements of platform scaling, specifically the mitigation of the "chicken-and-egg" platform launch challenge, the creation of an internal information economy and the identification and data-driven optimisation of value creation-mechanisms.
- Critically engage with the barriers to platform generativity, as well as the design and alignment of platform object design, realisation design and process design over the three design iterations
- Surface or engage with blind spots mentioned in earlier design lenses.

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as new institutional form*, leading to *design blind spots*. The LL approach did not**
    - Engage with platform value generation components and optimising of learning and feedback on that, rather remaining focused on more visible front-end design input i.e., user experience design *(illusion of simplicity blind spot)*
    - *Surface or mitigate the platform business model blind spot, platform ownership blind spot, platform stakeholder blind spot, the invisible/cloaked convenience blind spot, the platform scaling mechanism/emergence blind spot,* the *developer over-reliance blind spot,*
    - Surface or mitigate the *object fixation blind spot* which means scaling design, when informed at all by the LL approach, mainly focused on front-end and visible *object-design* elements and did not at all engage with the equally important *realisation design* and *process design* decisions required to reach scale
- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leading to:**
    - Inconsistent LL application
    - Technocratisation of design process
    - Institutionalisation capacity to develop scaling design not developed over the three design iterations
    - Developer over-reliance masking the lack of engagement over underlying scaling mechanisms
- **Failure to surface and mitigate *limits to Freedom to Design*, leading to *forced design compromises*,** *specifically:*

- o *Forced technical design compromises, forced technology adoption compromises* and *forced data ownership compromises* that lead to over-reliance on external data, tools and data-providers to inform ongoing learning, adaptation and re-design of the application and its realisation design
- o *Forced architecture/governance alignment compromise*

Findings:

Whereas we expected LL to contribute negative to informing of this EDP design process, the observed and experienced contribution was negative.

3.5.2. Scaling Evolution

Table 18: Emergence Lens - Scaling Evolution

Emergence Lens					
Scaling Evolution					
Key Design Problem: ***How is the design of the emergence of the platform externally influenced by contextual factors?***					
Key Design Problems	***Expected Contribution of Living Labs***	***Observed & Experienced Contribution of Living Labs***	***Actual Contribution of Living Labs***	***Mechanisms & structures***	***Heuristic***
	N	—	—		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

The LL approach did not enable appropriate responses of designers to relevant external influences, such as for example to the high velocity of scaling of competitive platforms (i.e., WhatsApp), the broader availability of smartphones and raised user expectations, as well as the fact that, although the student population utilised mostly Android phones, a significant portion of institutional staff members used iOS devices, which the ***UDUBSit*** EDP did not support in all three design iterations.

The underlying mechanisms and structures that impacted on the actual contribution can be identified and categorised as follows:

- ***Failure to recognise EDP as new institutional form*, leading to *design blind spots*. The LL approach did not**
    - Engage in benchmarking of platform value generation components against external competitors, mainly front-end design decisions were externally benchmarked
    - *Surface or mitigate the platform business model blind spot, platform ownership blind spot, platform stakeholder blind spot, the invisible/cloaked convenience blind spot, the platform scaling mechanism/emergence blind spot,* the *developer over-reliance blind spot,*
    - Engage with platform value generation components and optimising of learning and feedback on that, rather remaining focused on more visible front-end design input (i.e., user experience design)
    - Surface or mitigate the *object fixation blind spot* which means competitive advantage and external ecosystems' impact of the UDUBSit EDP was mainly focused front-end and visible *object-design* elements and did not at all engage with the equally important *realisation design* and *process design* aspects which changed in the external ecosystem as new technologies of mega-platforms developed and matured.
    - The LL approach also did not o surface or mitigate the *neutral platform infrastructure blind spot: the illusion that designing and concretising technical artefacts on infrastructure provided by mega-platforms (often competing in same market as EDP,) provide a neutral impact on value generation and value capture in an EDP design process*

- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leading to:**
    - Inconsistent LL application
    - Technocratisation of design process
    - Institutionalisation capacity to develop scaling design not developed over the three design iterations
    - Developer over-reliance masking the encroaching threat of mega-platform dependencies on the EDP’s value creation and value capture opportunities and capacity to design

- **Failure to surface and mitigate *limits to Freedom to Design*, leading to *forced design compromises, specifically:***
    - *Forced technical design compromises, forced technology adoption compromises* and *forced data ownership compromises* that lead to over-reliance on external data, tools and data-providers to inform evaluation of the external platform ecosystem and surface and/or mitigate external environmental changes (such as the hardening reality of *planetary-scale computation* as mega-architecture by which design decisions were becoming more and more limited) that impacted on the adaptation and re-design of the application and its realisation design

Findings:

Whereas we expected LL to contribute neutrally to informing of this EDP design process, the observed and experienced contribution was negative.

3.5.3. Architecture-Governance Alignment

Table 19: Emergence Lens: Architecture-Governance Alignment

Emergence Lens					
Architecture-Governance Alignment					
Key Design Problem: ***How is the alignment of the platform's architecture and governance designed?***					
Key Design Problems	***Expected Contribution of Living Labs***	***Observed & Experienced Contribution of Living Labs***	***Actual Contribution of Living Labs***	***Mechanisms & structures***	***Heuristic***
	N	—	—		
	Process Design *Realisation Design* *Object Design*	*Process Design* *Realisation Design* *Object Design*			

Analysis:

LL did not assist in clarifying architecture/governance alignment as process focus was skewed towards one side of platform and did not engage deeply enough with underlying architecture of the EDP and changes thereof in the three design iterations.

- ***Failure to recognise EDP as new institutional form*, leading to *design blind spots*. The LL approach did not**
    - Surface or mitigate the *object fixation blind spot* – to much focus in the LL process on user perspective and artefact-focused minutiae and User Experience Design rather than architecture.

Platform's scaling requires both architectural and governance alignment

- Surface or address the fact that gradually online community governance was largely determined by external actors rather than internal design *(platform business model blind spot).*
- Surface or address the *invisible/cloaked convenience blind spot*: the pragmatic compromise due to resource constraints and seamless convenience and invisible/cloaked interfaces of ubiquitous and "free"/low friction availability of mega-platform technical solutions

- **Failure to surface and mitigate *limits to Capacity to Design*, and specifically institutional capacity constraints, leading to:**
    - Inconsistent LL application
    - Technocratisation of design process
    - Institutionalisation capacity to develop scaling design not developed over the three design iterations
    - Developer over-reliance masking the lack of engagement over underlying scaling mechanisms
- **Failure to surface and mitigate *limits to Freedom to Design*, leading to *forced design compromises, specifically:***
    - Forced pragmatism around governance that resulted in significant dilution of EDPs own role in its own technical governance.
    - *Forced technical design compromise*: Pragmatic compromise of technical design and introducing external dependencies to attain Artefact delivery within resource constraints
    - *forced technology adoption compromise:* Pragmatic compromise due to resource constraints and ubiquitous and "free"/low friction availability of mega-platform technical solutions
    - LL did not address the fact that platforms govern both instantaneously (real-time) and cumulatively
    - LL did not engage with either real-time or cumulative governance as priority and all designed artefacts only enabled *ex post facto* governance via manual processes. Some community governance was externally done via mega-platform dependencies
    - Forced architectural and governance compromises introduced as mega-platform dependencies introduced due to: Pragmatic compromise to attain object/realisation and process design delivery within resource constraints

Findings:

Whereas we expected LL to contribute neutrally to informing of this EDP design process, the observed and experienced contribution was negative.

4. Summary of Findings: Research Question

Based on our analysis of the ***UDUBSit*** case in **Chapter 7**, we found that the LL approach did not inform the EDP design process consistently through the different phases in the design process. To better apply Living Labs in the design of emerging digital platforms, it is necessary to be more aware of, and responsive to, the mechanisms and structures that challenge its optimal application and manage or mitigate those.

Through the three design iterations of the ***UDUBSit*** EDP (see **Chapter 6**, **Table 14)**, there were several external dependencies (for example on the IT level, data level, integration layer etc.) on mega-platform technologies that were decided upon (for example, Google's FireBase[115] database and various APIs/OpenAUTH). These decisions were often made due to the seamless convenience and resource-allocation efficiency it presented to design decision makers at that moment of pragmatic decision-making under constrained conditions.

What may be less apparent is the re-casting of the EDP designer as a mere User within Bratton's Stack of planetary-scale computation, diluting not only *capacity to design*, but also *freedom to design*. The seamless convenience of the mega-platform technologies and design tools contributed to the fact that EDP designers did no become more aware (even during the LL processes) that digital platforms present a new institutional form, requiring a different approach to design so that value generation and value capture can be assured.

Over the three design iterations, the application of the LL approach diluted noticeably and by the third iteration its impact in informing the EDP design process was markedly less than during the first design iteration. In this chapter, the mechanisms that influenced this dilution have been examined.

Various capacity challenges (*capacity to design*) faced by the project (i.e., lack of developer continuity, budgetary constraints, lack of internal mobile

[115] https://firebase.google.com/

application development capacity) negatively impacted on its growth and hampered its attainment of the scaling factors detailed in **Chapter 2, section 2.2**, including the enablement of generativity, network effects, information sharing, collaboration, collective action, connection, gravity and flow. Several challenges were also faced in establishing and clarifying institutional ownership and operational institutionalisation processes of the EDP.

In this chapter, viewing the ***UDUBSit*** case through the EDP lenses, the mechanisms and structures that influenced these limitations to the capacity to design also became more apparent.

In CR terms, the domain of the *real* includes the entities and structures of reality and the causal powers inherent to them as they independently exist (Wynn & Williams, 2012). The tensions introduced and the powers exerted by planetary-scale computational structures, such as mega-platforms (Bratton, 2015) on the design process, as well as the utilisation of LL within the EDP design process, will also be commented on.

The Living Labs approach failed to inform the EDP design processes more effectively because of the following main structures and mechanisms identified (see **Figure 45**):

- Failure to *recognise digital platforms as a new institutional form*
- Failure to surface and mitigate *limits to the capacity to design*
- Failure to surface and mitigate *limits to the freedom of design*

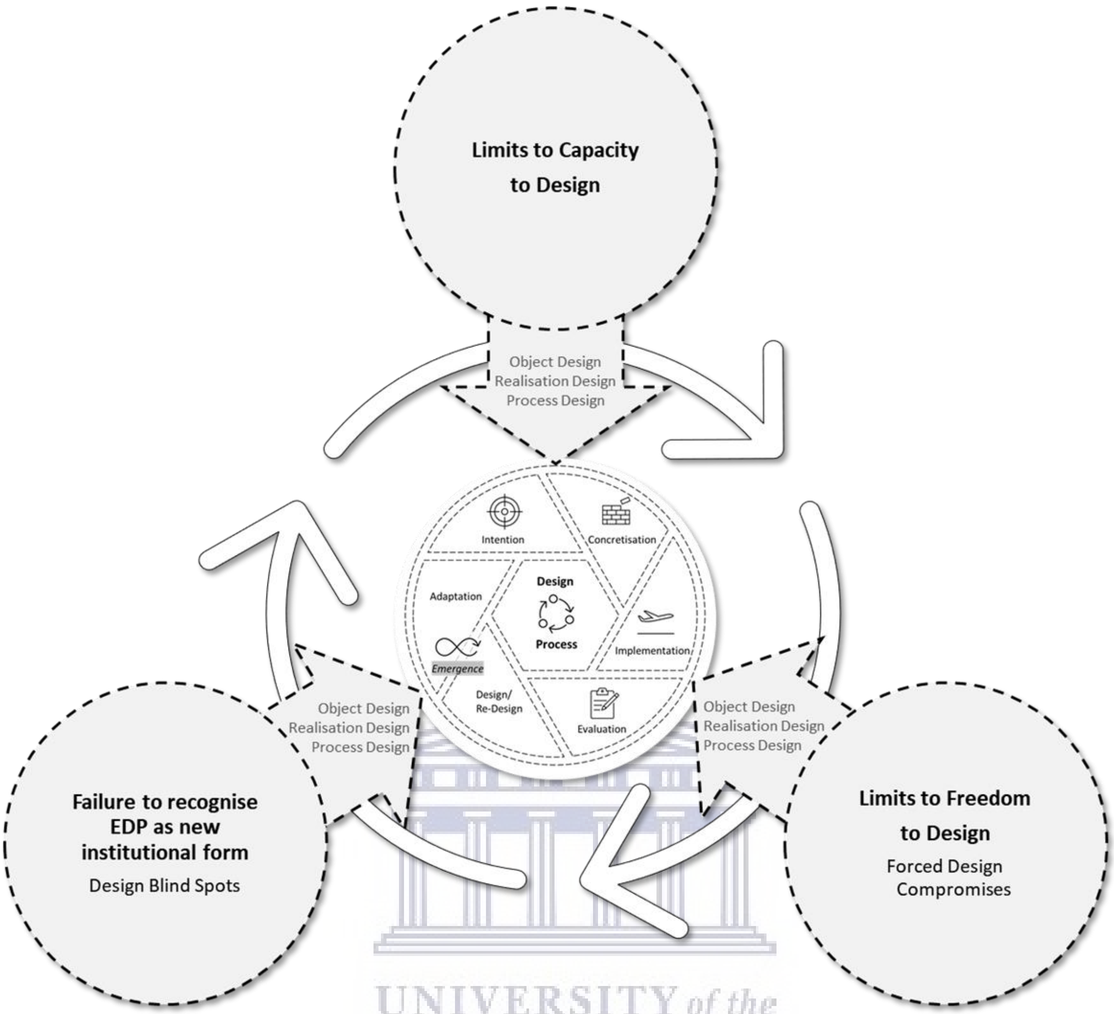


Figure 45: Findings - Mechanisms and Structures

4.1. Failure to Recognise Digital Platforms as a New Institutional Form

A key finding of this study is that the LL approach failed to position the EDP design process and it's informing thereof within the context of planetary-scale computation and its hardening architecture, power tension fields and invisible interfaces of convenience and seamless interaction. The fact that the LL process failed to engage with all the sides of the platform being designed may be viewed as a significant failure in recognising the fundamentally different approach required by digital platforms as emergent new institutional form.

The significant power asymmetry between the *Platform layer of the Stack* (Bratton, 2015) and the small *UDUBSit* EDP design project studied also highlighted not only the *design blind spots* (see **Table 45**) that resulted from the failure to recognise the different nature of platforms from an object design, realisation design and process design perspective, but also how this contributed to the vulnerability of the EDP when competing against the allure of mega-platforms' offerings to EDP designers. Not recognising DP as different institutional form and deepening the process of engagement to deal with DP on an appropriate level of societal impact underlying its complexity and implications is probably one of the most important lessons for LL practitioners from this case.

A further research opportunity may be to analyse existing LL co-creation tools against the requirements identified to determine if these tools exhibit any inherent "toolset blind spots" that may need to be adapted for EDP design purposes.

Design Blind Spots
•Platform Ownership blind spot •Platform Stakeholder blind spot •Platform Business Model blind spot •Illusion of Co-Creation Inclusivity blind spot •Invisible/Cloaked Convenience blind spot •Illusion of Simplicity blind spot •Platform Scaling Mechanism/ Emergence blind spot •Trust in Developer's Black Box– blind spot •Developer Over-reliance blind spot •Object Fixation blind spot •Neutral Platform Infrastructure blind spot

Table 20: EDP Design Blind Spots (Author)

The failure of LL to engage with the issue of control of user and platform data and data analytics as the main driver of platform value creation and value capture also deserves further investigation. To a large extent, LL also failed to engage with "prediction" as the core data-driven value generation mechanism required to compete with any mega-platforms and create a generative internal information economy within the EDP.

4.2. Failure to Surface and Mitigate Limits to the Capacity to Design

Based on our analysis of the ***UDUBSit*** case in **Chapter 7**, we found that constrained institutional capacity impacted negatively on the way in which the LL approach informed the EDP design process. Limits to the capacity to implement LL within institutional ecosystem created inconsistency in the way LL informed the EDP design process. This was observed (see **Table 46**) in the inconsistent application of the LL approach over the three design iterations, a gradual technocratisation of the design process, lack of institutional absorption capacity, and lack of developer continuity and over-reliance of developers to inform the EDP design process.

Limits to Capacity to Design
•Inconsistent LL application •Technocratisation of design process •Institutionalisation capacity •Lack of Developer Continuity •Developer over-reliance

Table 21: Limits to Capacity to Design (Author)

These limits to design, for example, manifested through the following:

- **Lack of continuity of LL application consistency and depth of engagement over the three design iterations:**
    - Dilution in the application of LL tools and toolsets over the three design iterations
    - Failure to surface and mitigate the gradual technocratisation of the EDP design process
    - Failure to recognise how deeply mega-platforms have colonised the life worlds of EDP participants/possible users
    - Failure to add meaningful friction to design processes of decision-making about the introduction of external dependencies that diluted value creation and value capture of the EDP
- **Inconsistency, due to limits to the *capacity to design* within the institutional ecosystem, mainly due to resource constraints:**
    - Lack of Platform Developer Continuity
    - Different developer skillsets dictated object and realisation design, rather than longer term vision of appropriate architecture design and architecture-governance alignment
    - No internal skills capacity development over the design iterations.
    - Budgetary constraints
    - Lack of clarity about platform institutionalisation and embedding of ownership
    - Resource constraints limiting capacity to subsidise/cross-subsidise seeding of platform in launch phase

- LL did not surface the importance of building own *developer ecosystem* over the three design iterations, yet various external dependencies were introduced without critical engagement around its implications. The creation and empowerment through connecting tools such as APIs and SDKs are critical to empower a platform to leverage its value creation mechanisms and create generative network effects

4.3. Failure to Surface and Mitigate Limits to the Freedom of Design

Based on our analysis of the ***UDUBSit*** case in **Chapter 7**, we found that the LL approach failed to surface and mitigate certain *forced design decision compromises* (See **Table 47**) that were observed during the three design iterations.

Forced Design Compromises
•Forced Design Objective compromise
•Forced Design Value compromise
•Forced Technical Design compromise
•Forced Technology Adoption compromise
•Forced Ecosystem Design compromise
•Forced Data Ownership compromise
•Forced Architecture/ Governance Alignment compromise

Table 22: Forced Pragmatic Design Compromises (Author)

Forced Pragmatic EDP Design Compromises can be defined as design decisions in EDP design processes that are made due to the combination of resource constraints, limits to the capacity to design and, in contrast, the seamless convenience and invisible/cloaked interfaces of ubiquitous and "free"/low friction availability of mega-platform solutions to design problems. The impact of these compromises results in the introduction of external dependencies that are deep and (often) irreversible, limiting *freedom of design.* Ideally, the role of LL should be to add meaningful friction to design processes to facilitate more critical engagement by platform stakeholders around these invisible/seamlessly convenient design options.

However, this was not achieved in the ***UDUBSit*** case analysed.

Failure to position EDP as well as its co-creation approach (LL in this case) in a planetary-scale design constellation meant that the hard design barriers that *The Stack* brings and how it reduces *freedom to design*, even more so in resource-constrained environments, was not recognised, not mitigated and gradually encroached on the design process of the EDP. The LL approach also failed to recognise the positioning of dominant platform firms within the mega-structure of planetary-scale computation and its powerful gravitational forces impacting EDP design processes.

5. Summary of Findings: Research Sub-Questions

We will now address the sub-questions that were developed based on the three different design decisions Information Systems professionals make when developing IS initiatives (Van Aken, 2004), which has previously been applied within IS design research from a critical realist perspective (Carlsson, 2005).

5.1. How does Living Labs Inform the *Object Design* of an Emerging Digital Platform?

In this case, the *object design* of the ***UDUBSit*** mobile application (the design of the IS intervention/initiative) was informed inconsistently by an LL approach that was hampered by challenges with the institution’s capacity to concretise the intended and appropriate design artefacts to attain the intended platform owner and platform designers’ objectives. The Living Labs approach largely failed to address the object design of this EDP, as it failed to correctly identify a digital platform as a different type of institutional form that requires a specialised approach to object design. This failure caused the object design to exhibit several blind spots and introductions of *forced design compromises*.

Over the three design iterations observed, the object design did not support the EDP to reach scale and did not facilitate value-generating network effects for all platform sides.

5.2. How does Living Labs Inform the *Realisation Design* of an Emerging Digital Platform?

In this case, the *realisation design* (the plan for the implementation of the IS intervention/initiative) was informed inconsistently by an LL approach that was hampered by challenges with the institution's capacity to design the sustainable implementation plans to concretise, implement, evaluate and scale the EDP as socio-technical solution. The Living Labs approach largely failed to address the realisation of this EDP, as it failed to correctly identify a digital platform as a different type of institutional form that requires a specialised approach to realisation design. This failure caused the realisation design to exhibit several *design blind spots* and introduction of *forced pragmatic design compromises*.

5.3. How does Living Labs Inform the *Process Design* of an Emerging Digital Platform?

The *process design* refers to the design professional's own plan for the problem solving cycle and includes the methods and techniques to be used to design the solution (IS intervention) to the problem (van Aken, 2004; Carlsson, 2005). In this case, the plan was informed inconsistently by an LL approach that was hampered by challenges with the institution's capacity to design the sustainable processes to concretise, implement, evaluate and scale the EDP as socio-technical solution, embed and institutionalise the initiative and apply the LL approach more consistently and in more depth over the three design iterations. Largely, LL failed to address the process design of this EDP, as it failed to correctly identify a digital platform as a different type of institutional form that requires a specialised approach to process design. This failure caused the process design to exhibit several *design blind spots* and introduction of *forced pragmatic design compromises*.

6. Chapter Conclusion

In this chapter, we have utilised the *Emerging Digital Platform Design Lenses* (EDP Lenses) as conceptual framework to assist us in analysing the design decisions required within the process of designing and scaling a digital platform within the context of higher education in South Africa. We specifically investigated the contribution of Living labs in informing the platform design process. We presented our findings and we focused on identifying from a Critical Realist perspective the mechanisms by which LL may have informed (or not informed) this design process.

Our findings indicated that the failure of LL to engage with Digital Platforms as a new different and very fast-changing type of institutional and socio-technical form, leads to it exhibiting several design blind spots during the ***UDUBSit*** case. Furthermore, constrained institutional capacity did not only impact its capacity to design, concretise, implement and evaluate an EDP within its specific design context, but also reduced its capacity to apply the LL process more effectively to create EDP growth and scale. This lack of capacity became evident over the three design iterations of the ***UDUBSit*** project.

The LL approach also failed to surface and to mitigate various forced pragmatic compromises the designers and the project owners made over the lifecycle of the project. These compromises resulted in often cloaked and largely invisible value sinks in the form of external dependencies that reduced the project's ability to create more value and capture more intended benefits for its stakeholders.

Although this failure case did not by any means exhibit a text-book application of the LL approach, we have found that these design compromises limit the *freedom of design* of its designers and played an import role in reducing the possible impact that LL may have had on this EDP design project.

What we have found significant, is the fact that these design-compromise blind spots and the introduction of various external dependencies were largely cloaked by a veneer of convenience, seamless and "free" accessibility, ubiquitous existing open platform connectivity components, mature developer ecosystems with highly structured and standardised design rules and governance structures that affected object design, realisation design and process design. With a more consistent application of the LL approach and its expanding design and innovation toolsets (see Leminen & Westerlund, 2017), we believe it may have more to offer the EDP design process than what we have observed and experienced in the ***UDUBSit*** case. In the next chapter, we will discuss our integrated conclusions and recommendations for further research. A set of *EDP design heuristics* for platform design and LL practitioners will also be proposed.

Chapter 8 – Conclusions and Recommendations

The aim of art is to represent not the outward appearance of things, but their inward significance.

-Aristotle

We know more than we can tell.

-Michael Polyani, Hungarian-British polymath

1. Chapter Introduction

In this chapter, the implications of our main findings are discussed and recommendations are suggested based on our analysis of the ***UDUBSit*** case study in **Chapter 7** that utilised the *Emerging Digital Platform (EDP) Lenses*, as a conceptual framework and logic model.

The design process of the ***UDUBSit*** EDP was simultaneously technological and social. It deeply reflected the underlying mechanisms and tensions inherent in the emergence of planetary-scale computation. The seemingly simple process of developing a small social media platform for a previously disadvantaged university in South Africa deeply reflected some of the key global tensions introduced by the gradual, then sudden "*platformisation of everything*". The historic inequalities and power asymmetries between the emerging world and the more technologically empowered developed economies were embedded into the design and architecture.

Also becoming evident in the analysis were the dependencies and gradual technocratisation creeping into the platform design process of the development process. This process of design decision-making being influenced by history and power was often invisible beneath its veneer of frictionless convenience. Furthermore, it was exacerbated by capacity constraints, skills constraints and the way IS professionals, HEI executives and managers continue to grapple with making sense of the digital platform as newly dominant digital artefact, socio-technical system and new type of institutional form.

The role of Living Labs within this case's design process offers both hope and despair. The LL approach offers a potentially effective and appropriate toolset to create "meaningful friction" within the EDP design process. However, this will require a more focused and consistent application of the LL principles, which, in this case study, often fell by the wayside (mostly due to underlying capacity constraints and the invisible hand of the emerging tensions of planetary-scale computation and the alluringly convenient power-fields of mega-platforms), resulting in certain "pragmatically forced pragmatisms" adopted by the platform designers.

The purpose of this study was to contribute towards creating a better understanding of EDP as design problem in the HE context. We also focused on the specific contribution (or non-contribution) of LL in informing the design decisions affecting the development of the ***UDUBSit*** EDP over three design iterations.

We will also highlight further possible research opportunities stimulated by this study. We are cognisant of the limitations of any single-case study. However, we do believe that this case forced us to ask some pertinent questions around EDP design that may also have potential value for other platform design projects, specifically those in emerging contexts. The *in-situ* role of the researcher contributed to the perspectives and insights developed in this study.

However, we believe that LL may still offer significant value to EDP projects, especially if applied more consistently throughout design iterations. However, we also identified certain blind-spots specifically pertaining to the application of LL in the EDP design case we studied.

We propose a set of ***Living Labs Design Heuristics for EDP Design Processes*** as a design toolset, by which affordances can be activated and realised in a manner more beneficial to the platform owner's intended value creation and value capture objectives.

2. Overview of Findings

From a Critical Realist (CR) perspective, the focus of analysis is the provision of clear, concise and empirically supported statements detailing causation, specifically "how and why *a phenomenon occurred"* (Wynn & Williams, 2012). Through the application of the EDP Lenses to our analysis in **Chapter 7**, that is what this study attempted to achieve.

As per the CR principles suggested by Wynn and Williams (2012), through the *explication of events* (observed and experienced) and *structure* and *context*, rich descriptions of the key design decisions in the EDP design process were developed, focusing on the observable and unobservable elements and components of both social and physical structures and relationships. Retroduction was applied to focus on the powers of the mechanisms that may have interacted to generate the *events* and *structures* within the specific *Context*. Empirical corroboration of the mechanisms was assessed based on three design iterations of case study data, with the selection of the mechanisms offering the most explanatory value. A variety of approaches, data sources and theoretical perspectives was utilised to triangulate the causal analysis.

In our evaluation of the ***UDUBSit*** case, we were again reminded that digital platforms are much more than mere digital artefacts. In the words of Wittel (2012):

> "It is important to stress however that the social can never be fully separated from the technological. Every medium is simultaneously technological and social. Technological structures and relations between human beings are interlocked and mutually constitutive."

At its core, platform design requires addressing two interconnected problems: firstly, facilitating and regulating value creation and value capture into smaller tasks and components, and secondly, coordinating this optimally to enable realisation of platform value and achievement of the ecosystem goals (Tura, Kutvonen & Ritala, 2018). For platform design to contribute to online community building, it requires the three components of its architecture, namely core, interface and complements to collectively support the social interaction structure (information sharing, collaboration, and collective action) that can enable online community (Spagnoletti, Resca & Lee, 2015). For a platform to become economically sustainable, the costs of providing systemic mediation should, in aggregate, be less than the total value of user[116] information for the platform (Bratton, 2015).

Our analysis of the ***UDUBSit*** case study (**Chapter 7**) indicated this EDP design process as a clear failure case. It was not able to create, through three design iterations, the components of digital platform architecture (core, interface, and complements) (Spagnoletti, Resca & Lee, 2015) to collectively support, grow and sustain a trusted online community (which was its over-arching design objective). The design process largely failed to design, maintain and scale the components to enable the types of social interaction structures required to build an online community, namely information sharing, collaboration and collective action (Spagnoletti, Resca & Lee, 2015).

Digital platform design, especially within the South African context with its highly unequal society, needs to be even more sensitive not only to the impact of platforms as emergent new institutional form on the organisation

[116] Bearing in mind Bratton's definition of the user as not only including human users, but also non-human users such as bots or automated machine-to-machine interactions.

of society, but also its impact on traditional public values and established institutional arrangements.

As Van Dijck, Poell and de Waal (2018) contextualise the role of design in this process:

> "Such mutual shaping of platforms and society is not predetermined or irreversible. On the contrary, platform mechanisms can work very differently depending on how technologies, economic models, and practices are deployed and implemented. Currently, the Big Five platform corporations, shape the core technological infrastructure, dominant economic models and ideological orientation of the ecosystem as a whole".

Simultaneously, digital platforms present us with both the solution and the problem. Designing meaningful, inclusive and scalable solutions remains the challenge. However, we are still not very good at it, especially in a resource-constrained context, where design constraints and forced pragmatism may limit the *freedom of design*, often behind an alluring veneer of convenience and cost savings.

In **Chapter 2, section 2.2**, we presented various arguments from literature on the factors and design decisions required to design scalable digital platforms. The LL approach itself is not immune to grappling with the digital platform as newly dominant digital artefact with increasing new tensions and force-fields it introduces into the co-creation process. Although the process of co-creation has largely been viewed in a positive light by participants, with encouraging feedback in general on the designed ***UDUBSit*** application, the underlying reality was that the LL approach did not surface or mitigate the deeper underlying factors that acted as barriers (sometimes visible, sometimes not) in the attempts of the designers to deliver on the intended design objectives.

The inability of LL to empower designers to surface blind spots in EDP design, (largely unknowingly) contributed to unfavourable terms of inclusion in the true empowering potential offered by DP in emerging contexts. We aimed to highlight the fact that sometimes affordances are simply not perceived by users, especially if there are other mechanisms interfering with their actualisation (Bygstad, Munkvold & Volkoff, 2016).

The simultaneous failure of the LL approach to surface and/or mitigate the *pragmatically forced design compromises* that designers (mainly the software developers in the ***UDUBSit*** case) needed to adopt to meet the design objectives within the specific HEI context, has led to further disempowerment of platform role players, including platform designers, in the ***UDUBSit*** case.

As stated by Sen, unfavourable terms of inclusion may result in deprivation: "Indeed, many problems of deprivation arise from unfavourable terms of inclusion and adverse participation, rather than what can be sensibly seen primarily as a case of exclusion as such" (Sen, 1999). Bygstad, Munkvold and Volkoff (2016) posit that affordances can broadly be defined as a possibility for action. Bygstad, Munkvold and Volkoff (2016) furthermore propose that:

> "…affordances offer ('afford') an analytical bridge between the observed events and the causal structure of mechanisms. The relational nature of this analytical bridge is essential, in that it helps us to identify the socio-technical dynamics of mechanisms in IS research, i.e., the possible interaction between human/social entities and technology. In particular, it allows for a more specific analysis of the role of technology".

In the ***UDUBSit*** case, we observed and experienced certain mechanisms and structures that presented limits to possibility for action within the specific design context. These limits to action were not effectively mitigated, or even surfaced, by the LL approach through the different stages of the EDP design process. LL as approach will need to become increasingly aware of the ontological reversal in IS (Baskerville et al., 2020) as design context, and the necessity for "meaningful friction" needs to be introduced to surface the deeper questions EDP asks of its designers.

In our analysis, we aimed to identify some of these mechanisms and structures we believe may have exerted gravitational fields that impacted on the EDP design process itself, but also the application of LL within this process. Furthermore, we aimed to inform the future application of LL in an EDP context by suggesting a set of *design heuristics* that may potentially result in enhanced application of LL in future cases in similar design contexts.

3. The Importance of Failure Cases at the Intersection of Emerging Digital Platform Design and Living Labs Discourse

The failure of an EDP such as ***UDUBSit*** has real-world consequences and is important for researchers not to neglect the study of failure cases such as this. Similarly, the ***UDUBSit*** case also presents a failure of the LL approach to inform a design process with significant consequences, including financial losses and opportunity costs. If an EDP fails, it also means the underlying problem it aimed to address is still in existence. A stark reminder of this reality can be seen in the communication received a few years after the project has already been dormant.

The following email was sent to the ***UDUBSit*** application’s email address on Sep 1, 2021:

> *“Dear committee.*
>
> *I wanna sell my shoe. What should”*

In a sad and rather confusing way, this is an indication that, even after the project has been dormant for a few years, the need for a trusted online community within this particular HE context still exists. This need is seemingly not addressed fully by all the existing online initiatives, including modern responsive websites, various social media properties and various commercial apps.

In a tragic way, this also signifies a state of disempowerment so prevalent in developing world contexts. Multi-dimensional disempowerment involves multiple levels of inclusion barriers such as literacy, access to digital devices, connectivity, social exclusion, language barriers and a multiplicity of other factors that have been extensively researched from various perspectives, such as Political Economy (Gigler, 2015), Economics (Chancel et al., 2022)[117] and Development Studies (Chib, May & Barrantes, 2015).

This almost submissive plea for assistance re-emphasises the fact that EDP design, as a *wicked design problem,* is important. It is important to the lives of HE communities in South Africa. It is important to real people with real feelings of disconnect and real challenges in their lived reality which digital technologies can potentially assist in solving. We firmly believe in the value of the study of failure cases, but as Edmondson (2011) stated, not all failures are created equal:

[117] From Piketty et al’s South Africa Country Sheet: “Today, the top 10% in South Africa earn more than 65% of total national income and the bottom 50% just 5.3% of the total”.

> "Tolerating unavoidable process failures in complex systems and intelligent failures at the frontiers of knowledge would not promote mediocrity. Indeed, tolerance is essential for any organisation that wishes to extract the knowledge such failures provide. But, failure is still inherently emotionally charged; getting an organisation to accept it takes leadership" (Edmondson, 2011).

The key to deriving value from failure is focusing on understanding the underlying mechanisms that may have contributed to the failures. At the very least, HEIs should not view the application of the LL approach as a challenge that has been solved in this time where *digital transformation* is being treated as a peak that we have "scaled" under the pressures of Covid-19 pandemic-induced urgency.

We should still attempt to become better at it.

4. Implications of Findings

Emerging Platform Design as a *wicked problem* in this case studied, leads to both avoidable and unavoidable failures in a complex system. The nature of power relationships that impacts on design decisions in the context of planetary-scale computation and the dominance of mega-platforms, coupled with resource, continuity and skills challenges faced by the design team and platform owners, leads to limited *freedom of design*. Design decisions were more often driven by survivalist forced pragmatism, rather than strategy (strategic freedom of design). Deep, value-sucking dependencies were introduced into design decisions impacting the platform architecture and governance.

This directly limits the ability of the EDP to create full value from its own data assets, user base and unique and trusted online community. The ability to reach useful predictive analysis that can drive generativity and network effects for all users is often beyond the scope of technical abilities or resources available to EDP owners and designers, despite their best intentions.

Although we have highlighted the increasing infrastructuralisation of platforms (Plantin et al, 2018), it bears mention that not all platforms do indeed become infrastructural behemoths. *Emerging Digital Platforms,* because they attempt to create, grow and scale socio-technical systems within the increasingly monopolistic planetary-scale structure dominated by mega-platforms, find themselves with limited design choices between the walled gardens with low barriers to entry and very high cost of exit. Limits to their *capacity to design* also decrease their *freedom to design,* as it restricts their degrees of freedom of decision-making. It has been noted that large and commercially driven digital platforms have often been filling "institutional voids" in addressing developmental challenges in developing country contexts, but with increasing inequality often being the result (Heeks et al., 2021):

> "We showed this inequality to be a result of the platform companies' internally institutionalising – in digital and digitally-enabled functionalities, in their broader business model and in their outward-facing relations – all market functions and power that were previously distributed across different market stakeholders".

Therefore, as mentioned in **Chapter 5**, CR provides this study with a useful middle ground between developing "universal" design principles and mere sense-making, accepting that although the world is socially constructed, at the same time it is not entirely so (Thapa & Omland, 2018).

Design Science is, as highlighted in **Chapter 2**, is not primarily concerned with action itself, but with informing knowledge to be used in designing solutions, to be followed by design-based action (Van Aken, 2004). The ontological reversal in IS, as described by Baskerville, Myers and Yoo (2020), however implies that as designers of IS systems (including EDPs), our relational position vis-à-vis the *object design, realisation design* and *process design* of these systems need to change fundamentally. The role of the designer needs to engage with the two essential properties of digital objects, which is their non-materiality and computed nature (Baskerville, Myers & Yoo, 2020). With digital technology mediating virtually all aspects of our human activities, the digital is increasingly shaping physical reality and our human experiences become computed (Baskerville, Myers & Yoo, 2020). This is applicable not only to the role of the designer in the EDP design process, but also to that of the participants in co-creation design approaches such as LL.

Therefore, we propose an extension of the Living Labs definition we proposed in **Chapter 2**.
Our original definition reads as follows:

> A Living Lab, in the context of Emerging Digital Platform Design, is a process of making, facilitating and enabling design decisions by aware platform designers and users in the co-creation of the intention, concretisation, implementation, evaluation and adaptation/ re-design of digital platform artefacts (including object-design, realisation-design and/or process-design).

Our proposed extended definition (to improve LL relevance against the background of the ontological reversal in Information Systems, the increasing agency of digital technologies, and the increase in invisible interfaces with digital technologies) is as follows:

> A Living Lab, in the context of Emerging Digital Platform Design, is a process of making, facilitating and enabling design decisions by aware platform designers and users in the co-creation of the intention, concretisation, implementation, evaluation and adaptation/ re-design of digital platform artefacts (including object-design, realisation-design and/or process-design).
>
> A critical goal of the Living Labs approach should be to add meaningful friction to design decisions and processes cognisant of the fact that:
>
> - Technology interfaces are becoming more difficult for human designers, technology users and co-creation participants to recognise.
> - Design decisions may often be automated, obscured from view and human control.
> - Engagement around non-human actors (technologies with increasing forms of agency) will increasingly be required, especially surfacing and mitigating the "black boxes" of these (often highly complex) technologies.
> - The non-critical introduction of external socio-technical dependencies, especially as it relates to platform architecture-governance alignment.
> - Platforms govern both instantaneously and cumulatively and external dependencies may reduce freedom to design and introduce forced pragmatic design compromises.
> - Platforms don't look like how they work and don't work like how they look.

Although LL has been viewed as an exemplar of the positioning of the design of artefacts as a socio-technical process (Rossi et al., 2013), it is our opinion that the LL approach can benefit from deeper engagement with the blind spots and pragmatically forced design compromises surfaced by the ***UDUBSit*** case study. This deeper engagement may be required to, in the terms of Amartya Sen, expanding the real freedoms that people enjoy and removing major sources of unfreedoms (Sen, 1999).

It is our contention that if we analyse the LL approach itself, it may also present a wicked problem in the case of EDP design (applying the guidelines of Gleasure 2013 discussed in **Chapter 2**). The causal mechanisms on the design problem variables are difficult to isolate, with considerable overlap and blurry boundaries between the mechanisms, mediating influences and interactions identified in the ***UDUBSit*** case. Our study highlighted several blind spots within a laudable attempt to co-create an empowering digital technology platform by including a more inclusive representation of stakeholders within the design process of ***UDUBSit.*** The implications of LL creating a false sense of participation of platform stakeholders in the design process is problematic, specifically the *illusion of co-creation inclusivity blind spot,* described in **Chapter 7**.

The creation of a false sense of certainty – that because a certain co-creation approach was applied it resulted in meaningful inclusion of all stakeholders - can lead to EDP design projects that will do nothing more than entrench existing inequities and power differentials. This may be particularly true in the context of the platform as a new type of institutional form with vastly different design requirements and boundaries of *freedom of design*.

In this case, within the constrained and limited design environment, the purposeful and best-practice application of the LL approach has been diluted to serve short-term needs and the imperatives of short-term thinking and forced pragmatism, resulting in compromising on design principles, values, architecture, and governance decisions, which in combination, contributed to its eventual failure.

5. Recommendations

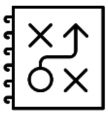
Based on our analysis (**Chapter 7**), Living Labs may offer many opportunities in informing EDP design processes. However, it will be necessary to adapt some of the fundamental assumptions made and techniques/approaches utilised within the LL process to address the specific design challenges brought about by the *"wicked design"* problem of EDP design. Not recognising DP as a different institutional form and deepening the process of engagement to deal with DP on an appropriate level of societal impact underlying its complexity and implications is probably one of the most important lessons for LL practitioners from this case. A further research opportunity may be to analyse existing LL co-creation tools against the requirements identified to determine if these tools exhibit any inherent "toolset blind spots" that may need to be adapted for EDP design purposes.

In the next section we will suggest some *EDP design heuristics* that may be of value for both platform design professionals and/or Living Labs practitioners.

5.1. Intention Lens: Proposed Design Heuristics

The following design heuristics are proposed to improve the way in which the LL approach informs EDP design when analysed from the perspective of the Intention Lens (see **Table 48**):

Table 1: Intention Lens: Design Heuristics

Intention Lens: Design Heuristics	
Objectives	
Key Design Problems	***What are objectives (explicit and implicit) of platform owners and designers?***
 ***Heuristic***	• Recognise that digital platforms are a different institutional form requiring specialised design process and "Platform Thinking". • Consistent application of LL required through all design iterations to actively engage with the balance between social and technical elements of platform design. • Attempt to create continuity of the Platform Development team and their approach to objective re-validation. • Deliberate surfacing of *forced design objective compromises* required, especially in resource-constrained contexts. • *Deliberate surfacing of especially implicit objectives* required through all design iterations. • Re-validate platform institutionalisation and embedding of ownership over design iterations.
Values	
Key Design Problems	***What are the (explicit and implicit) values underlying this design process?***

Intention Lens: Design Heuristics	
Heuristic	• Recognise that digital platforms are a different institutional form requiring specialised design process and “Platform Thinking”. • Re-validate platform stakeholder value alignment through all design iterations cognisant of platform emergence that may add new sides/re-prioritisation of sides over design iterations. • Consistent application of LL required through all design iterations to actively engage with the balance between social and technical elements of platform design. • Consistent and deliberate confirmation of changes in context and its impact on design values adopted through all design iterations. • LL needs to inform technology decisions more effectively and specifically the introduction of external dependencies due to forced pragmatism as this may often require value re-validation. • Add friction to technical technology design value choices even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality.
Context	
Key Design Problems	**What is the context in which this design process takes place?**
Heuristic	• Recognise that digital platforms are a different institutional form requiring specialised design process and “Platform Thinking”. • Re-validate platform stakeholders through all design iterations cognisant of platform emergence that may add new sides/re-prioritisation of sides over design iterations. • Consistent application of LL required through all design iterations to actively engage with the balance between social and technical elements of platform design. • Consistent and deliberate confirmation of contextual relevance required through all design iterations. • LL needs to inform technology decisions more effectively and specifically the introduction of external dependencies due to forced pragmatism. • Add friction to technical technology design choices even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality.

5.2. Concretisation Lens: Proposed Design Heuristics

The following design heuristics are proposed to improve the way in which the LL approach informs EDP design when analysed from the perspective of the Concretisation Lens (see **Table 49**):

Table 2: Concretisation Lens: Design Heuristics

Concretisation Lens: Design Heuristics	
Platform Type	
Key Design Problems	**What type of platform is being designed (explicitly and implicitly)?**
Heuristic	• Recognise that digital platforms are a different institutional form requiring specialised design process and "Platform Thinking".
Ecosystem	
Key Design Problems	**How is the platform ecosystem being designed?**
Heuristic	• Recognise that digital platforms are a different institutional form requiring specialised design process and "Platform Thinking". • Re-validate platform stakeholders through all design iterations cognisant of platform emergence that may add new sides/re-prioritisation of sides over design iterations. • Consistent application of LL required through all design iterations. • LL needs to inform technology decisions more effectively and specifically the introduction of external dependencies due to forced pragmatism. • Add friction to technical technology design choices even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality.
Components	
Key Design Problems	**How are the platform components being designed?**
Heuristic	• Recognise that digital platforms are a different institutional form requiring specialised design process and "Platform Thinking". • LL needs to inform the EDP design process from a deeper and more holistic "planetary-scale computation" perspective rather than focusing mainly on what is visible to end-users. • Add friction to technical technology design choices even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality • LL needs to inform technology decisions more effectively and specifically the introduction of external dependencies due to forced pragmatism. • Consistent application of LL required through all design iterations

Concretisation Lens: Design Heuristics	
Value Creation Mechanisms	
Key Design Problems	***How are the platform value creation mechanisms being designed?***
Heuristic	• Recognise that digital platforms are a different institutional form requiring specialised design process and "Platform Thinking". • LL needs to inform the EDP design process from a deeper and more holistic "planetary-scale computation" perspective rather than focusing mainly on what is visible to end-users. • LL needs to inform decisions around the role of data more comprehensively and critically throughout all design iterations. • LL needs to inform technology decisions more effectively and specifically the introduction of external dependencies due to forced pragmatism. • Add friction to technical technology design choices even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality. • Consistent application of LL required through all design iterations.
Governance	
Key Design Problems	**How is the platform governance being designed?**
Heuristic	• Recognise that digital platforms are a different institutional form requiring specialised design process and "Platform Thinking". • Consistent application of LL required through all design iterations to actively engage with the balance between social and technical elements of platform design. • Add friction to the design choices of architecture-governance alignment when creating online social communities even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality. • Add friction to technical technology design choices even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality. • LL needs to inform technology decisions more effectively and specifically the introduction of external dependencies due to forced pragmatism.
Platform Competition	
Key Design Problems	**How is the platform being positioned within the competitive landscape?**

Concretisation Lens: Design Heuristics	
Heuristic	• LL needs to inform technology decisions more effectively and specifically the introduction of external dependencies due to forced pragmatism.

5.3. Implementation Lens: Proposed Design Heuristics

The following design heuristics are proposed to improve the way in which the LL approach informs EDP design when analysed from the perspective of the Implementation Lens (see **Table 50**):

Table 3: Implementation Lens: Design Heuristics

Implementation Lens: Design Heuristics	
Launch	
Key Design Problems	**How is the platform launch being designed?**
Heuristic	• Recognise that digital platforms are a different institutional form requiring specialised design process and “Platform Thinking”. • Focus LL process on clarifying launch design and ensure that all elements are designed to create generative entrenchment with all relevant sides of platform through all design iterations (especially managing the “chicken-and-egg” challenge). • Consistent application of LL required through all design iterations.
Operations and Process	
Key Design Problems	**How is the platform scaling being designed?**
Heuristic	• Recognise that digital platforms are a different institutional form requiring specialised design process and “Platform Thinking”, as well as different operational processes and systems to sustain and scale. • Focus LL deliberately on engaging with barriers to scaling on all sides of platform through all design iterations. • Attempt to create continuity of Platform Development team and their approach to objective re-validation. • Focus LL deliberately on engaging with barriers to institutional adoption, acceptance and integration on all sides of platform through all design iterations. • Consistent application of LL required through all design iterations.
Sustainability	
Key Design Problems	**How is the platform’s adaptation (sustainability/relevance) to context being designed?**

Implementation Lens: Design Heuristics	
 ***Heuristic***	• LL needs to focus on clearer understanding and re-validation of mega-platforms as gravitational forces for EDP participants/possible users throughout all design iterations. • Recognise that digital platforms are a different institutional form requiring specialised design process and "Platform Thinking" as well as different mechanisms of sustainability. • Consistent application of LL required through all design iterations to actively engage with balance between social and technical elements of platform design. • Consistent application of LL required through all design iterations.

5.4. Evaluation Lens: Proposed Design Heuristics

The following design heuristics are proposed to improve the way in which the LL approach informs EDP design when analysed from the perspective of the Evaluation Lens (see **Table 51**):

Table 4: Evaluation Lens: Design Heuristics

Evaluation Lens: Design Heuristics	
Meeting Objectives	
Key Design Problems	**How is the success of the design process in terms of meeting the design intentions measured?**
 ***Heuristic***	• Recognise that digital platforms are a different institutional form requiring specialised design process and "Platform Thinking" as well as different measures of success. • LL needs to measure attainment of design objectives of EDP design process from a deeper and more holistic "planetary-scale computation" perspective rather than focusing mainly on what is visible and conveniently accessible and easy to measure. • Focus LL deliberately on engaging with barriers to institutional adoption, acceptance and integration on all sides of platform through all design iterations. • Consistent application of LL required through all design iterations.
Value Realisation	
Key Design Problems	**How is the success of the design process in terms of meeting the value realisation intentions measured?**

Evaluation Lens: Design Heuristics	
Heuristic	• LL needs to measure attainment of design objectives of EDP design process from a deeper and more holistic “planetary-scale computation” perspective rather than focusing mainly on what is visible and conveniently accessible and easy to measure. • Add friction to the design choices of architecture-governance alignment when creating online social communities even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality. • Add friction to technical technology design choices even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality. • LL needs to inform technology decisions more effectively and specifically the introduction of external dependencies due to forced pragmatism. • LL needs to inform decisions around the role of data more comprehensively and critically throughout all design iterations.

Value Capture	
Key Design Problems	**How is the success of the design process in terms of meeting the value capture intentions measured?**
Heuristic	• LL needs to measure attainment of design objectives of EDP design process from a deeper and more holistic “planetary-scale computation” perspective rather than focusing mainly on what is visible and conveniently accessible and easy to measure. • Add friction to the design choices of architecture-governance alignment when creating online social communities even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality. • Add friction to technical technology design choices even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality. • LL needs to inform technology decisions more effectively and specifically the introduction of external dependencies due to forced pragmatism. • LL needs to inform decisions around the role of data more comprehensively and critically throughout all design iterations.
Feedback	
Key Design Problems	**How are the lessons learned (feedback) in the design process communicated and utilised to inform learning and appropriate adaptation of design to context to attain objectives?**

Evaluation Lens: Design Heuristics	
Heuristic	• Consistent application of LL required through all design iterations. LL application in EDP contexts requires a high iteration rate and fast learning (design/re-design) cycles.

5.5. Emergence Lens: Proposed Design Heuristics

The following design heuristics are proposed to improve the way in which the LL approach informs EDP design when analysed from the perspective of the Emergence Lens (see **Table 52**):

Table 5: Emergence Lens: Design Heuristics

Emergence Lens: Design Heuristics	
Scaling Design	
Key Design Problems	**How is the emergence of the platform deliberately designed in each phase?**
Heuristic	• Recognise that digital platforms are a different institutional form requiring specialised design process and "Platform Thinking" as well as different measures of success.
Scaling Evolution	
Key Design Problems	**How is the design of the emergence of the platform externally influenced by contextual factors?**
Heuristic	• Recognise that digital platforms are a different institutional form requiring specialised design process and "Platform Thinking" as well as different measures of success. • Consistent application of LL required through all design iterations. LL application in EDP contexts requires a high iteration rate and fast learning (design/re-design) cycles.
Architecture-Governance Alignment	
Key Design Problems	**How is the alignment of the platform's architecture and governance designed?**
Heuristic	• Consistent application of LL required through all design iterations. • Recognise that digital platforms are a different institutional form requiring specialised design process and "Platform Thinking". • Consistent application of LL required through all design iterations to actively engage with the balance between social and technical elements of platform design. • Add friction to the design choices of architecture-governance alignment when creating online social communities even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality. • Add friction to technical technology design choices even though this may need to be balanced with project objective constraints such as balancing of scope, time, cost and quality. • LL needs to inform technology decisions more effectively and specifically the introduction of external dependencies due to forced pragmatism.

6. Implications of Findings

Although we have highlighted the increasing infrastructuralisation of platforms (Plantin 2018), it bears mention that not all platforms do indeed become infrastructural behemoths. Emerging Digital Platforms, because they are attempting to create, grow and scale socio-technical systems within the increasingly monopolistic planetary-scale structure dominated by mega-platforms, find themselves with limited design choice between the walled gardens with low barriers to entry and very high cost of exit. Limits to their *capacity to design* also decrease their *freedom to design* as it limits their degrees of freedom of decision-making.

Therefore, as mentioned in **Chapter 5**, CR provides this study with a useful middle ground between developing "universal" design principles and mere sense-making, accepting that although the world is socially constructed at the same time it is not entirely so (Thapa & Omland, 2018).

It is our contention that if we analyse the LL approach itself may also present a wicked problem in the case of EDP design (applying the guidelines of Gleasure 2013 discussed in **Chapter 2**). The causal mechanisms on the design problem variables are difficult to isolate, with considerable overlap and blurry boundaries between the mechanisms, mediating influences and interactions identified in the ***UDUBSit*** case.

We should be mindful that co-creation is also not a panacea for all HEI platform design challenges, as it has its own perils and risk (Verhoef, van Doorn & Beckers, 2013). To minimise or avoid some of the co-creation risks, it is critical to focus on creating collaboration processes with perceived fairness and a sense of community (Gebauer, Füller & Pezzei, 2013).

To facilitate fairer and more equitable user participation in design processes, we believe that some friction in the design process is a desired outcome, especially if friction means more human interaction with the value creation mechanisms of emerging platforms and not just (as what we suspect may happen often in user co-creation processes) dealing primarily with interface level design input. Therefore, we believe that the Living Labs process needs to add deeper friction to design processes.

Our findings indicate that the application of LL in a higher education context may offer unique challenges, specifically as digital platform design processes require an active engagement with the re-positioning of digital platforms as an emerging new institutional form. Our analysis of the literature, confirmed by our analysis of the ***UDUBSit*** case, indicated that this engagement process may currently be lacking, resulting in certain potential blind spots in design processes that may have the unintended consequence of exacerbating inequality rather than providing disempowered communities and South African HEIs with opportunities to develop more impactful and sustainable digital technologies to address their multitude of societal challenges.

7. Limitations of the Study

We are consciously aware of the limited nature of our enquiry. We recognise that LL is but one of the wide ranges of potential approaches within the innovation landscape showing promise to address the design complexities of digital platforms in a higher education context in South Africa. (For a comprehensive overview of the innovation landscape and the positioning of LL therein, see Salminen et al. (2011), Almirall et al. (2012) and Schuurman (2015).

We are aware that the DSR discourse in Information Systems (see Thakurta et al., 2017) is a rather distinct subset of the broader design discourse in academic and non-academic discourse. The concept of design is broadly applied in divergent contexts as Architecture, Engineering, Art, Economics, Evolutionary Biology, Political Science, Policy Studies and many others.

In our analysis of the ***UDUBSit*** case, we are aware of the fact that we were oversimplifying project ownership, as if it is a relatively simple and clear line of responsibility, whereas the matrix nature/internal political "power-political" nature of HE organisations often mean that reporting lines and/or ownership lines can be exceptionally muddled and dynamic or rather obscure (*"no one knows who is really responsible as ICT is everywhere and nowhere at the same time").* As a result of our focus on design decision rather than managerial decisions, we did not address the very important issues of digital leadership, such as the strategic engagement of organisational leaders in the totality of the complexity of digital transformation in terms of its organisational direction and strategic positioning.

We are conscious of the fact that this study is examining a higher education context that is also dynamic, especially against the background of large-scale, global disruption of institutions, processes, technologies and the long accepted "way things have always been done" in HE. In our approach, we endeavoured to focus on identifying the deeper underlying mechanisms driving the shifts in the "tectonic" plates of the foundations of HE in South Africa.

The study focuses mainly on the higher education context South Africa, a country with one of the most unequal societies in the world[118]; therefore, its generalisability may be limited to other, more privileged developed economic contexts.

The emerging digital platform we examined specifically aimed to build a mobile application/s. Not all our observations, findings or design heuristics may necessarily be transferable to different types of digital artefacts (for example, the recent emergence of the "metaverse" augmented reality/virtual reality concept may require a completely different approach to the application of LL in digital platform design.

The positive aspects of the LL approach did not accrue to the entire EDP being designed, but only to the one side, resulting in an illusion of inclusive design, which, in developing contexts, may potentially result in an increase in platform design failures to scale.

The fact that we specifically studied a failure case, of which there are many in the South African and African context, does have its drawbacks. On the one hand it generated rich, perhaps unexpected insights into the blind spots and failures to deal with forced pragmatism in EDP design decisions. On the other hand, because there were significant capacity and resource constraints, it may have skewed our analysis into painting a bleak picture, where many more successful cases of course exist, where digital platforms are significantly empowering online communities and successfully creating and capturing local value.

[118] South Africa remains a dual economy with one of the highest, persistent inequality rates in the world, with a consumption expenditure Gini coefficient of 0.63 in 2015 according to the World Bank: https://www.worldbank.org/en/country/southafrica/overview#1

8. Contribution and Significance of Research

In this study, we critically evaluated the LL approach as an approach to co-creating the design and implementation process of specific digital artefacts.

Our case study analysis is the product of a four-year longitudinal research process focused on the development of a location-based, goal focused mobile application as an intended emerging social networking platform and emerging digital platform. The emerging social networking platform has been developed using the Living Labs methodology, with a particular in-case focus on digital inclusion and online community building using mobile technology within the context of a higher education institution in South Africa.

Therefore, the study contributes to the academic debate about emerging digital platforms, while simultaneously also generating potentially useful insights for designers grappling with the challenges of designing platforms for online community building and engagement, specifically in developing world contexts and HE contexts. The study contributes to addressing the current gap in the extant literature (as highlighted in **Chapter 3**) at the intersection of *Design Science Research*, *Digital Platform Design* and the discourse around *Living Labs*.

The following four categories of findings constitute the contribution of this study:

Firstly, the contribution this study makes to the IS body of knowledge is defining the *emerging digital platform* conceptually, and creating, refining and validating an analysis tool and conceptual model for the analysis of the application of Living Labs within the context of the design of an emerging digital platform within the specified context, namely HE in South Africa. In this regard, we proposed the *Emerging Digital Platform Lenses (EDP Lenses).*

Secondly, this analysis tool was applied to analyse three iterations of a (failure) case study of an EDP where the Living Labs approach was applied up to the end of the platform's existence, focusing on co-creation and iterative design, as well as overcoming real-life barriers encountered.

Thirdly, based on our analysis and findings, we present a comprehensive set of *EDP design heuristics* that may improve future LL applications in developing world EDP design contexts and HE contexts. The process of developing this proposed design analysis tool over the three design iterations of the case, incorporated lessons learnt about digital inclusion, user experience, end-user co-creation, platform institutionalisation, and the capabilities and limitations of mobile technology in a platform design context and user-community engagement. It also surfaced some critical and previously under-researched potential *design blind spots* and *forced pragmatic design compromises* that may hamper the more effective application in resource-constrained developing world contexts and HE contexts in particular – an area of Information Systems that remains largely unexplored in extant literature.

Fourthly, our understanding of platform design gained from three design iterations and our analysis of the Living Labs application process compelled us to critique the Living Labs methodology, informing this emerging methodology with valuable insights from our emerging platform design theory and design heuristics. The study also engaged in a critical analysis of the theoretical intersection of the LL methodologies (as an emerging theoretical area) and DSR, specifically highlighting the positioning of EDP design as a wicked design problem that is not immune to the tensions and power dynamics created by planetary-scale computation as design context, but also through the introduction of limits to the *freedom of design*. These pragmatically forced design decisions are often obfuscated by the alluring convenience of the introduction of dependencies on external mega-platforms because of its convenience and superior cost-benefit analysis in financial terms.

9. Further Research Opportunities

In the field of Information Systems our understanding of digital platforms is still in the middle of the maturity curve (De Reuver, Sørensen & Basole, 2017). This study made a limited contribution to the scoping of digital platforms by defining *emerging digital platforms* (EDPs) within the typology of digital platforms, a typology that is still largely unclear in IS (De Reuver, Sørensen & Basole, 2017). A further opportunity may be the expansion of the EDP concept to position more clearly whether it should be approached as a type of platform *per se,* a measure of maturity, or both.

Possible opportunities may exist for comparative reviews of EDP design processes in similar or near similar HEI contexts. This may assist in contributing to further rigorous validation of the *EDP Design Lenses* as analytical framework, as well as the *EDP design heuristics* as possible basis of an EDP design toolset.

The balancing within EDP design processes of “retention of control” decisions against available resources and skills available to conceptualise, concretise and implement EDP design processes is furthermore an area that may require further research, specifically in the HEI context.
The value of the LL approach to DSR methodologies is centred on its openness, co-creation and evaluation of the design of digital artefacts beyond merely the organisational context (Thapa et al., 2014). A logical further research opportunity will be to investigate whether the same LL failures we observed in the ***UDUBSit*** case holds true for organisational contexts with more capacity to design and less resource constraints. It is quite possible that better capacitated and resourced emerging digital platform design projects may have increased ability to surface and mitigate design blind spots and pragmatically forced compromises. However, this question would need to be investigated in more detail.

This study did not expand in detail on the methods or tools already available within the LL approach that can be included in EDP design processes to add meaningful friction. The creation of a typology of LL co-creation tools mapped to each EDP *Design Lens* and/or aligned to the EDP *design heuristics* may be a worthwhile exercise.

Our study highlights certain weaknesses, blind spots and forced pragmatic compromises, but also opportunities within the application of LL in the design context of HE in South Africa. The impact of addressing these blind spots and mitigating forced pragmatic design compromises to the success of EDP design projects, may also offer opportunities for further research, which may benefit from the refinement of the EDP *Design Lenses* into a more user-friendly format, including, for example, the development of co-creation design input maturity scales.

As argued in **Chapter 2**, digital platform design has largely been informed by *ex-post* studies of successful cases rather than failure cases (De Reuver, Sørensen & Basole, 2017). It will therefore be beneficial to conduct more case study research of failure cases of EDP design projects with the aim of creating more direct design knowledge.

The changing nature of co-creation (and Living Labs as an approach) within the context of planetary-scale computation is also an area that may benefit from further research. Bergvall-Kåreborn et al. (2010) highlight the difference in participatory Design between designing for users, designing with users, and designing by users; however, the emergence of "non-human users" and its (often invisible) force fields it introduces in participatory design processes needs to be better understood.

A further avenue of research may be the development of a comprehensive design theory of emerging digital platforms, specifically bearing in mind that these design processes have different boundaries and barriers than the much more intensively researched mega-platforms.

10. Conclusion

In this chapter, the implications of our findings and suggested recommendations based on our analysis of the ***UDUBSit*** case study in **Chapter 7** were presented. We focused on identifying from a Critical Realist perspective (as discussed in **Chapter 5**) the mechanisms by which Living Labs may have informed (or not informed) this design process and reflecting on its implications.

Power, in the context of digital platforms, (as discussed in **Chapter 1 & 2**) is primarily predicated on the ability to harness the predictive power of digital technology assemblages to create generative and entrenched loops of data-driven, seamlessly mediated value creation activities between platform sides within an ecosystem.

The structured literature review conducted in **Chapter 3**, investigated the intersection in literature between Digital Platforms (DPs), Emerging Digital Platforms (EDPs) and Living Labs (LL), specifically in the context of Higher Education (HE) in South Africa. The findings of this literature review indicated that the Information Systems (IS) discourse may benefit by addressing the gap in literature at the intersection of these concepts, particularly given the fact that there may be potential for EDPs to contribute to the innovation strategies of HEIs (see **Chapter 1**).

To sustain a platform, a strategic minimum of new content needs to be produced into its own communication economy (Bratton, 2015). The mediation of user inputs needs to be value-adding for users. The platform needs to be able to mediate, in real-time (or preferably predictively), value-creating interactions, thereby increasing the perceived value for users. A platform needs to be extensible (through API's and SDK's) and empower its users to modify and adapt the platform so that more value can be created, mediated, accelerated and sustained for more users.

The ***UDUBSit*** case (as presented in **Chapter 6** and analysed in **Chapter 7**) showed clear evidence that the actors in the design process failed to become empowered to design, build and sustain these generative mechanisms (and the requisite architecture-governance alignment) required for a digital platform to grow and scale.

However, upon analysis of the case study data over the three design iterations, it became evident that this failure was affected by more than the mere lack of technical capacity to design and build digital artefacts within a resource-constrained context.

EDP Design, in the case of ***UDUBSit***, presented a *wicked problem.* However, it is our contention that the application of the LL approach in EDP design processes also presents a *wicked design problem*. The ineffective application of LL within EDP contexts may have a deleterious impact on value creation and value capture. It may also fail to engage with the true mechanisms of platform scaling and growth unless the *design blind spots* and *forced pragmatic design compromises* highlighted are addressed.

The LL approach, as applied in the ***UDUBSit*** case, failed to surface or mitigate key barriers to the design of the EDP and informed the design process inconsistently and with significant blind spots and design decisions that (conveniently, non-critically and/or pragmatically) compromised the intended design objectives, values and various other elements within the design process.

In **Chapter 8**, the *Emerging Digital Platform Lenses* were applied as a conceptual framework to present and structure a set of *EDP design heuristics* for EDP design processes as a design toolset. These heuristics may assist with informing EDP design projects to better meet the platform owner's and platform designers' intended value creation and value capture objectives.

The study contributes to the academic discourse about emerging digital platforms, while simultaneously also generating potentially useful insights for designers grappling with the significant challenges of emerging platform design, specifically in developing world contexts and higher education in particular.

In conclusion, digital platforms, and the mega-platforms within the emergent structures of planetary-scale computation in particular, act as mediating factors for the distribution of control within ecosystems. In this process, it often leads to an obfuscation of design roles. Responsibilities become blurred, roles become reversed, overlapping or irrelevant. As digital platforms grow and expand, it tends to diverge. However, as it distributes and shares, it centralises and blurs. As data and interfaces and technologies become more seamless and invisible, power becomes obscured. As power becomes obscured, control over data, interfaces and technologies diminish even more for the ordinary user (especially when power relations between users and organisations/institutions/governments are highly unequal to begin with). Disempowerment may become seamless and invisible as it is cloaked in frictionless convenience.

The emergence of mega-platforms, not only as monopolistic and power-driven actors, but also as hardening manifestations of geo-political structures in their own right, presents significant barriers to emergent digital platforms and digital platform design. Platform designers, especially in resource-constrained contexts, would need to engage more directly with the different perspectives on digital platform design and engage more critically with their assumptions held about co-creation approaches such as Living Labs.

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Annexures

A. Ethics Clearance Documentation

UNIVERSITY *of the* WESTERN CAPE

YEARS *of hope, action & knowledge*

14 October 2020

Mr WJ Grove
Information Systems
Faculty of Economic and Management Science

Ethics Reference Number:	HS17/9/20
Project Title:	Applying living labs in the design of emerging digital platforms – a higher education case study in South Africa.
Approval Period:	09 October 2020 – 09 October 2023

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report by 30 November each year for the duration of the project.

The permission to conduct the study must be submitted to HSSREC for record keeping purposes.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

Director: Research Development
University of the Western Cape
Private Bag X 17
Bellville 7535
Republic of South Africa
Tel: +27 21 959 4111
Email: research-ethics@uwc.ac.za

NHREC Registration Number: HSSREC-130416-049

FROM HOPE TO ACTION THROUGH KNOWLEDGE.

UNIVERSITY *of the* WESTERN CAPE
Department of Information Systems

INFORMATION SHEET FOR PARTICIPANTS IN FOCUS GROUP RESEARCH

Dear participant

Wouter Grove (Student no: 2565753) – Degree PhD (Information Systems)

The title of my thesis is: **Applying Living Labs in the design of emerging digital platforms –a higher education case study in South Africa**

Please take time to read through this information sheet carefully in order for you to be knowledgeable on what is required of you as a research participant in this study.
As a participant who gave consent for your participation in this study, you will be required to:

1. ***Attend a short presentation on the UDUBS-it case under investigation and its concepts (taking approximately 15 minutes).***
2. ***Reflect on your experience with regards to the UDUBS-it mobile application and/or the staff portal of the application, and the design process followed. (taking approximately 45 minutes).***
3. ***Ask clarifying questions about the case***
4. ***Provide your comments, recommendations and rating of the UDUBS-it case, in order to improve the application and design process. This will be facilitated through the completion of a short focus group evaluation sheet.***

Your participation in this study is voluntary and no remuneration will be provided in return for your contribution. You remain free not to participate and have the right to withdraw from the study at any time without the need to provide any reason for such withdrawal. Your participation in the online survey process might result in research which may be published, but your identity will never be revealed. The researcher will ensure your anonymity throughout the research process.

If you have any questions concerning this research, feel free to contact me or my supervisor:

Wouter Grove | Cell phone: 076 449 2227 | (wgrove@uwc.ac.za)
Dr Johan Breytenbach | Cell phone: 0837088444 | (breytenbachj@gmail.com)

I hereby consent voluntarily to participate in this study. I have been given a copy of this form.

__________________________ __________________________

Name of participant **Date**

Email:____________________________________

Thank you for participation in my study.

UNIVERSITY *of the* WESTERN CAPE

Department of Information Systems

Letter of Consent

CONSENT FORM FOR FOCUS GROUP PARTICIPANT

I, ………………………………………………………………, have had the opportunity to ask questions related to this study and obtained satisfactory answers to my questions.

I have also received any additional information that I may have requested about this research.

I agree to participate in this research.

I understand that my participation in this study is voluntary and that no remuneration will be provided in return for my contribution. I am free not to participate and have the right to withdraw from the study at any time without the need to provide any reason for such withdrawal.

I am aware that the focus group outcomes might result in research which may be published, but that my identity will never be revealed. It is my understanding that the researcher will ensure my anonymity throughout the research process.

I retain the right of refusal to answer any question which I do not feel comfortable or able to respond to.

Date:	………………………………………………………………
Participant Name:	………………………………………………………………
Participant Signature:	………………………………………………………………

Interviewer name:	**Wouter Grove**
Interviewer Signature:	………………………………………………………………

If you have any questions concerning this research, feel free to contact me: Wouter Grove, Cell phone: 076 449 2227, wgrove@uwc.ac.za or my Supervisor Dr Johan Breytenbach, Cell phone: 0837088444

UNIVERSITY *of the* WESTERN CAPE
Department of Economic and Management Services

INFORMATION SHEET FOR PARTICIPANTS IN RESEARCH QUESTIONNAIRE/SURVEY

Dear participant

Wouter Grove (Student no: 2565753) – Degree PhD (Information Systems)

The title of my thesis is: **Applying Living Labs in the design of emerging digital platforms –a higher education case study in South Africa**

Please take time to read through this information sheet carefully in order for you to be knowledgeable on what is required of you as a research participant in this study.

As a participant who gave consent for your participation in this study, you will be required to:

1. ***Participate in a short online survey (taking approximately 20 minutes). The survey questions are about the UDUBS-it case under investigation and its design.***
2. ***If selected to do so, engage in a conversation with the researcher to verify the validity of the survey results for your role.***

Your participation in this study is voluntary and no remuneration will be provided in return for your contribution. You remain free not to participate and have the right to withdraw from the study at any time without the need to provide any reason for such withdrawal. Your participation in the online survey process might result in research which may be published, but your identity will never be revealed. The researcher will ensure your anonymity throughout the research process.

If you have any questions concerning this research, feel free to contact me or my supervisor:
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______________________________ ______________________________

Name of participant **Date**

Email:____

Thank you for participation in my study.

UNIVERSITY *of the* WESTERN CAPE

Department of Economic and Management Services

Letter of Consent

CONSENT FORM FOR QUESTIONNAIRE

I, ……………………………………………………………, have had the opportunity to ask questions related to this study and obtained satisfactory answers to my questions.

I have also received any additional information that I may have requested about this research.

I agree to participate in this research.

I understand that my participation in this study is voluntary and that no remuneration will be provided in return for my contribution. I am free not to participate and have the right to withdraw from the study at any time without the need to provide any reason for such withdrawal.

I am aware that the questionnaire might result in research which may be published, but that my identity will never be revealed. It is my understanding that the researcher will ensure my anonymity throughout the research process.

I retain the right of refusal to answer any question which I do not feel comfortable or able to respond to.

Date:	**……………………………………………………………**
Participant Name:	**……………………………………………………………**
Participant Signature:	**……………………………………………………………**
Interviewer name:	**Wouter Grove…………………………**
Interviewer Signature:	**……………………………………………………………**

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