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Innovations in Higher Education

Cases on Transforming and Advancing Practice

Edited by Dominique Parrish and Joanne Joyce-McCoach

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Edited by Dominique Parrish and Joanne Joyce-McCoach

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Contents

Preface XIII

Section 1
Educational Innovations That Promote or Foster Student Success 1

Chapter 1 3
Transformative Teaching of Engineering in Sub-Saharan Africa
by Kant Kanyarusoke

Chapter 2 27
Interdisciplinary Engagement in Higher Education: Opportunities Explored
by Usha Iyer-Raniga

Chapter 3 45
The Social Intrapreneurship, Innovating in the Competences Delivered to Students: Case Engineering Students of the University of La Serena, Chile
by Segundo Ricardo Cabana Villca

Chapter 4 59
A Responsive Higher Education Curriculum: Change and Disruptive Innovation
by Maureen Snow Andrade

Chapter 5 75
Learning Innovations for Identifying and Developing Talent for University
by Mel Henry, David C. Gibson, Charles Flodin and Dirk Ifenthaler

Section 2
Operational Innovations That Transform or Advance Practice 93

Chapter 6 95
Planning for Improvement: Leadership Development among University Administrators
by Tracy L. Morris and Joseph S. Laipple

Chapter 7 **111**
Talent Management as a Core Source of Innovation
and Social Development in Higher Education
by Atheer Abdullah Mohammed, Abdul Hafeez-Baig and Raj Gururajan

Chapter 8 **143**
An Integrated Model for Invigorating Innovation and Entrepreneurship
in Higher Education
by Teboho Pitso

Preface

Higher education is on the brink of major reformation. There is little doubt that higher education has contributed to the development of countries and their competitiveness in a global marketplace as well as informing national policies and driving modernization. However, if higher education is to remain relevant and meet the demands of an ever-changing world, institutions and their operations must progress in unison with the changing world in which they function. Innovations create new or significantly improved ways of operating and may be distinguished by their degree of novelty. Innovation can play a critical role in transforming and advancing practice and therein address socio-economic, organizational, operational and social challenges. The complexity and scope of higher education opens up the possibilities and potential for innovations to transpire in diverse settings and contexts or be embedded in a range of products and services. This book provides the reader with a collection of easy-to-follow vignette-based higher education innovations that have transformed or advanced practice and in doing so contributed to ensuring the relevance and value of higher education in a continuously changing world.

This book is organised into two sections. The first section is a collection of vignettes focused on educational innovations that promote or foster student success and the second section examines more operationally focused innovations.

Section 1:
In the first vignette, Kant Kanyarusoke describes a teaching innovation transpiring in a South African university of technology that compels engineering students to identify solutions to common, authentic and 'real-world' problems drawn from the Sub-Saharan Africa region. This educational innovation explains how the learning activities are designed to promote students' discovery of potential regional engineering solutions, and in doing so develops their enquiry-based thinking and creativity. The use of student projects as an effective and efficient way of engaging with the local region is also posited. In the second vignette, Usha Iyer-Raniga outlines a course innovation that focuses on problem-solving approaches to societal issues. This interdisciplinary innovation encourages students to solve an authentic industry problem, which contributes to their development of creative thinking and sustainable practice in the context of built environments. The educational design is purported to enhance graduates' aptitude for urban sustainability, career readiness across various professions and employability skills particularly related to technical and professional competence. In the third innovation in this section, Segundo Ricardo Cabana Villca reports on an empirical study that sought to validate a causal model for social intrapreneurial behaviour, in a cohort of engineering students at a university in Chile. In validating the model, the study affirmed the importance of strengthening social innovation in the curriculum and the consequent benefits with regard to students' loyalty to the institution as well as their enhanced view of the teaching–learning process. The fourth innovation from Maureen Snow Andrade introduces the construct of disruptive innovation being a conduit for transforming approaches to program review, curriculum proposal and curriculum approval

with a view to providing current viable and relevant academic programs. The need for higher education institutions to keep pace with continually evolving global circumstances presents challenges that could be effectively translated into opportunities using the approach detailed in this vignette, which was adopted by a large regional university in the United States. In the last vignette in this section, Mel Henry, David C. Gibson, Charles Flodin and Dirk Ifenthaler examine a range of strategies that have been embedded in formal pathway and partnership programs to recruit, retain and develop talent in students. These programs, offered at an Australian university, target prospective and current students as well as engage with local schools and the wider community. Additionally, this vignette describes two frameworks that propose a means of addressing the collection and evaluation of evidence associated with future-ready learners, and a plan for situating technology innovations across domains of higher education learning and teaching.

Section 2:
Tracy L. Morris and Joseph S. Laipple, in the first vignette of section two, describe a study that used predictive factors including job satisfaction, burnout and turnover to identify effective leadership development strategies. For the study, 1142 academic leaders from US research institutions representing roles including department chairs/heads, directors, associate deans, deans, and associate provosts were surveyed to ascertain the strategies that were most likely to advance leadership development of academic administrators. Seeking advice from senior colleagues was identified as the most frequently reported strategy for improving leadership skills. In the second vignette of this section, Atheer Abdullah Mohammed, Abdul Hafeez-Baig and Raj Gururajan report on a two-phased study that included a systematic review of thirty-five international academic works, published between 2007 and 2017 that explored key aspects of talent management. This was followed by a qualitative multi-method study conducted in six Australian universities focusing on identifying the best practices used to manage attraction, development and retention of talent in the higher education context. The finding that talent retention is the major factor in sustaining competitive advantage will be a pivotal insight for higher education institutions that are reportedly encountering significant challenges in relation to talent management. In the final vignette conducted in five Scandinavian and three South Africa universities, Teboho Pitso examined the use of an integrated model for invigorating innovation and entrepreneurship and its relevance for optimising the social impact of higher education. This model consisted of three key elements, namely, faculty activities, activities of innovation hubs and entrepreneurial activities. The study targeted senior university staff managing innovation centres or entrepreneurship hubs. Interviews were conducted in the respective hubs and centres, which availed opportunities for the researchers to observe actual activities in context. An integrated model was developed that has the potential to enhance the social impact of universities through the innovation and entrepreneurship capability of individuals.

This collection of practical yet transformative innovations is a testament to the creative means by which higher education institutions are responding to the ever-increasing and varied demands of progress that are being enforced on them. The editors would like to thank all of the authors who have generously shared their innovations and

insights. The valuable information contained in this compilation of vignettes will be of great benefit to others embarking on a quest to remain competitive and relevant in our continually changing world.

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Section 1

Educational Innovations That Promote or Foster Student Success

Chapter 1

Transformative Teaching of Engineering in Sub-Saharan Africa

Kant Kanyarusoke

Abstract

This chapter advocates transformative teaching in later stages of sub-Saharan Africa's engineering students' study periods. The teaching is meant to help them discover their potential in direct solution of the region's engineering problems. Student attention can be drawn to many of these problems through transformative teaching. Two illustrative case studies are presented. They demonstrate how students at one South African University of Technology were enabled to address common, authentic and 'real world' problems in the course of their learning. A review of theory of teaching modes is given first, with more focus on transformative teaching. The cases follow. The first case seeds a maintenance and continuous improvement culture among successive student cohorts, eventually producing an evolved new product ready for the market in a period of about 5 years. The second case uses multi-level, multi-national students, deploying multi-sourced funds and working at multi-premises in difficult campus study circumstances, to develop completely new products that are field-tested at two sites about 6000 km apart. Benefits, limitations and challenges of the teaching and how to navigate the latter, are given. Following its substantial benefits and the ways to overcome its challenges, transformative teaching is recommended to all engineering academics in the region.

Keywords: continuous improvement, engineering education, sub-Saharan Africa, transactional teaching, transformative teaching, transmission teaching

1. Introduction

As an adult transformative learner and educator, I will introduce this chapter through some questioning. Is it right, that in a region with one billion people [1], 619 million of them [2], should in this 21st century, be in total darkness at night? And that over 300 million [3] should be sharing watering holes with both domestic and wild animals? That is rural sub-Saharan Africa. Now, let us leave the rural areas—from where many urban people, including this author, originate, and still have relatives and homes. Is it nature-ordained that people can live in filthy, crowded and 'man-made' disease prone areas [4–6] without any local educated person doing something about it—either out of philanthropy or out of pure business sense? We go on: Why should a country of 40 million people claim to find substantial crude oil or other mineral deposits, and yet, take a generation or two [7] to get the first extract from underground? Let us come to engineering faculties: **Figure 1** shows part of a 2-year-old engineering faculty building at one of the region's leading universities. They teach Maintenance Engineering at this university. Why should the building look as shown?

Figure 1.
Part of a 2-year-old engineering faculty building at one sub-Saharan Africa's university (author).

Different explanations for these rather awkward questions have been presented by different people and interests at different forums (e.g. [8–11]). They have included malaria, poverty, slavery, colonialism, dependency syndrome, lack of technology and knowhow, poor governance, etc. Almost anyone can come up with an explanation—provided that explanation excludes her or himself. It is not the intention of this chapter to take that route of exclusion. Nor is it that we should delve on the explanations much longer. Rather, as an engineering educator, I take a pragmatic approach and advocate owning up part of the responsibility to change the status-quo. This is because, whichever cause, or combination of explanations others give, nothing will change, unless some people with engineering knowledge and skills get up and try to do something. It has been said—rightly or wrongly—that Africa is not short of good or bad analysts, advisers, and even policy makers. In only 3 publications [12–14], for example, one can identify not less than 27 advisers and analysts. What the continent is most short of, are thoughtful doers that can transform its resources locally, to benefit its residents first, and others, next.

Therefore, this chapter on transformative teaching is about practice change in sub-Saharan Africa's engineering schools and faculties. It draws on a literature survey and experiential work in 4 universities in Eastern, Western and Southern African countries to show that the current dominant mode of teaching in the region's engineering faculties and colleges is not transformative. For reasons ranging from faculty expertise, to facilities, to student and national politics and economies [15], current higher engineering education practice in the region still heavily relies on transmission teaching. This chapter suggests changes to this practice, particularly during later semesters of students' studies. It illustrates the changes with detailed descriptions of two examples from the author's practices over the last 8 years. The examples tackle some of the questions posed above in a more direct way. Specifically, it illustrates how transformative teaching is being used to address 'real-world' authentic problems. The main thrust of the chapter is that even within limited resources and in relatively difficult environments, a thoughtful engineering educator can enable students to think and act proactively on problems faced by their societies and which are initially thought of, as intractable.

It is acknowledged that most African students coming into engineering faculties and colleges have, in their high school days, been conditioned to

non-transformative learning. This is because many schools' interests are more on percentage pass rates than on deep understanding (e.g. see [16–18]). One of the first steps for an engineering educator, therefore, is to transform the thought and attitudinal processes of the students in regard to learning itself. Secondly, these students have usually not had much practical work, either in Physics laboratories or in engineering workshops. A result of this is that they come to engineering with a bias towards theoretical analysis. Also, they have a deficit of practical and of 3-dimensional visualisation skills [19, 20]. The second stage in their minds-transformation, therefore, is to be nurtured into engineering as a practice—based, tangible results oriented activity, needing multidimensional thinking. Accomplishment of these two stages is not transformative teaching yet. It is a prerequisite though. We discuss transformative teaching in Section 2 and tailor it to the need for physical engineering changes in the region. This prepares the ground for illustrative case practices in Section 3. One case addresses the maintenance question. The second one, tackles multiple issues using potable water and energy sourcing as a two in one example. We discuss key results of the case studies and show opportunities and challenges to effecting changes in Section 4. Finally in Section 5, we summarise the chapter and conclude with a recommendation for implementation of transformative teaching in the region's engineering classes. The originality and value of this chapter is that it illustrates how an engineering educator on the continent could use meagre resources to make a start in transforming both the students' learning and the continent's engineering approaches to solve its problems.

2. Transmission, transactional and transformational teaching

In this section, we make a brief review of the three modes of teaching commonly listed in the literature. The purpose is partly to give a theoretical basis for the case studies in the next section, but more importantly, to create a clear understanding of where the students in the cases are coming from.

2.1 Transmission teaching

In Transmission teaching, the teacher acts as an 'all knowing' individual, passing knowledge and/or skills to attentive, receiving students [21]. Typically, the teacher sources delivery content from a prescribed textbook, often with help of an instructor's manual, and then talks or writes or demonstrates to the students what the source says. Ref. [22] points out, transmission teaching is rigid and mechanistic, bordering on being robotic. This means, the quality and real value of a human-teacher in this mode is badly degraded, and therefore, that it matters less, what kind of teacher is available to handle the class. On the learner side, according to [23], it encourages passive learning, with the students, thinking all there is to learn is what the teacher has transmitted.

Yet, transmission is the simplest and most convenient mode of handling large classes say, of 100 or more students. And through its amenability to use of standardised teaching and learning materials it has been the choice mode of teaching at primary, secondary and high school levels in sub-Saharan Africa (e.g. [24–26]). In almost all countries, this period is up to age 17–19 for a non-repeating learner. The mode is convenient at these levels partly because of age, but mainly because of the national examinations held at ends of each of these levels. In countries like Uganda [27], Ghana [28], Gabon [29], DRC [30], etc., pupils must first 'pass' these exams satisfactorily before going to the next level. In those countries attempting universal and compulsory primary and secondary education like South Africa, Botswana,

Uganda, etc., government financing pressures are forcing an emphasis on fast throughputs, and thus, both schools and pupils are exploiting the weaknesses of a transmission system through what is commonly called 'spoon feeding' and 'spotting' to pass, and eventually come to university. 'Spoon feeding' means the teacher literally tries to do whatever is possible for the pupil, leaving almost nothing for the latter to develop her/his thinking and study faculties. Spotting means the teacher tries to make intelligent guesses of what the national examiners will ask, and then focuses teaching effort only on that.

To summarise, many students coming to university or to engineering colleges, have had almost all their learning times subjected to a transmission type of teaching. A majority have been silent listeners in class, and it should not surprise us that this silence and passivity should be carried forward to our engineering classes. Likewise, the other habits of expectations to be spoon fed and to be told of scopes of assessments are brought to our classes. It is the calling of a conscientious engineering educator to wean them off those expectations and nurture them into a new world of self-driven enquiry, innovation and creativity. Particularly, for the region in question, this is critical because of its level of underdevelopment, limited financial resources, and scarcity of technical personnel at all levels of engineering in each country [30]. Transformative teaching, as described in this chapter's case studies, is intended to demonstrate this nurturing and its potential effects on the wider society outside the universities. However, it requires that the students have matured a bit in their engineering thought and practices so that they can have something to reflect on and challenge. This necessitates a transition through transactional teaching, which we briefly describe next.

2.2 Transactional teaching

Transactional teaching deviates from transmission in sense that, the students are more engaged in physical activities that enhance their exploration of knowledge. They are exposed to experiences that enable them to learn through direct discovery and through sharing of these experiences among themselves and with the teacher. The teacher's principle role in this mode is to manage the learning. Ref. [31] advises and demonstrates through a case study on a class of teacher educators, that this mode of teaching is highly reflective: starting with the planning of activities the teacher will get the students involved in, availing the resources, space and support during the activities and report backs, and finally in interpreting the outcomes of the activities and how they may have been evidence of achievement of the desired learning outcomes. The basis of enhancing learning through this mode is according to Dewey, extensively cited, in [32], similar to Darwin's evolution theory, in which constant interactions with an environment causes organisms to develop features that sustain survival in that environment [33]. In other words, student constant exposure to carefully planned and executed practical experiences will tend to lead to natural adaptation for learning and retaining lessons from those experiences longer.

For the kind of student received in many African engineering faculties, i.e., one who has not been exposed to much engineering, or even, to normal physics practical work previously, and who, during most of the past study time, has been used to transmission teaching, the reflective part of the teacher, should help design activities to wean this student. Therefore, transactional teaching in the region's engineering faculties could be looked at as a first step in reorienting the study styles of the students. But as this chapter is about transformative teaching, and as the students in the cases of Section 3 are towards the ends of their studies, we will not pursue transactional teaching beyond this point. Interested readers can refer to the works in Refs. [34–38] on the mode.

2.3 Transformative teaching and learning

In the first part of this section, we will describe and relate transformative teaching to the case studies described later. Then, in the second subsection, we will outline methods of using it.

2.3.1 What is transformative teaching?

In the literature, many writers (e.g. [39–45]) present transformative teaching as directed to adults or to people who have had previous experiences that shape their current viewpoints and outlooks on existing situations and issues. It then seeks to help them change those viewpoints presumably, for improvement of their understanding of the issues and situations. It was best championed by Jack Mezirow in late 1980s [46, 47], but two other thinkers, Robert Boyd [48] and Paulo Freire [49] made useful circumstantial contributions. Mezirow postulated what is called a perspective model of transformative learning. Here, the learner confronts a dilemma which requires her/him to critically examine and question pre-existing assumptions and beliefs. These assumptions are typically stereotypical and embedded in either culture or norms of a society. In most of sub-Saharan Africa engineering faculties, an example could be that 'engineering is a male's profession' or 'women are better off in industrial and chemical engineering than in mechanical and civil engineering'. Both case studies demonstrate that female students in Mechanical Engineering can be enabled not only to find the area interesting, but that they can also be very useful and motivational members of engineering teams. An even more striking belief the author had to confront among his industrial workers in Uganda, East Africa at the close of the last century, was: 'new production machinery needs blood sacrifice to be installed properly'. Here, the belief was turned upside down to motivate peak performance during installation by promise of a big celebratory 'bull roasting' after—*not before*—successful installation. A similar approach of promises for, and actualisation of, celebrating engineering project successes, has since been used in student projects to motivate maximum learning effort.

Boyd introduced the analytical model of transformative learning. Rather than focus on society beliefs, this model pushes the learner to re-examine her/his inner self to seek personality changes that will enable solution of the problem on hand. The learner tries to identify traits, personal behaviours or previous own long term effect experiences that may be impeding understanding or performing the current task. In the case of the author for example, three entire household item losses in his childhood due to fires in grass-thatched homes, had left a semi-permanent impression on him by the time he came to study engineering. So, when it came to materials selection in Machine Design courses, wood/timber and many other easily combustible materials were treated as off limit. That is—till he had to supervise an undergraduate student who could only cost effectively accomplish his final year project using timber, as a machine frame material [50]. May be, as we will see later in the chapter, this impression mildly lingers on, because the decision to focus his research on solar energy engineering, and use solar energy systems in his current non grass thatched village home(s) was partly to do with their safety.

For the intellectual class in Africa, perhaps the most appealing mode of transformative learning is the so called 'Emancipatory' model, introduced by a radical Brazilian intellectual, Paulo Freire. The model looks not just at individuals, but at whole societies and socio-political-economic systems that keep some of these societies less developed than others. The teaching is then meant to help learners to critically examine these systems and change attitudes, approaches and actions so that they may work for a more equitable society. In the opinion of this

author, while some of this may look extreme, there is merit in questioning the current world economic order and the so called laws that regulate it. For example, the 'law' of comparative advantage [51]: each country or society producing what it does best, and buying everything else from countries that produce those other goods better. What if—as happens in Africa—a country's best output is of low value: how will it ever raise money to buy the other goods of higher value? The answer is partly in Engineering, and partly in rejecting that comparative advantage law. Countries need engineering to convert resources within their borders into useful products for their people and for others outside who may need them. But development of engineering skills and of top quality products is a dynamic process requiring time. In that intervening time, it is absolutely essential to identify, or even to create, local and external captive markets that can take the evolving products at the prices the captive markets can afford. In Section 4 of this chapter, we will find that this is one of the main things the author tries to sensitise his students about.

2.3.2 Elements and methods of transformative teaching

Mezirow listed 10 stages of transformative learning as in [52, 53]. Briefly, they convey three themes: a recall of past experiences; an unbiased critique of those experiences in light of the present situation; and a rational change of course of action in a new dispensation. To facilitate these, Christie et al. [54] advise that transformative teaching involves doing the following:

- Creation of targeted experiences for students, so that they can reflect on the past
- Melding the art and science of a problem, so that all its features can come to the fore
- Creating an enabling environment so that students care and take charge of their learning
- Modelling symphonic thinking so that students can create a more holistic and balanced solution
- Facilitating productive struggle, so that the students will appreciate and value the solutions and learning better.

How are these actions done? Slavich and Zimbardo [55] outline a method the author prefers to use for the reasons given in each step as:

- First, communicate and share the vision of the course with the students. This creates a shared mission, and common objectives, making the students feel you regard their eventual success as yours too.
- Then, provide unquestionable mastery experiences in what you are teaching. This creates authenticity.
- Give intellectually challenging assignments and motivate the students along the way. This helps them to learn deeper.
- Personalise attention and feedback. This makes each student feel noticed and valued.

- Provide experiential work outside the formal class room and times. This creates some realism on what is being done.

- In all these steps, encourage students to reflect on the work so far, and perflect (i.e. imagine what final solution they envisage). Particularly at the one on one feedback interaction, let them share their learning experiences. This provides an opportunity to redirect the learning if there is need.

In summary, transformative teaching should enable students master the particular topic/assignment to the extent that the knowledge and skills so gained, are irreversible. We will not go into the details of the theories behind this irreversibility but they are listed in [55] as: Piaget's constructivism [56]; Vygotsky's social constructivism [57]; McGregor's Transformative learning [58]; Bandura's social cognitivist [59]; Boyatzis' intentional change [60]; and Bass' transformational leadership theory [61]. We will now turn to the case studies demonstrating this transformative teaching.

3. Case studies

We started this chapter with a set of questions. Although any other question could randomly have been asked, these particular ones were not. They do reflect some of the issues the author tries to address with his students. In this section, we will illustrate two different cases: evolution of water purifying system case study that addresses both energy sourcing and clean water generation at rural home level; and development of a maintenance culture as early as possible in the students' engineering professional journey. The latter case is entirely at undergraduate mechanical engineering level, but it includes research and action elements in non-engineering areas. This is to help the students uncover the totality of the project assignment because the system they work on must in the end be saleable or actionable. The water-energy project is more complex. It is a multi-level project by mechanical engineering students. National diploma, Bachelors, Masters and a Doctoral student are involved. In addition, it is intentionally made pan Africanist in sense that the post graduate students are required to consider elements that would be helpful in their countries of origin. The countries represented are: Angola, DRC, Gabon, Lesotho, Libya, Mozambique, Namibia, South Africa and Tanzania. The lecturer, who in this case, is the overall project manager, is from Uganda, East Africa. We will start with the relatively easier one.

3.1 Case 1: maintenance of engineering systems

This case study illustrates an approach the author uses to inculcate a maintenance conscience and activism among his students, even though he does not teach 'Maintenance Engineering' as a subject. First, a brief background and rationale for the approach is given; then, the approach is explained and illustrated. Some results of the approach are given at the end. The discussion on challenges and opportunities from this approach is left to Section 4, where it is handled with those from the second case study.

3.1.1 Background and rationale

Engineering systems have a life cycle, almost similar to that of natural living things: they are created to perform specific functions; they need energy, other utilities, and physical and mental inputs to operate; they need to be cared for because

they also can 'die'. After 'death', their constituent parts can be recycled for use elsewhere, like for any natural living thing. However, they are incapable of reproducing themselves in ways that normal living things do. In Africa, the problems about these systems start with inadequate understanding of their very nature, through their creation, operation, all the way to, neglect of their recycling possibilities. For example, while Africa's modern infrastructure systems were initially designed and constructed by Europeans [62], today those roles are increasingly being taken over by Chinese and Indians [63]. It is only bits of operation and maintenance which are in hands of the few, yet, inadequately trained and underfinanced African engineers and technicians [64]. Against this background, is an engineering education system that:

- Is rooted, and is still stuck in old Europe: uses old Europeanised syllabi, European textbooks and is taught by Europe/America trained academics, usually without any form of industrial practice exposure [65, 66]. This may seem to be partly fine—until one realises the following: one—new Europe/America are changing their curricula to emphasise more practical work to match demands of the times (in Europe/America/rest of developed world) [67, 68]; two—European text books are expensive, well beyond the means of most students in Africa. Besides, they lack examples, literature and data, which African students can easily relate to for ease of understanding [69].

- Is elitist and theoretical. It influences students and graduates to expect only white collar office jobs in industry. They hope to find industry, full of artisans and craftsmen, whom they can supervise and direct to do manual, blue collar work. Yet, industry is in shortest supply of these [70], because by nature of national reward systems, it pays non artisanal work better [71]. This has direct impact on maintenance of systems because they require hands-on people.

The effect of the above two points at universities and colleges, is that the 'Maintenance Engineering' syllabi are designed to emphasise the theoretical aspects only. **Table 1** is an example of one semester course content(s) at two different universities on the continent.

It is seen from the table that the contents at these universities are biased towards management and analysis. In a situation of insufficient numbers of technicians, fitters, electricians, painters, etc., as happens in the region, it can be asked: whom will the technologists and engineers trained at these universities manage—to do the actual physical maintenance? Needless to say, this negatively impacts on the lives of engineering assets and increases the cost of products and services in the region.

Topic number	University no. 1	University no. 2
1	Business strategy	Maintenance structure
2	Theory of management	Maintenance management
3	Maintenance planning	Statistics
4	Maintenance management	Reliability centred maintenance
5	Maintenance costing and economics	Investment decisions
		Computer methods
		Tribology

Table 1.
Course contents of maintenance engineering at two universities in sub-Saharan Africa.

The rationale and originality of this case study therefore, was to nurture students into a hands-on maintenance approach which, for some, complements the theoretical grounding they receive in 'Maintenance Engineering' courses. I say 'some' because at many universities—including the above two, this subject is taken as an elective at undergraduate level. The other objective was to sensitise students about financial and non-financial costs either of not maintaining or of outsourcing maintenance work that could be done in-house. An offshoot objective was to enlighten them on opportunities available in taking maintenance as a business proposition for serving those members of society who, for one reason or other, do not do their own in-house maintenance.

3.1.2 Methodology

Basically, the students are assigned team projects during their final semester as part of either their Applied Thermodynamics or of their Mechanical Engineering Design courses, handled by the author. The former, deals with thermodynamic devices such as Boilers, Compressors, Engines, Refrigeration systems, Heat Exchangers, etc. The latter deals with design of machinery through choices of appropriate materials, manufacturing processes, machine elements and devices to make safe and functional complete mechanical systems that do a specific task. Here, we illustrate a case of solar water heaters, in which, different teams of students in both subjects have been involved over the years, since 2011. The project started off like that described in Case No. 2 below, as a design one. It has since, evolved as an on-going maintenance and reengineering project in the compound at entry to Mechanical Engineering building of the author's university. Its organisation, conduct and assessment are similar to all others used by the author and are fully described in [72]. We shall now show the successive major steps it has gone through since inception in 2011.

Inception: The start was by a survey of available solar water heating systems in Cape Town and their corresponding prices.

Subsequent work: The lecturer discussed the above students' report with subsequent teams of Machine Design students. Then, he instructed the teams to design and construct 1 m^2 solar collectors, their stands and tanks. They were also to compare the manufacturing materials costs with 30% of sale prices reported in the previous report. If found to exceed this level, they were to suggest changes in design that could be done to keep costs within target.

Figure 2 shows the students at work, and their initial finished products.

Reengineering of the initial designs: subsequent teams of both Thermodynamics and Machine Design were guided to refine these initial designs every semester, as part of an on-going maintenance program. At one stage for example, two Thermodynamics teams were assigned to change the sun tracking system from manual to electro-mechanical, and test their design changes for a period of 1 week. In addition, they were to make presentations to Mechanical Engineering academic staff at the end of the semester.

The students reengineered the systems successfully, changing from wooden frames to weather resistant aluminium ones. They also incorporated mechanised sun tracking in the systems. Thus, by doing so, they had been guided to learn that maintenance is not simply a 'repair' or a 'prevent failure' activity. But that it could also be a 'continuous design improvement' activity. This is an extremely important lesson for present day Africa, where most engineering systems are originating elsewhere.

Emergency repair maintenance: one morning in early winter of 2015, the polar tracking collector was found blown over by a night storm, unlike its counterpart azimuthal tracking unit. **Figure 3** shows a photograph of what we found in the morning. Students had not yet been assigned the semester's projects. Immediately, however, a team of 8

Figure 2.
Students in the workshop and their finished products in the Mech. Eng. Dept. compound.

Figure 3.
The blown-over solar collector (left) and the author inspecting the repaired system (right).

Machine Design students requested to repair the installation as their semester project. They were assigned the repair project, but with additional instructions to consider whether, in light of longer term weather data, available at the department's weather station, it was necessary to re-examine the designs of both systems. Additionally, they were to cost their repair work, including their labour at assigned hourly rates. They successfully repaired the system, as in the second part of **Figure 3**. Costing was correctly done and useful observations on the installations were made.

3.1.3 Illustrative results of the case study

There have been many good outcomes of this particular case study and of others, related to in-house maintenance of systems. Those to do with student performance evaluation and team workmanship were described in [72, 73]. We will not repeat them here. We shall mention three others as follows:

- Student learning—the students were exposed to, and did use, different areas of knowledge and skills to supplement their normal mechanical engineering knowledge base. In particular, they learnt to: cost materials and labour; use and program electromechanical and electronic circuits to obtain desired mechanical motions. This was a result of the purposeful attempt to 'meld art and science' and of 'modelling symphonic thinking' mentioned earlier in Section 2.3.2.

Such width of exposure on one specific problem in engineering classes is better facilitated by transformative teaching than by any of the other types.

- Development of entirely new ways of installing and using solar syphon systems. To the limits of the author's knowledge and research, nowhere else in the history of solar water heating, have we had such a concerted approach to sun tracking of these passive heating systems. Ref. [74] gives a more detailed account of effects of these efforts. Again, we see that transformative teaching, through its requirement of 'productive struggle', when consistently applied to solar siphons, was responsible for development of innovative installation methods, which could not ordinarily be achieved using the other types of teaching.

- Industry-faculty cooperation: the routine (semi-annual) sending of student teams to industry during academic term time for consultations and/or assignments as opposed to during scheduled experiential training, has developed good will and cooperation between industry and faculty.

3.2 Case 2: solar water purification using multi-level, multi-nationality teams

This case study is primarily about sensitising students to address the water and energy twin problems of rural and semi urban sub-Saharan Africa. But it was designed to do a lot more than that. Recognising the shortage of artisans in the region, and knowing that it is impossible for engineers to transform natural resources for service of society without artisanal and technician skill support, the case illustrates efforts at imparting some of these skills among all students irrespective of level. That notwithstanding, it also simulates a real workplace environment in which administrative hierarchy is generally structured. This is easiest at a University of Technology, educating and training most of the categories of the engineering profession. Hence, in this section of the chapter, we first give a brief justification of the approach. Then, we explain and illustrate it. Finally, we give some results from using it so far.

3.2.1 Why multi-levels, multi-nationalities on one 'student' project?

In industry, every challenging engineering project involves the following activities: Abstract thinking—i.e. visualising, contextualising, interrogating a specific need for society or for individuals, and formulating (an) engineering problem(s) from that need. This is normally best handled by long experienced senior engineers who are able to seamlessly interact with other engineering and non-engineering professionals or leaders to fully comprehend the—often non-technical—need and reformulate it into a solvable engineering problem. After problem formulation in engineering terms, other engineers, including specialists, apply their knowledge, skills and competencies to work out (an) appropriate engineering solution(s). Technicians are then assigned to implement the solutions through the artisans they supervise. Each solution normally requires multiple crafts. Worldwide, in non-highly automated establishments, the generally expected ratios of these professionals to accomplish a large scale, transformative project are of the order of 1 engineer to 4 or 5 technicians to 20 artisans [75]. **Figure 4** is a graphical representation of this pyramidal line organisation.

It has already been said that many engineering students expect, and do want, to work near the apex of this structure, without realising that their real world pyramid base is very narrow, or even that they need time to build competencies and change attitudes to work near the apex effectively. Therefore, one of the necessary steps in transformative teaching of these students ought to be an involvement in a real life project for which they can be held directly accountable. This forms a key feature of transformative

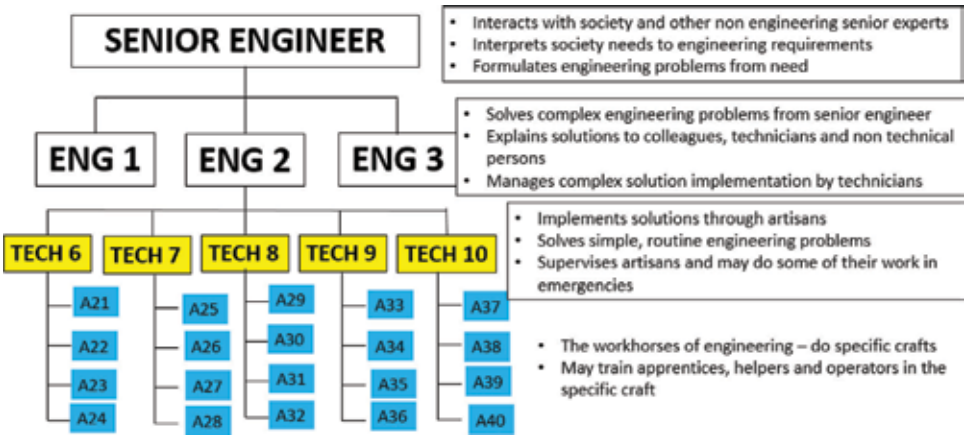

Figure 4.
Typical organisation and roles in an engineering assignment: A—artisan; tech—technician; Eng—engineer.

learning: that of encountering, and being required to solve a problem they would never ordinarily meet in class, because of difficulty, time and other resources limitations. As pointed out in [72], failure to accomplish the project cannot be an option. As mentioned earlier in Section 2.3, other factors to facilitate transformative teaching include: creation by the teacher of an atmosphere of learners safety, open-mindedness and mutual trust both among themselves and with the teacher. The teacher needs to behave as part of the team but in a leadership and "provocateur" role, providing direction, where there seem to develop a gridlock. This is especially important in engineering design practice problems, where apart from functionality of products, consideration of conflicting requirements on costs, quality and safety are almost of equal importance. This means, all necessary knowledge, skills, competencies and attitudes have to be marshalled and deployed in the projects. It is the reason why projects like that about to be described in Section 3.2.2, are necessarily, multilevel; i.e. they involve: a senior engineer (the lecturer), engineers to be (post graduate students), technologists and technicians (bachelors and diploma students), and artisans (all the above 4).

A typical university of Technology in South Africa outputs all but one of the 4 levels of engineering professionals. This is why the author's projects demand that the artisan level be infused into all levels. The second reason for the infusion is that after graduation, the students will find no sufficient artisans in the field, and therefore, will on certain occasions have to do the artisanal work themselves.

The projects use multinational, multicultural teams, partly for the simple fact that the particular university has students from many countries, especially those in the southern half of the African continent. More importantly, different nationalities and cultures can bring new dimensions and solutions to the problem on hand. For example, the fact that in some African cultures and countries, women are the ones expected to fetch both water and firewood, and still prepare meals for the family [76], brings passion and urgency to solving the water-energy problem in a team containing students from such backgrounds. The other factor necessitating a mix of nationalities is that the fundamental problems needing most attention are virtually universal across the continent. They are not specific to particular peoples or areas. For a continent where racism, xenophobia, tribalism and other man-imposed divisions are still factors that can bar access to social, economic and political opportunities [77], transformative teaching needs to bring this fact to the fore: that as humans living anywhere on the continent, largely not by choice, our fundamental existential interests are the same, and therefore, we need to cooperate across these artificial barriers to satisfy the common interests.

3.2.2 The approach

We will now describe the rest of the approach in this case study.

Inception: the water purification project is one of two projects which started as an off shoot of a failed solution in the author's 2012 solar-thermal-hydraulics design of a mechanical sun tracking mechanism invention [78, 79]. The other, was solar crop drying [73, 80]. One of the first motivational pieces of advice all students on these two projects receive, is that: 'in engineering design practice, even a tried and tested failure is a success'. This is meant to transform their attitudes on fears of taking initiative to transit from being analytical theoretician designers, to reflective pragmatic designer-doers, needed by the continent, as pointed out earlier, in Section 1.

An evacuated water evaporative chamber had been required. It was actually designed and constructed. Water was supposed to boil at very low pressure so that steam could rise up and be routed into a raised, shaded condensation tank. Yes, boiling was achieved, but two practical problems had arisen. One was that steam began condensing way before entry into the tank and therefore, water was dripping back to the evaporation chamber. Secondly, it proved impractical that the high vacuum necessary for low temperature boiling could cost-effectively be maintained by users in the field. The designed, constructed, and tested unit was therefore abandoned. As other completely different approaches were being tried, the issue was what to do with the materials of the abandoned unit.

First designs: meanwhile, the observation of rapid evaporation using solar energy in the unit and a recollection of rural Africa's potable water needs led to formulation of a new problem as:

> *"Design and construct a solar water purifier for rural areas".*

This was passed on to a Master of Technology student from Gabon, Central Africa, with the proviso that initially, she would have to work with a team of 6 diploma students for one semester. She designed a model, passed the design to diploma students, and together as their leader, constructed and tested the model. The diploma students left. She used the results to make a fresh prototype design, which she had computed to be big enough to serve a small African home of 4 people with drinking water only. She now worked with one student doing in-service training under the author's overall supervision in the university workshop. They constructed the prototype, which she tested again, and mathematically modelled to complete writing her thesis in November 2014. Details of her work are available in [81].

Reengineering amidst problems: the pioneer prototype was not producing water at design output levels. It was bulky and heavy at 42 kg. The designer, in her thesis, had made recommendations on improvements. These were tried out by a subsequent MEng. student, also from Gabon. Together with another group of 6 diploma students in first semester of 2017, they managed to reduce the weight to 28 kg. Performance was increased by 13% on a per m^2 basis, but by over 20% in actual output due to a bigger size. Both lecturer and student thought, more could be done. But there was a student strike at the university in the second semester of 2017. To press the point that as a targets-driven engineer to be, the student should always endeavour to push on, amidst difficulties, Design and Production were shifted to an outside campus workshop, where the student now had to work with an intern from DRC on experiential training and with other people of varied nationalities. Eventually, two completely new designs were developed, with one weighing 9.8 kg and the other, 15.6 kg. Full-fledged scientific tests were done at the university in semester 1 of 2018 during late summer and winter seasons. Most of this work is reported in [82, 83].

3.2.3 Interim results

As far as this particular case study is concerned, the following are the key, previously unreported results of transformative teaching:

- *New products*: functional, and value for money solar water purifiers can now be made available in a region where they originally were not. This is a major achievement, although, more still needs to be done.

- *Continuous improvement*: as already implied in Section 2, at the heart of transformative teaching is a cultivation of a constant urge among learners to seek improvements of a current situation by questioning premises that may have led to it. One of the two designs developed above, was made to larger commercial size and in April 2018, transported from Cape Town to the author's rural home in Uganda, East Africa for field consumer tests in an equatorial climate. **Figure 5** shows the installation. By July 2018, this unit's daily output had not yet reached the design 5 L (which it was achieving in Cape Town) owing to daily cloud cover. Therefore, at the time of writing this chapter, one Doctorate student has been identified, assigned and started not only to solve this cloud cover problem, but also to extend production deep into, if not across the night.

- *Student interest in postgraduate work*: there has been an unprecedented rise in numbers of students wishing to undertake postgraduate studies with the particular lecturer. From an average of 2 MTech students a year in the early half of the decade, to a current 10 Masters and 2 doctoral, with others being channelled to other academics because of capacity limitations.

Figure 5.
One of the new solar water purifier designs deployed in Uganda for consumer trials.

4. Discussion: opportunities and challenges

In this penultimate section of the chapter, we will briefly discuss the results of Section 3 and follow on with opportunities and challenges of transformative teaching of engineering in the region—as encountered in the author's practice of the same.

4.1 Brief discussion

As a way of discussing the 6 listed results in Sections 3.1.3 and 3.2.3, we ask: are these demonstrated outputs beneficial to student learning and society or not? Would they have been achieved in equal or greater measure by means other than transformative teaching? The first question need not take space and time to answer. The fact that student numbers wanting to do postgraduate studies under supervision of the lecturer using this approach, had multiplied by a factor in excess of 5 in just 5 years, is proof enough that they found the approach beneficial. This is especially so when it is noted that most of those wanting to do these studies prefer to pursue what they had been involved in at diploma or at Bachelor degree levels. For society, it could be debated whether the resulting industry-faculty cooperation could not have been achieved otherwise. But here, the focus is on student learning. And in the situation of the author, he found use of student projects as the easiest and most cost effective way of reaching out to many industry players in the Cape Town area.

On development of new products, subsequent maintenance and continuous improvement culture among students: again it might perhaps have been possible to do so without transformative teaching. For example, the experiential training they receive outside campus could probably help in this direction. However, that training is largely outside the control of engineering academics, and is non-uniform across the student cohort. Moreover, we could argue that there is nothing to lose, but everything to gain if that training was simply an addition to what is obtained at campus through transformational teaching. In any case, the author has not witnessed or found recorded efforts on the African continent which produce the same outputs at a rate exceeding that demonstrated and not demonstrated in this chapter (because there are at least six other areas not discussed here).

4.2 Opportunities offered by transformative teaching as practiced in the case studies

Here, we will share some opportunities as first-hand experienced in the practice of transformative teaching. The aim is to persuade those engineering academics on the continent, who may not already be practicing it, to give it a try.

- Rapid development of products touching every day needs of a majority of the African peoples, using locally available materials and resources. Involvement of students helps bring vigour and variety to this process.

- Accelerating human capital development through the motivating effects of successful implementation of a project within the time and cost allocated (recall that failure in these projects is not allowed and cannot be submitted to).

- A great opportunity to increase the academic's publication record (and its attendant rewards) through multiple openings addressing engineering and non-engineering aspects of the projects.

- Easiest method to develop patentable products and consequent raising of third stream incomes for both university, and lecturer.

4.3 Challenges encountered by transformative teaching as practiced in the case studies and how they could be overcome

Major challenges to be encountered can include:

- Disruptive strikes, leading to destruction of facilities, project materials and loss of teaching and learning time. This can partially be overcome by arrangement with willing and secure, off campus workshops, preferably, under partial control of the academic.

- Projects funding limitations and financing micro-controls, leading to stunting creativity and stifling innovation respectively. Both of these could be partially overcome by careful choice of initial start-up projects and material selections followed by seeking alternative less formally controlled funds, including own, and participating students' contributions.

- For purely academic research-based universities, without complements of technician and artisan training, a lack of sufficient lower level engineering skills to accomplish the projects in time and cost-effectively. Perhaps, in the short term, the easiest way out is to cooperate with universities of Technology or even, with technical colleges on joint projects. Another short term, but perhaps more difficult option, is to search for industries or workshops willing to commit extra training resources for joint Research and Development projects. The longer term solution is to question the rationale of continuing as a purely basic research engineering faculty in a continent, severely deficient of lower level skills, and then, change course. In other words these universities need to transform in order to facilitate 'transformative teaching' in a form exemplified by the above case studies.

- All said, perhaps the greatest challenge could be insensitive, irresponsive, and rigid university management systems and their managers. For, it is these that hire and fire, motivate and demotivate staff; admit students and discontinue them; plan, and fail to plan revenue generation; allocate and misallocate funds. As in financing above, a partial solution to this is to seek less controlled funding, even sometimes operate in alternative environments. In the extreme case, the concerned transformative lecturer is best advised to seek satisfaction elsewhere.

5. Summary and conclusion

We have come to the end of this chapter on transformative teaching of engineering in sub-Saharan Africa. Its discussion was premised on the observation that many students in the region come to study engineering after having been subjected to a transmission mode of teaching during most of their school time. A transactional mode, which enables positive interaction among themselves and with the teacher as they learnt new material, was recommended as the initial weaning approach. However, as they matured and gained more knowledge, it was suggested that they should be encouraged to adopt a critical look at the past, the present, and imagine a future they would want to have. A transformative teacher brings them to this state, and then, tips them over into working for that dreamed future. At the very least, this teacher would use the following principles in assignments for the students:

- Provide intellectually challenging assignments, which for engineering, take the form of real life projects tackling problems that on first thought, seem intractable in the prevailing circumstances.

- While giving students latitude to freely make independent decisions, retain the authority and use the capacity to provide expert guidance when achievement of critical project milestones is at stake.

- Though students would be working in teams, pay attention to each individual's specific concerns, and provide appropriate counselling where needed.

The above narrative formed the foundation of the two illustrated case studies that have been run by the author since 2011. One case tackled Africa's maintenance culture problem, where once assets are acquired, their maintenance is not taken seriously. The case also highlighted the accompanying design evolution work in which, totally new kinds of solar syphon installations were eventually introduced on the scene. The second case illustrated how multi-level, multi-national teams were enabled to use multi funding sources to develop a series of completely new products on multi premises for the African market, even in times of severe campus crises. In the author's opinion, this was transformative teaching at its best.

There were several benefits of transformative teaching illustrated in these case studies. The more important ones included:

- Getting students to develop products they never ever thought they were capable of making in the circumstances and at costs they did.

- Increasing the publication record of the concerned academic both in Engineering Education and in Solar Energy Engineering areas

- Increasing several fold interest by students in postgraduate work

The benefits notwithstanding, limitations of the teaching include:

- When there are many students, a corresponding big number of projects is required if each team is not to be too big. The author has usually overcome this problem by creating competitive teams on variants of similar projects as in the solar syphon case of Section 3.1.

- Real life projects involve real time, expenses, quality, and safety pressures. These factors do not normally get encountered to the same intensity in normal educational processes. There can therefore be initial resistance not only by students but by their sponsors and even by some university administrators. Persuasiveness, Professionalism, Persistence and Resilience are the key success factors in such situations.

Finally, a brief attempt to persuade all engineering academics to adopt the teaching approach through highlighting the key benefits, and then, showing the most critical challenges to expect along the way, and how to possibly navigate through them, was made. In conclusion therefore, we should have by now shown that: transformative teaching of engineering in sub-Saharan Africa is not only desirable, but it is possible too.

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Conflict of interest

The author's interest in this, and other related work, is driven by an insatiable desire to make students realise that by their last year of undergraduate study, they can already have an inner ability to start contributing to make their societies live better now, and not wait for tomorrow.

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Chapter 2

Interdisciplinary Engagement in Higher Education: Opportunities Explored

Usha Iyer-Raniga

Abstract

There are increasing pressures on universities to make their graduates ready for life and work, in addition to ensuring technical and professional competence. This chapter discusses the implications of supporting such an approach for higher education in a university in Australia where the university was treated as an urban living lab, supporting student engagement for a course innovated to cover three different disciplines. Urban living labs are a form of collaborative partnership particularly in urban areas to support sustainability outcomes. The innovation presented here was in using a green building on campus, bringing students from different disciplines, to study this green building, thereby also partnering with industry. The key question driving the research was whether academic-industry partnerships may be used to understand the performance of green buildings on an urban campus. The anchor course was in construction management and the other disciplines were business and computer science. Twenty three students undertook study of predetermined spaces of a green building on campus. The results show that as a pilot study, this project was successful, with good engagement of students, teaching and non-teaching staff from the university and industry. However, it was more difficult to convert the pilot to mainstream teaching and learning.

Keywords: Australian, university, innovation, built environment, students, sustainability, urban learning labs, green buildings, interdisciplinary, transdisciplinary

1. Introduction

Sustainability is about tackling real-world problems. To meet the needs of the Sustainable Development Goals, New Urban Agenda and future challenges, built environment professionals face unique challenges. The work of designing, procuring, financing, renewing and maintaining the built environment is undertaken by professionals who are being confronted with incorporating new knowledge and professional practices into the way they produce and renew less carbon and water-intensive built environments. Higher educational institutions the world over educating built environment professionals, such as in architecture, engineering, building, construction management, project management and urban planning, are being tested to renew their curricula and research capacities so that their graduates can contribute more to urban sustainability. While industry and government have responded to some of our current sustainability challenges by developing rating

tools and regulations for reducing energy and water use in the built environment, academia and curricula in the built environment have not kept pace with these challenges.

This chapter focuses on innovating an existing course to support student learning outcomes while also understanding how buildings are performing on an urban university campus. This is undertaken by exploring the sweet spot between using a green building on campus as a living laboratory for education in construction management, business and computer science students and structuring the curriculum for not just meeting academic outcomes, but also considering building performance from a user perspective. This brings in a real-world context, engagement with industry while also aligning sustainability outcomes of the university. The chapter focuses on curricular innovation engaging cohorts of students from different disciplines, while also preparing students to work in the real world where employees may work across diverse work groups. This was undertaken by innovating the curriculum, with very little change to the course and programme learning outcomes.

The primary question driving this research was to explore whether a green building on campus may be used as a vehicle for engaging students from different disciplines while also working with industry. Secondly, what learnings may be gleaned from such an approach and can student-academic-industry partnerships be strengthened in the future particularly for built environment education? A case study [1] approach was taken for this innovation trialled as a pilot and catalysed by a state government grant.

The overall findings of this study resulting from stakeholder engagement, student interactions, assessments, course and programme learning outcomes and teacher participation have already been presented [2]. This chapter focuses on the curricular innovation and the process that supported it, and related student and teacher experiences. The chapter commences with a literature review of universities and their responses to sustainability, followed by sustainability integration in built environment curricula focusing on innovation in particular. This is followed by an explanation of how a course was modified to incorporate student and industry engagement for a building on campus for the three disciplines considered. The findings of this engagement have been analysed from the building performance perspective, student and teacher experiences followed by some general discussions with conclusions at the end.

2. Universities and sustainability

The twentieth anniversary of the Tbilisi Declaration (1977) [3] was celebrated through an international conference in Thessaloniki, Greece, resulting in the Thessaloniki Declaration [4]. These are some of the earliest attempts for bringing in education for environment and sustainability, and these early attempts to include the environment have now been expanded to include beyond environmental concerns to social and economic concerns for sustainability. Further to this are the 'newer' challenges of also considering climate change, adaptation and resilience, particularly since the United Nations Sustainable Development Goals were adopted in 2016. There is a lot written but still not much evidence in practice on sustainability becoming mainstream since the first conference on sustainability in Rio in 1992, and the most recent conference in 2012, that capacity building for sustainability needs to be urgently addressed. The importance of refocusing on sustainability education, particularly, in light of the current challenges to the built environment

has been discussed [5]. The author indicates that supportive platforms to encourage and learn from each other for understanding and engaging with sustainability in the built environment are required as local contexts vary.

Filho [6] posits that while there are many problems preventing universities from implementing sustainable development as part of their programme, there are also opportunities to be explored. Filho et al. [7] state that while universities are now incorporating sustainability principles into practice, transformational changes in society to address sustainability concerns have yet to be seen. They report successful cases at the Hamburg University of Applied Sciences and Bournemouth University in the UK, where research and teaching on sustainability have been successful, so also extension into the community through capacity building and other such activities. These examples have deliberately moved away from traditional models of university operations, by investing time and effort to work collaboratively across professional and practitioner domains beyond traditional disciplinary silos. Transdisciplinary engagement is really critical if true sustainable development is to be achieved.

Lozano et al. [8] discuss the importance of moving away from traditional models of teaching and learning, if universities are to become leaders and change drivers. Universities need to engage with sustainable development principles and paradigms; they need to educate themselves before they can educate others. Universities are organisations that are typically slow to change. While universities are involved in the business of education, they are also involved in research and scholarship and in looking after and maintaining their own buildings. Shiel et al. [9] argue strongly the critical role universities play in community development, and a key tenet of that engagement is prioritising sustainability outcomes.

Velazquez et al. [10] note the various factors that may obstruct the implementation of sustainability initiatives in higher educational institutions. They argue that the current focus tends to be on good experiences rather than examining how these good experiences have *evolved*. Likewise, with the bad experiences, the learning itself is not supportive enough to ensure that other people and organisations *do not* make the same mistakes. Failures, therefore, may be used as a learning experience particularly when considering institutional barriers in particular situations. Among the many factors identified with respect to barriers are: lack of awareness, interest and involvement; organisational structure not supporting sustainability outcomes; lack of funding; lack of support from university administrators; lack of time; lack of access to data; lack of training; lack of opportune communication and information; resistance to change; focus purely on profits; lack of more rigorous regulations; lack of interdisciplinary research; lack of performance indicators; lack of policies to promote sustainability on campus; lack of standard definition of concepts; lack of designated workplace; lack of standard definitions of concepts and male-dominated workplace, not supporting 'softer' skills required with sustainability outcomes.

Trencher et al. [11] state that there is increasing focus now on the co-design and co-production of knowledge and solutions for advancing urban sustainability. Their research to understand the features of university partnerships across many areas also included the role of diverse actors, and they sought to identify drivers, barriers and impacts. Their study found that while quantitative measures such as energy, buildings, governance and social systems are integrated well into local scales, individual partnerships are important for making strong environmental and sustainability impacts; and academic, industry and government timelines are not always in sync. This has also been echoed by Pereira et al. [12] examining the relationship between the environmental management practices at a campus of a

Brazilian university and the greening of its organisational culture. The university bureaucracy and hierarchy got in the way of implementing and delivering on an environmental management programme for the university and the key performance indicators of the teaching staff was focused on publications not on practice or supporting practical outcomes.

Urban living labs or laboratories (ULLs) offer another model of participation, collaboration, experimentation, learning and governance particularly where low carbon and sustainability outcomes are desired [13]. They may be applied across cities, where geographical embeddedness, experimentation and learning, participation and user involvement, leadership and ownership, and evaluation and refinement form the key characteristics of ULL. ULLs offer a type of partnership that enables the co-production of knowledge and often support innovative solutions. Hence, ULLs may be seen as a form of partnership, they may be seen as forms of experimentation or they may be seen as opportunities to test a product, service or technology. ULLs are test grounds in a real-world environment and, thus, are very context specific by definition. Therefore, ULL requires contextualisation and translation to other urban realities [14].

Evans et al. [15] describe the establishment of living labs at the University of Manchester where teaching and learning and research on sustainability were trialled. They also use a co-production approach where diverse stakeholders get together to co-produce knowledge in real-world settings. Living laboratories offer an opportunity to push the boundary for innovation of collective urban governance and experimentation to address sustainability challenges and opportunities created by urbanisation [13, 16]. The greatest advantage of using living labs is the engagement with students and staff for applied sustainability issues.

Similarly, the role of campus, curricula and community in higher education has been discussed [17] where universities can clearly play a leadership role in being exemplars of sustainability for the community. The importance of engagement of students in university campuses may be seen as opportunities for interaction with the real world and these offer prospects for curricular innovation as well.

Thus, urban universities may function as living labs. Chambers [18] shows how the University of Melbourne in Australia is working to become a sustainable organisation. They were able to do this by supporting recycling initiatives on campus; supporting teaching, research, community engagement and education, and operations through the development of a green roof on one of their campuses and pushing innovation through the development of a shallow geothermal system on their main campus.

The research undertaken is set against the background of universities acting as living labs for engagement with students and the wider communities. At the same time, universities are also working to improve the sustainability outcomes of their own campuses by reducing resource use, energy and water. Often, learning outcomes and anticipated student attributes between academia and industry are not quite aligned. While academics tend to focus on discipline/competence, industry tends to focus on wider inter- and transdisciplinary attributes. Using campuses as learning labs offers an untapped opportunity for universities to walk the talk and show students that universities can become exemplars of sustainability models.

The next section examines how built environment curricula have dealt with integration of sustainability in their programmes.

3. Sustainability in built environment curricula

Built environment curricula have largely tended to focus on imparting technical skills to students. This may be attributed to pressures of accreditation, focusing on

the competencies graduates need to gain entry as a professional and to practise in a built environment profession. Certainly, in Australia at least, the focus of employers in most disciplines including the built environment has shifted from purely technical or professional skills. Employer perspectives on work trials and work experience indicate that they are looking for employees with 'an interest in the industry and personal attributes such as good communication skills, a willingness to listen and learn, a positive attitude and good work ethic' [19].

There is not much in the literature by way of practical application of how built environment educators may approach either interdisciplinary education or innovation in the classroom, particularly where the subject content is about engaging on sustainability underpinnings. By its nature, sustainability requires an action-oriented practical approach. Yocom et al. [20] indicate that deliberately keeping a built environment studio experimental supported students to pursue new approaches and suggest alternative approaches and disciplinary responses. Developing a collaborative understanding between students was more difficult and communication is essential to tease out the issues and develop shared understandings. They highlight that adjusting pedagogical frameworks is an important aspect of education today and into the future.

Posch and Steiner [21] strongly endorse linking innovation with inter- and transdisciplinary underpinnings. An integrated process of knowledge production, they argue, is bringing together scientists and practitioners in a real-world context to produce more robust societies. Transdisciplinary approaches may be seen to be an instrument in a common process of inquiry beyond problem-solving and mutual learning. Knowing, understanding and applying in a circular or non-linear approach enable students and other learners to gather knowledge as a tool for problem-solving in real-world situations. Along similar lines, Callaghan [22] discusses how a reflective collaboration framework can support academics to find unique solutions in different academic contexts. He sees this as an opportunity to collaborate across traditional disciplinary contexts, providing unique problem-solving opportunities. Informal collaborations may also support formal collaborative practices.

Some level of contextualisation is required, which needs to move away from prescriptive approaches. This is the case for built environment engagement [5] as well as in other areas intersecting with the built environment such as for disability planning [23] and also where health and built environments intersect [24]. The literature has some examples of interdisciplinary and transdisciplinary underpinnings in curricula, but not many applicable for the built environment, and examples particularly using urban campuses for academic-industry collaboration. One thing that is commonly seen though in the literature is that innovations of some form, quite distinctly different from traditional pedagogies, are essential components of change. Hence, the next section focuses on innovation.

3.1 Innovation for education for sustainability

Innovation for sustainability responds to issues that are relevant for society, and where innovation becomes the underlying platform for problem-solving approaches, it is an essential element to creative thinking and practice for sustainability in the built environment. The role of interdisciplinary, intradisciplinary and transdisciplinary approaches as indicated in the section above is therefore critical, as is the context. Taking a systems approach to innovation for sustainability also presents its own challenges, particularly with respect to temporal issues, which may need further development and understanding with feedback over the time of the project/engagement with the users.

Taking an example of the real world, Nidumolu et al. [25] show in their research that sustainability underpins organisational and technological innovations leading

to both top-line and bottom-line returns. Smart companies treat sustainability as innovation's new frontier. As discussed by Barbieri et al. [26], the role of various actors is critical for generating, implementing and diffusing technological innovations. As universities are responsible for educating vast number of students, it is critical they are constantly innovating across teaching and learning, research outcomes and the application of this knowledge.

In a study in the UK at the University of Salford [27], the development and implementation of an interdisciplinary course in the final year for five different built environment disciplines showed that both staff and students felt that the course was successful. However, feedback provided also indicated that sufficient time was not allocated for delivery and management of the course. Assessment criteria also needed more work.

Innovation in education has inherently been linked with technology; however, it may also be linked to teaching practices, curriculum development and learning [28]. Innovation in education needs to be proactive, it involves knowledge transfer and, therefore, the process of transfer: the 'why' and 'how' rather than the 'what' becomes the focus. In a study across four universities in Australia [29], the authors show that communities of practice supported to build collaborative relationships of trust and reciprocity between teachers in a wide range of disciplines. Their study was able to integrate diverse disciplinary perspectives, teach collaboratively, promote innovation through exchange and, by doing these, demonstrate leadership within their own institutions. In another study, also in Australia [30], it is shown that collegiality and support for teaching innovation were a primary measure of success; however, increased workloads and lack of time were also reported by the participants. As administrative structures are predominantly discipline-based, if such innovation is to succeed in the long term, early adoptive measures for interdisciplinary teaching need to be supported by financial and other resources to be fully embedded.

The Faculty of Built Environment in UNSW underwent a radical change in 2012, where there was a deliberate attempt to bring in inter and transdisciplinary engagement through a faculty-wide initiative called the common learning experiences [31]. This was seen as an innovative approach by the school. These experiences not only embedded interdisciplinary experiences in the faculty's undergraduate curriculum; it was also supported by staff through a process of ongoing engagement and supported by the leadership team of the faculty.

Using an example of an environmental subject in the sciences [32], Simon and others show that curriculum design, engagement in small groups and field trips outside the classroom supported interdisciplinary understandings in undergraduate curricula. In yet another example on development of a sustainability course, it was found that engaging teaching staff from various disciplines supported organisational change to become a core course in a university-wide programme on sustainability.

Alongside formal curricular changes, the informal curriculum is also seen to be significant. Winter and Cotton [33] refer to 'informal curriculum', extra-curricular activities and student activities linking estates and operations to formal study. Such informal curricula, they believe, have been overlooked as potential influence on student learning and behaviour. Using the UK experience, the authors state that helping students deconstruct the hidden campus curriculum may enhance aspects of sustainability literacy, developing students' understanding about sustainability and creating solutions to sustainability issues, enabling evaluative dialogue around campus sustainability and also self-reflection, which could be transformative and translate into pro-environmental behaviour change.

Beyond the built environment disciplines and attendant curricula, and examining the integration of sustainability in business disciplines and curricula show that most business schools are focusing on 'piggy backing', 'digging deep',

'mainstreaming' or 'focusing' their sustainability and ethical approaches to curricula [34]. Each of these curricular approaches refer to 'blending' approaches where they may be added to existing courses in a very narrow curricular context of piggy backing, and development of new stand-alone structures through digging deep. Mainstreaming is still tinkering with existing structures but taking a broader curricular approach of emphasising cross-curricular perspectives. Focusing also takes a broader curricular approach where new structures are created through new cross-disciplinary offerings including new programmes.

Therefore, curricular changes are not simply a matter of 'academic' engagement; it is also about its holistic interaction about engagement with students, teaching and non-teaching staff and strategic outcomes for the university.

4. The anchor course and innovation

The innovation of the course (subject) was deliberately not set up as a new multidisciplinary course for students from different disciplines as the timeline to do so was not considered to be practical. First, an anchor course was needed to allow innovation for student engagement on campus. As the project leader was from a built environment school, the anchor course logically rested within this school. The school offers undergraduate programmes in property and valuation, construction management and project management. Other built environment programmes such as planning, architecture and landscape architecture are part of other schools. The anchor course selected was a construction management course on research; so, it was relatively easy to bring in building post-occupancy study as part of the research course. The course was undertaken in the final semester of the final year of construction management students. The students were encouraged to solve an authentic industry problem or address real issues within the various professions. The students were encouraged to seek question/s, collect and evaluate data, analyse and report their findings and recommendations.

Second, since the intent was to use the campus as an urban living lab, a building was selected for the study. The building selected was where the author had already undertaken a post-occupancy survey to understand if the green building met its intended performance targets. In the post-occupancy research, staff and higher degree by research students were involved and also key stakeholders such as the architects, project managers, builders, various ESD (environmental and sustainable design) consultants and the facilities managers of the building and the property services section of the university were engaged in the research process. The green building was completed in 2012 and staff and students moved into the building not long after mid-2012, just prior to the commencement of the second semester that year. The outcomes of the post-occupancy evaluation focusing on staff and higher degree by research students, stakeholder engagement and its learnings from various perspectives have already been presented [35–38].

Third, innovation was required for students to engage with industry, the building occupants and other stakeholders. But, as the literature demonstrates, innovation is also about engaging students beyond their own disciplinary boundaries. Therefore, at least two other schools, attendant courses, teaching staff and students needed to be engaged. Through informal discussions, teachers from two other disciplines interested in cross-disciplinary engagement expressed interest. They were from business and computer science. Each of the business and computer science courses selected was such that industry engagement was part of the course requirement. Industry stakeholders acted as mentors to support student learning and

provided industry input as appropriate. This included an industry mentor's input through the formulation of the research question/s itself, situating the research with industry, data collection, analysis and evaluation as appropriate.

Thus, innovation lays in not just using a building on campus, but also with understanding the sustainability underpinnings, engaging with industry and working with students from other disciplines to promote transdisciplinary engagement. The opportunity for innovation in the course came in the form of an application and, eventually, as successful recipient of a grant undertaken through a state government competitive grant process. The objective of the grant was to support students and future designers to learn from real-world problems and suggest improvements in the design and post-design process. The grant supported employment of an assistant for project management and administration.

Thus, students from three different disciplines were brought together to study different aspects of the building. The engagement of the different student cohorts supported multidisciplinary engagement in the urban living lab. The process for engagement with each of the disciplines has been provided below.

The initial idea of engaging with the business and computer science students was to also seek students in the final years of their programme, undertaking a research component. It was not realistic to set up a new course with common course learning outcomes across the three cohorts of students as this required a two-year lead time to go through administrative processes within each of the relevant schools and university to set up a multidisciplinary course. Moreover, the timing of receiving the grant and its contractual obligations did not allow equivalent levels of engagement with the business and computer science students as, again, administrative processes and securing commitments from relevant course coordinators took time.

Clearly, the university's property and facilities services department needed to be involved and this was not a problem due to the relationship the project leader had with the said department owing to previous research undertaken on post-occupancy evaluation of the building. Since students from three disciplines, teaching and non-teaching staff and industry were involved, ethics clearance from the university was needed and obtained before commencement of the course. Students were surveyed at the end of the course across all the disciplines as normal for any course undertaken in the university. Although a survey was deployed specifically relating to this course, it did not provide any insight as the survey was deployed quite late in the semester.

4.1 Student engagement

As explained in the previous section, the catalyst for student engagement commenced with construction management students undertaking their final-year research projects with the author of this paper being their supervisor. A total of nine students in groups of three each studied various components of the building. Computer science students were much older students and they were in the final semester of their Masters by course work programme. Business students were in their final year/final semester of Bachelor of Business programme. Eight computer science and six business students participated in the study of this building. For the computer science and business students, the course was part of an existing course, similar to the construction students, although it was not a research course.

Spaces to be studied by the students in the green building included student portals, teaching rooms and one café. The students engaged in three workshops: one at the beginning of the semester, one in the middle of the semester and one at the end. The workshops included the academic coordinators/supervisors for the three cohorts of students, the students themselves, and the industry stakeholders such as

the architects, project manager, building managers and property services staff of the university. The first workshop was to explain the project, identify the spaces and do a general walk around in the building to view the various spaces in the building and get a sense of user interaction. The second workshop was for students to present their interim work and seek feedback from the industry stakeholders (including appropriate university property and facilities staff). The final workshop was for students to present their work and seek feedback.

The construction management students undertook a thermal comfort study of the building examining the specific predetermined areas in consultation with the design and project architect and the building manager of the green building. The construction students focused on day lighting, ventilation, thermal comfort and acoustics, and used appropriate instruments to gather this information. The business students observed and interviewed fellow students and staff in these spaces to understand whether user needs were met. The computer science students prepared an application (app) to be trialled in these spaces by their fellow students and staff to understand the use of space and attendant user needs.

The intent was that all three cohorts of students would undertake their research at the same time so as to minimise disruptions to their fellow students and staff. The students agreed at the first workshop the dates/times when they would do this over three weeks in the semester (weeks 2–5) so that they could then share these findings with each other and report during the second workshop. Students across the three cohorts engaged with their own lecturers/tutors as required to assist their learning throughout the course of the semester. Each cohort of students had to meet the interim and final assessments in their course. So, the student engagement was designed to meet the learning outcomes for all the three courses.

The project leader and teachers involved across all three disciplines attended the three workshops and engaged with students and industry (separately and together) at various times during the course of the semester. They also met each other at periodic intervals to discuss student engagement, course learning outcomes and student experiences. No other formal survey was undertaken specifically for these students other than the standard course experience survey undertaken by the university.

5. Findings and discussions

As indicated, overall experiences of this study have been presented in another paper [2]. With the scope of this chapter being on course engagement and innovation, these aspects are delved into further detail in this section. The findings of the students' evaluation of the green building, their engagement and experiences and those of the teachers are provided briefly in the forthcoming sections.

Generally, the coordination of the industry stakeholders, student and staff was a big challenge. Students' timetables invariably clashed, as did the teachers' availability to attend meetings to discuss students' work, engagement and course progressions.

The construction management students focused on the physiological and perception issues related to the environmental side of the building performance. The computer science students undertook an online survey, focusing on the environment and social issues pertaining to sustainability through the development and fine-tuning of their app. Their focus was on the environmental perceptions of comfort as their online tool needed to be finessed and mapped, and further fine-tuned. The business students focused purely on the social issues. However, the integration between the groups of students could have been done better.

The overall findings and learnings from this project have been summarised in **Table 1** and also presented in the sections below.

Issue	Pilot output/outcomes	Lessons learned
Overall coordination of the project	Needed more coordination than estimated.	Plan early and seek support.
Overall time spent on the project	More than estimated.	Factor in administrative time, seek both top-down and bottom-up support.
Course innovation		
Teachers involved in discussions and teachers involved in project not same	Limitations.	Involve the teaching staff and leadership team as early as possible.
Targeting the correct disciplines	Selection based on convenience.	Depending on study, disciplines will vary, need to involve property services department of the university.
Study of the building		
Green buildings may be used to seek industry-academic engagement as well as student learning	Successful pilot.	Green buildings may be used to support student learning outcomes. Industry-academic collaboration is possible but needs to be planned.
Thermal comfort study	Suits built environment students. This study used computer science and business students too.	Can cover a range of built environment disciplines such as property, construction, building, architecture and design, project management. Can include other disciplines such as engineering, agriculture, health.
Types of building/s to study	Office and teaching space, student portals.	May be extended to include vegetation/green areas on campus, café/eating areas, student residences, seminar rooms and other such spaces.
Student experiences		
Assessments	Integrated into existing courses.	For true transdisciplinary engagement, assessments would need to be set up appropriately.
Learning outcomes	Integrated into existing courses.	Learning outcomes would need to be set up for courses that are appropriately structured as a new course taking into consideration various disciplines.
Student interaction with other students between disciplines	Limited due to practicalities such as timetabling.	Course may be developed such that interaction of students is optimised.
Teacher interaction with students from other disciplines	Limited.	May be improved by ensuring better optimisation in timetabling and recognition in workloads of teachers.
Engagement with industry	The cohort that got the best value from the pilot.	Industry engagement may be further improved, for instance, industry may also be involved in assessments.
International and local students	International students got more value as their interaction with industry is usually limited in the programme due to various reasons. Local students are usually working even if not in the same discipline/industry.	Industry engagement for local and international students varies due to a range of different issues, context, age, discipline base and a range of other similar factors.

Issue	Pilot output/outcomes	Lessons learned
Teacher and stakeholder experiences		
Teachers involved in discussions and teaching not the same	Limitations: coordination between planning staff/leadership team and teacher may have been better achieved.	Better planning would ensure better communication between the teachers involved in course development and teaching. Recognition of workload issues would assist.
Senior management support	Limited.	Top-down engagement from senior management will support bottom-up engagement.
Industry stakeholders, including facility managers	Very supportive and got the most out of the project.	Industry engagement varies depending on the types of personalities involved. Relationships between teaching and non-teaching staff and students need nurturing and support.

Table 1.
Summary of the findings and learnings.

5.1 Overall course innovation outcomes

The primary question driving this research on the nature of academic-industry engagement to understand the performance of a green building on campus has been answered in the affirmative through the research. Urban campuses may be used as learning labs. As to whether these partnerships may be strengthened for built environment education is also in the affirmative. Sustainability education for built environment students may be undertaken using buildings on campus as educational opportunities. Not only built environment students but students from other disciplines may also benefit from a study of campus assets. However, putting this into practice is not straightforward. Curricular innovation requires injection of resources to put into practice.

The overall experience of the course innovation was that it was successful, but not without some limitations. Using a building on campus for student learning was a good idea, and it benefitted the university in doing so as they got information about what worked and did not work well in their own building. The green building findings, particularly student responses, were very similar to that of the staff who took part in the post-occupancy evaluation undertaken by the author and team post the completion and occupation of the green building [35–38]. Some of the challenges of comfort in the student portal areas and cafes have been addressed by the property services department of the university. Relationships with on-campus facility managers are needed to support green building outcomes; hence, nurturing these relationships between academic staff, students, industries and campus staff is quite important.

The course experience surveys did not reveal any specific point of success or challenge across students from all disciplines; nevertheless, the students' verbal feedback during the course of the semester was positive. Student course experience surveys deployed by the university did not separate the students involved in the study of the building from their peers. While an online survey was deployed specifically to capture student experiences involved in the study of the green building at the end of the semester, it was undertaken too late and students did not respond to this survey as they had already completed all their requirements for graduation.

The teachers involved in the course across the three disciplines were keen to share their experience with their peers, particularly to continue to engage students across

the disciplines in future courses. However, this did not happen in practice for several reasons. Firstly, the teachers did not end up being involved in the same courses that allowed innovative course learning and student engagement to be incorporated for the following academic year and continue on the successes built in the pilot. Secondly, the teachers who were teaching these courses in the following academic year were reluctant to add to their academic workloads as it required project managing across the disciplines, over and above the normal teaching/assessment times. Thirdly, the leadership team across the three schools did not particularly care for engaging their students on campus projects because it required engagement with non-academic part of the university, which again, requires more time involvement and relationship building. Fourthly, the time to select appropriate courses/disciplines that can meaningfully engage with university assets while ensuring the course and programme learning outcomes are aligned needs to be considered at the outset. Time is also required for project managing the stakeholders including the students and the teachers. If it had not been the grant that spurred the project, allowing a research assistant to be employed, the idea would probably never have taken off.

This pilot example shows that it is possible to provide a vehicle for engaging in real-world teaching and learning using a building on campus. Providing genuine transdisciplinary engagement and learning outcomes using an existing course with defined learning outcomes already is not possible. To do so will require development of new course/s to support learning outcomes that will genuinely engage students beyond their own disciplinary boundaries, along with appropriate assessments to support this. This needs time, and it also needs support from discipline leaders as well as strong engagement from teaching and learning services of the university to support such outcomes. Long-term planning for such a scenario is required. As Painter-Moreland et al. [34] argue, there needs to be a systemic institutional integration which can be defined as

'building a systemic capability towards sustainability, distributed and nurtured throughout the organisation, which creates the impetus towards change in students, faculty, administrators, the institution as a whole, as well as organisations that hire its alumni' (p. 743).

5.2 Green building findings

The student surveys and thermal comfort testing undertaken by the three cohorts of students included lecture theatres and other tutorial rooms, cafe and student portals. Rather than separate the findings for each of the cohorts of students, general findings have been presented. A general observation made by all students was that the building was very well used, with far higher utilisation rate than other buildings on campus. This was validated by the property services staff. Students liked working in the building, not just students from the business schools that were housed in the building, but also students from other schools across the university. This was largely because the spaces in this green building were comfortable, convenient and modern. Generally, spaces that were mostly liked by students were the lecture theatre, teaching spaces and the student portals.

In terms of room layout of the teaching spaces:

- Students were more responsive to learning with the way the rooms were designed. It was found that students found it easier to communicate with each other due to the room layout supporting student learning outcomes.

- Some lecture spaces used whiteboards. Frequent comments regarding the white boards were: *The whiteboards are difficult to teach with*. These comments refer to technical issues relating to the use of whiteboards, and the type of pens

to be used. This may seem a trivial matter, but since the technology was new, not all teachers knew how to use the special pens.

- Room layouts were not necessarily always conducive always to communication where eye contact between teacher and students could be maintained. There were situations where the room layout presented the person's back to the class while discussions took place.

- Placement of air vents under the chairs was not the most effective way to dispense air circulation in the space, as the few students felt quite cold at the end of the class.

- From a thermal comfort perspective, most of the teaching spaces were comfortable. Daylight levels were good, artificial lighting-supported day-lit spaces where required and temperatures were usually comfortable. Air movement was fine in most places and the teaching spaces were not noisy.

Feedback regarding common student spaces, including cafe, were as follows:

- Students complained of glare in common student spaces. *Sometimes, the sun shines in too strongly*, and its variations were comments often heard. Students needed to move around in these spaces as the day advanced.

- Few students preferred a designated quiet study area. They preferred to work with other students around (even though most students often used ear phones).

- Where there were designated quiet study areas, these did not work particularly well, as the acoustic separation was still a problem. Some students discussed their work creating issues for others.

- Students indicated that there were not enough power outlets. Almost 90% of students using the study area were observed to be using an electronic device and it was critical to provide more of these to facilitate student learning outcomes.

- Some spots in the building also had poor internet connectivity, which was a cause of frustration for some students.

- Unsatisfactory air flow in the café space, student hub, portals and common areas were also reported, making the space quite uncomfortable to be in for long periods of time, particularly during the winter when the study took place.

Student experiences of taking part in this course are presented next.

5.3 Student experiences

All students passed the course. For the construction management students, all students were international students and they found the experience of engaging with the industry particularly useful, as this was a further insight that they normally would not have had access to. Undertaking some primary research was also interesting for them, particularly compared to their peers who mostly used secondary data. They also found interacting with students from other disciplines useful as there were not too many opportunities for them to interact with students beyond their own disciplines in a study setting.

For the business students, their experience of engaging with the industry stakeholders, and particularly the construction management students were interesting. They were all local students and felt they had learnt more about acoustics, thermal comfort and daylighting from the construction students, as these students used instruments to measure these at set points in the building. For the computer science students, the experience was yet again slightly different. The students were postgraduate students, mix of international and local. Their engagement with the industry and other students was a very different experience compared to their other classes where technical work was the main focus. This course supported development of their softer skills.

The intent of the workshops during the semester with the students across the three disciplines and the teachers was to also support interaction between the students. This did not happen to the extent expected or desired. The interaction between the students of the various disciplines was limited. Unsurprisingly, students within the same schools interacted more with each other. While this was disappointing, the practicalities of timetabling, assessment scheduling and such other matters prevented students from engaging with each other beyond the requirements of the project.

5.4 Teacher and stakeholder experiences

As mentioned, teachers met several times throughout the semester to compare notes, discuss learning outcomes and discuss engagement with the various stakeholders. Not all the teachers were directly involved in interacting with the students. The project leader, also being an academic supervisor stayed in close contact with all the stakeholders. The computer science teacher was also the course coordinator and supervisor for the Master's students, so this teacher closely followed the innovation and student experiences in the course. For the business students, the teacher and the course coordinator were not the same as the business school typically has a large number of students in their classes. Therefore, getting both the course coordinator and teacher/tutor in the discussions was more difficult. It was felt that if support from senior executives such as the dean in the business school had been provided, the experience of the business students and staff would have been much stronger, contributing to a richer experience for all. To achieve better integration, getting buy-in from the staff would have supported better outcomes. A lot of time was also spent on ongoing engagement with the teachers from the three disciplines, contributing to workloads, not accounted for at the start of this project.

The industry stakeholders were very supportive. Despite busy schedules, they took the time and effort to work with the students, sometimes, even seeing students directly, without the presence of staff and guiding the students through industry-related knowledge. The architect, builder and project managers were particularly keen to understand how the spaces were used in the building. They were perhaps the cohort that got the most out of the process, as normally post-occupancy studies are not typically undertaken for buildings, even green buildings. The university property and facilities departments also learned a lot from the exercise as they were able to use this feedback to prepare better briefs for future buildings across various campuses of the university.

6. Conclusions

The research project set out to understand if a green building on campus may be used to engage students across various disciplines as well as support academic-industry engagement. The response to this is affirmative. The second question underpinning this research was to understand what, if any such innovation may influence built

environment education? The response to this second question is that, while it is not possible to generalise based on the one case study, nevertheless, there are some positive attributes of using campuses as urban learning labs for built environment students.

As a pilot project, the engagement of teachers and students in three disciplines, using a building on campus as a real-world example and engagement with industry was successful. Most spaces within the building reported satisfactory outcomes for students and staff. There were however further areas for improvement. Student engagement was successful, although it is difficult to discern if the use of a green building made any difference through the standard university course experience surveys. Staff were committed, and this commitment may be attributed to the success of the project. Time is a big factor in getting engagement between academic staff, students, industry stakeholders and the university facilities staff. Support is required centrally from the university if such projects are to be successful. Relationships between academic and non-academic staff need to be nurtured.

The systemic institutional integration of sustainability in existing and new programmes requires work and commitment from the leadership of the discipline at the university, particularly if the campus is to be treated as an urban living lab. If multi- or cross-disciplinary engagement is sought, it needs to be supported by an institutional commitment that influences all aspects of the institution. Such a holistic approach has the greatest potential to lead to change in students, teaching and non-teaching staff and the institution as a whole, including organisations that absorb graduates once they leave the comfort of the university environment.

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Conflict of interest

There is no conflict of interest.

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Chapter 3

The Social Intrapreneurship, Innovating in the Competences Delivered to Students: Case Engineering Students of the University of La Serena, Chile

Segundo Ricardo Cabana Villca

Abstract

It is important to connect the concepts of innovation and development with the incoming entrance of sociological phenomena, in such a way that an integrating education is allowed, where the role of university education becomes a key element, where innovation in the competences delivered to the undergraduate students it becomes a challenge, which is approached from the perspective provided by the strategies that allow students to wake up the social intrapreneurship.

Keywords: student, teaching and learning, satisfaction, loyalty, support network

1. Introduction

At present, no one argues in the academic environment that we are in a moment of change and profound transformation in the role and function that education has to play in today's society, more specifically, higher education. In the last decade from different academic and also institutional areas, through the adaptation to the European Education Space, it has been declared that the role of the University and of the teachers, must make a radical change to adapt to the knowledge society [1]. Today is a challenge to overcome a teaching based on content and mastery, respond to needs, take advantage of the potential of new generations of students, and make possible a University that is connected to the social and professional environment. Every time it is imposed more in our societies not to separate the academic, labor aspects of the vital ones. In short, we need another university with a different training project for a complex society. It seems that the Bologna process forces in that direction [2], to create a university project focused on student learning in which emotion, connection, interrelation, and collaboration move, if we want it to be deep learning [3]. Undoubtedly, there are few steps that are being taken with the purpose of moving toward that horizon of learning. In the University of the Basque Country, where the experience we are going to present has been developed, we have opted for an educational model that we call IKD (Ikaskuntza kooperatibo and Dinamikoa), terms that in Basque mean Cooperative and Dynamic Learning. It is a collective attempt to develop an innovative model focused on students and their learning [4].

And in relation to it, all efforts are made to rethink university teaching betting on the use of methodologies that encourage autonomy, critical thinking, and teamwork [5].

Today the university is seen as an organization that has among its activities the generation, dissemination, and transfer of knowledge, becoming a fundamental actor of the new economy, society, and culture, which understand knowledge as a strategic factor that generates competitive advantages for allow the differentiation of organizations and their sustainability. Aware of this, universities have begun to give greater importance to one of its substantive functions: university extension or social projection, through which they hope to bring knowledge to the environment to contribute to local, regional, national, and international development. In this scenario, university students have a fundamental role in acquiring such knowledge and begin to develop their social intrapreneurial behavior, that is, thanks to their activities generate benefits at the university level and positive impact on society.

In Chile, universities are currently competing for students, resources (human and financial), and reputation, the most important being students. This increase in competition between universities is shared in other contexts. Thus, in Europe, and within the framework of the European Higher Education Area, there is also an increase in the level of competition of universities in various aspects [6]. These important changes, together with an increase in society's expectations regarding the work of state universities and the demands of users of these services, have caused great problems and a concern to improve the quality of teaching, research, and all the services that a university provides. This interest has led to a greater emphasis on the analysis of two aspects that are closely linked: quality and satisfaction [6]. Therefore, the educational process is a crucial activity in every university and can be characterized in a simple way as an interactive and intentional process; interactive, not only by the existence of human relationships among its members, but also by the interaction that occurs with a multiplicity of factors associated with this process [7].

On the other hand, when there is a correct relationship between the University and its students, and they have the conviction to formulate and implement initiatives that arise from a need of the same university, a project developed by students with intrapreneurial behaviors will be carried out. Generating activities from within the university, which are beneficial not only for your home study, but also can generate favorable impacts for society, and train an intrapreneurial future corporate character and/or entrepreneur who has his own ambitions, which generate impact in companies, the community and the world [8].

In this chapter, the impact of the variables satisfaction, identification, and fidelity is analyzed in the social intrapreneurial behavior of the students of the Faculty of Engineering of the University of La Serena. From this systemic analysis, the relevance of forming a skills profile consistent with the previous variables in a public university in Chile can be evidenced.

With regard to social innovation and social intrapreneurship, research shows the relationship between both variables. This is consistent with the statement by Esen and Sekerdil [9].

2. Analysis of the university environment

By uniting two concepts as universal as innovation and social, it is not surprising that the definitions of Social Innovation have taken such different shades over the last 10 years. While there is a general consensus in using the term to describe a novel project that has a social purpose; its focus, scale, and orientation can vary considerably, depending on the context in which it develops. In 2013, the European Commission published a Guide to Social Innovation in which it defined the concept

as "innovations that are social, both in their end and in their process," which "are not only good for society, but also boost the capacity of individuals to act." Interestingly, although said Guide clarifies that there is still no real consensus as to the meaning of this term, it considers it as an essential strategy for competitiveness [10].

The satisfaction of the teaching-learning process is the favorable appreciation that students make of the results and experiences associated with their education, based on the attention to their own needs and the achievement of their expectations [11]. There are several researches that studied the positive effects of the confidence and support of teachers. Cokley et al. [12] found that the vast majority of students considered important the relationship with their teachers for their development. Willie [13] points out that through interpersonal relationships of respect and trust, learning environments can be transformed into true learning communities. McNeely and Falci [14] found that adolescents who perceive support from their teachers are more committed to their educational institution and are less vulnerable to engaging in risky behavior. Klem and Connell [15] are recognizing that the link with educational institutions is important for learning and that students through the years of study live a progressive disengagement with these, in their research found that the support of teachers facilitated maintain ties with their schools. In the same line, Yáñez et al. [16] found that trust in teachers was a significant determinant in the attitude of students to believe in the value of the evaluation of teacher performance and in the positive disposition to answer it.

The student sets his objectives according to the institutional image projected by his house of study, which is the importance of the university in the leverage of tools that encourage innovation in the learning stage and link with the environment. This is how various investigations confirm that the way in which the organization is perceived (the evaluation made of it, its image) will influence the identification. Likewise, several researches have explored the influence on the identification of different characteristics of the identity of the organization that favor the satisfaction of said needs for self-definition. In this line, it has been demonstrated that the prestige or reputation of the organization improves the attractiveness of identity and identification. In this way, the brand image of the university will be based on solid and relevant bases for its graduates, directly influencing their levels of identification with the institution, being able to defend and feel part of it, as well as at the levels of loyalty, which will increase the intention to choose it again for postgraduate studies, keep in touch with it, recommend it or speak well of it in their environment [17].

They also contribute to the formation of the image, and in a decisive way, the information coming from the environment of the organization. This last statement must be highlighted, since not only the messages sent by the organization influence or affect the image formation, but also all those that may come from other sources and that contain information about the organization or its activities, as well as those that refer to their scope of work or action (sector to which they belong), which may indirectly affect their image [18].

The mechanisms linked to communication allow to maintain a motivating relationship between the students and the house of higher education. Corporate communication serves to remind members of their current membership and generate a positive consideration of their organizational identity. A useful communication tool is the corporate media, where the values, norms, and institutional seal are positioned in the educational community to strengthen their cohesion with the University. The frequency and quality of the university's communication with the student, also increases their loyalty with the House of Higher Studies, enhancing their identification and thus generating a positive relationship that will be the basis for social innovations that benefit the University and the society. In addition, the relational and emotional link between the University and the students is enriched,

thus increasing the benefits for all involved, reinforcing student loyalty, and activating extraordinary behaviors to support the organization [19].

From the approach of social identity applied to work, it has been insisted that social identity is the basis for receiving social support within a group and an organization. In fact, there are three different ways in the identification can affect social support: by the availability of one member of the group to provide social support to another, due to the probability that the person in need, what is accepted and finally, depends on the interpretation of the support offer from the recipient. As these studies have shown, social support is contingent on perceptions of a shared social identity, where a person is more likely to provide social support to a member of their own group, social support is more likely to be accepted when who provides it is perceived as a member of a shared social category and it is more likely that the intentions with which support is offered are better interpreted when both people belong to the same social group [20]. In this way, student satisfaction in their insertion in the university, helps to reaffirm their institutional commitment [21].

A study conducted by Schlesinger et al. [22] confirms the influence of identification on fidelity and commitment. Given the current characteristics of the university environment, such as the reduction in the number of students entering and the increase in those who drop out of studies, among others, they justify the importance of analyzing fidelity in this area, which is necessary for the survival of higher education institutions [23]. After graduation, a student identified with the institution can attract new students through positive word-of-mouth communication, improve the image and reputation of the university in their environment or attract entities or organizations that donate or fund research projects. In this way, we can see how the consequences of this identification generate fidelity, which is not limited to the time the student remains in the institution, but continue throughout his life [24]. Strategies focused on improving student satisfaction and fidelity should be converted into strategic decisions at CES, installing a paradigm of priority educational management in Chile, where the quality of education is simultaneously a short-term goal as well as a strategic objective, which should impact the decisions of educational managers [25].

In higher education, the fidelity of the user would be expressed both in their willingness to return to it to continue training as in the possibility of recommending the university to other potential users belonging to their environment (work, family, neighborhood), thus generating attitudes positive toward the institution [26]. For the university, in its educational role, not only must the student be trained to face the dynamic labor market that requires quick, innovative, and specialized answers, but it must also contribute to their citizenship formation, during this process of student training, the university should instill a sense of gratitude for the institution and of retribution for its contribution in its formative development, generating an emotional bond of fidelity [27].

The social intrapreneurship is about the possibility that employees take their value in the workplace and dare to do something with it, its materiality will result in behavior based on intrinsic motivation and resulting in high levels of commitment. The theory suggests that when people are engaged, it leads to greater creativity and greater commitment to make their initiatives a success. That is what is needed to make companies more sustainable and create a more positive impact step by step in the world [28].

The social intrapreneurship not only locates the best minds to find ideas and solutions, but also involves these people in the innovation process, letting them turn their ideas into projects and see how these projects lead to new businesses. Therefore, social innovation is based on an effective conceptual framework of university doing from the social (moral) responsibility that falls within an integrated organization, in a world of vertiginous change and increasing complexity. It is a way

of understanding the social meaning of university activity for the personal, civic-social, political and cultural development of people, communities and peoples. It is linked to the university function itself, rooted in its mission and vision [29].

In this research, the social intra-entrepreneurship in universities is deepened, together with the risk that it carries. The willingness to risk can be defined as the preference for situations that can yield beneficial rewards in case of success, but also severe consequences if the individual fails. In this way, the intrapreneur ventures into areas unknown to the organization, without knowing what the results will be. It refers to the willingness of the subject to commit to sources of opportunity that are likely to fail [19]. Personal factors are an important part when making an entrepreneurial profile, since they are talking directly to the individual. Researchers have tried to highlight the psychological aspects and personal characteristics of the entrepreneur. The University of La Salle seeks students to materialize their ideas through the design and implementation of diverse strategies that make it easier for them to present to the world life projects that not only can represent profits in monetary terms, but also provide a life experience and growth at the personal and professional levels, since these influence, in turn, the development and growth of our country. For this reason, it has contributed to the formation of its students, fostering entrepreneurial spirit and the ability to be creative, innovative, leading, and perseverant [30].

3. Proposal for a model capable of explaining the generation of social intrapreneurship in universities

3.1 Methodology

Based on the analysis of the university environment, a model is proposed, whose objective is to describe the relationship between variables that produce social intrapreneurship in universities.

To validate the proposed model, an empirical study is presented, where the method used to collect the information is of a quantitative nature based on a structured survey of 57 Likert-type questions, scale of 1 (minimum value associated with response) to 5 (maximum value associated with response), the type of sampling is probabilistic with a confidence level of 95%. The survey covered the following items, satisfaction, among which is differentiated according to its origin (Process social support, teaching-learning process, internal support process, and institutional image), identification of students with their careers, student loyalty to their university, innovation, willingness to take risks, and social intrapreneurial behavior in IES, which was evaluated based on the following two questions: Do I execute social actions or social intra-undertakings that manage to generate social value in the University/career or internal activities? Do I execute social actions or social intra-undertakings that manage to generate social value in society? The fieldwork was done personally and online, between December 2015 and May 2016, data that presented measurement errors and inconsistencies, represented with a standard deviation of 0. The valid cases amounted to 401, being all students of the Faculty of Engineering of the University of La Serena-Chile. **Figure 1** shows the outline of the proposed model.

3.2 Individual reliability of the indicators

In order to evaluate the viability of the factorial analysis, the Kaiser-Meyer-Olkin index (KMO) was quantified, which for each of the factors was greater than

0.5 and the Bartlett's sphericity test (PEB) which must be significant ($p < 0.05$) [31]. For this, the SmartPLS software version 3.2.6 was used, using the Bootstrap extraction method. In this regard, to accept an indicator as a component of a construct, we considered factor loads with values higher than 0.4 suggested by Hair [32], however, to obtain more rigor in the data, factor loads with values lower than 0.5. **Table 1** shows that the indicators FEU021, SPEA043, SPEA044, SPEA048, SPEA049, SIGI051, SPASP071, SPASP072, IS081, IS082, and DAR094 were eliminated because they did not comply with the minimum established.

3.3 Coefficient of determination and predictive validity of the model

The coefficient of determination of the endogenous or dependent variables (R^2) must be equal to or greater than 0.1 as the minimum value [33]. On the other hand, what determines the prediction quality of the structural model is the Stone-Geisser Test (Q^2). This test is used as a criterion to measure the predictive relevance of the dependent constructs and is calculated using the Blindfolding technique. In the case that $Q^2 > 0$, it indicates that the model has predictive relevance. In **Table 2**, it can be seen how the R^2 value for Social Intrapreneur Conduct is 0.465 which means that 46.5% of the variance of this construct is explained satisfactorily. From this empirical criterion all constructs have an acceptable quality of prediction power and in all of them the values of Q^2 are positive, which certifies the predictive relevance of the model.

3.4 Goodness of adjustment and hypothesis contrast

Esposito [34] suggest a global criterion of goodness of fit for PLS structural models, propose that the global goodness index of adjustment be given by means of the square root of the multiplication of the arithmetic mean of the analysis of the variance extracted (AVE) and the arithmetic mean of the coefficient of

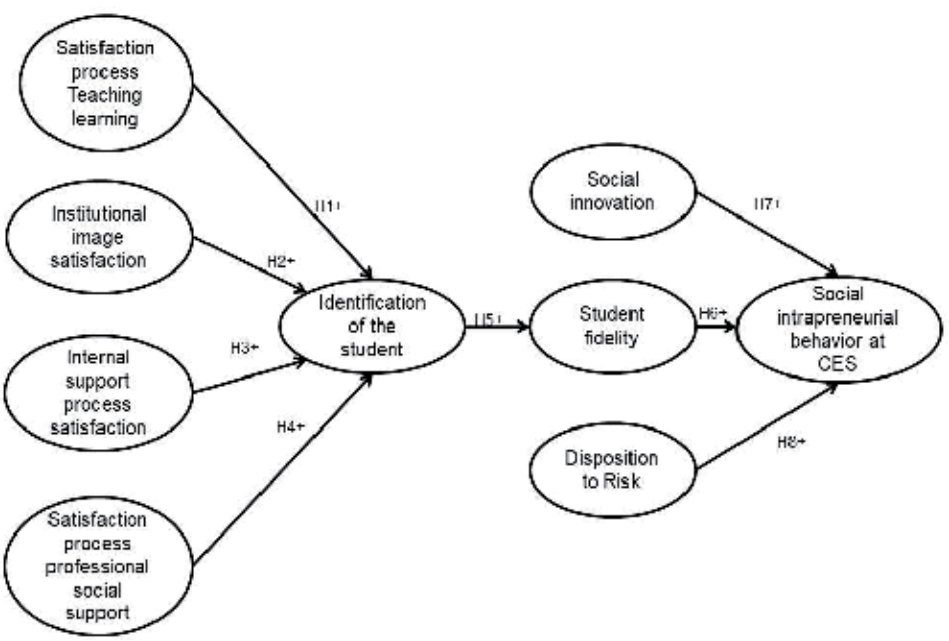

Figure 1.
Causal model on social Intrapreneur conduct in higher education institutions. H: Hypothesis.

Construct	Indicator	Factor load
Fidelity of the student with his career and university (FEU)	FEU021	0.482
	FEU022	0.722
	FEU023	0.874
	FEU024	0.605
	FEU025	0.844
Student identification with career and university (IEC)	IEC031	0.798
	IEC032	0.845
	IEC033	0.858
	IEC034	0.650
	IEC035	0.688
Satisfaction of the teaching-learning process (SPEA)	SPEA041	0.728
	SPEA042	0.695
	SPEA043	0.379
	SPEA044	0.301
	SPEA045	0.714
	SPEA046	0.771
	SPEA047	0.684
	SPEA048	0.055
	SPEA049	0.168
	SPEA050	0.661
Institutional image satisfaction (SIGI)	SIGI051	0.464
	SIGI052	0.629
	SIGI053	0.778
	SIGI054	0.765
	SIGI055	0.727
	SIGI056	0.811
Satisfaction of internal support processes (SPAI)	SPAI061	0.654
	SPAI062	0.771
	SPAI063	0.730
	SPAI064	0.663
	SPAI065	0.719
Satisfaction process professional social support (SPASP)	SPASP071	0.487
	SPASP072	0.314
	SPASP073	0.882
	SPASP074	0.892
Social innovation (ISO)	IS081	0.203
	IS082	0.086
	IS083	0.742
	IS084	0.812
	IS085	0.788

Construct	Indicator	Factor load
Risk disposition (DAR)	DAR091	0.837
	DAR092	0.864
	DAR093	0.815
	DAR094	0.369
Social intrapreneur conduct at CES (CIIES)	CIIES010	0.906
	CIIES011	0.912

Table 1.
Factorial loads of the indicators.

Construct	R^2	Q^2
Social intrapreneur conduct in IES	0.465	0.364
Fidelity of the student with his university	0.280	0.154
Identification of the student with his career	0.216	0.115

Table 2.
Explained variance and predictive validity of the model.

Hypothesis	Relations	PATH coefficient	T statistic	P Value	Contrast
H1	SPEA → IEC	0.333	6750	0.000	Accepted
H2	SIGI → IEC	0.179	3550	0.000	Accepted
H3	SPAI → IEC	0.006	0.104	0.917	Rejected
H4	SPASP → IEC	0.054	1181	0.238	Rejected
H5	IEC → FEU	0.529	13,061	0.000	Accepted
H6	FEU → CIIES	0.101	2248	0.047	Accepted
H7	ISO → CIIES	0.602	16,045	0.000	Accepted
H8	DAR → CIIES	0.117	2427	0.016	Accepted
Adjustment Goodness Index (GoF): 0.454					

Table 3.
Structural equation model: Analysis of causal relationships and hypothesis testing.

determination (R^2) of the endogenous or dependent variables. As can be seen in **Table 3**, the goodness of fit index (GoF) of the analysis model is 0.454, showing that there is a good fit in the measurement model and in the structural model, thus complying with the empirical criterion that the Goodness of fit measure should vary between 0 and 1, the higher the value, the better the index [35].

3.5 Analysis of causal relationships and hypothesis testing

The PLS methodology does not presume that the information is normally distributed, which means that, in order to evaluate the quality of the complete model, it is necessary to apply a nonparametric re-sampling technique called bootstrapping, which involves random re-sampling with replacement of the original sample,

creating new pseudo-samples from the original sample in order to obtain sample errors for hypothesis testing. The new sample obtained by this process allows the estimation of coefficients in the PLS-SEM methodology to test their statistical significance. This technique offers the calculation of the standard error of the parameters, where the condition of the statistic $T \geq 1.96$ must be verified in order to determine its level of significance (see **Table 3**) [36].

4. Comments regarding the proposed model

Esposito et al. [34] suggest a global criterion of goodness of fit for PLS structural models, propose that the index of goodness of global adjustment is given by means of the square root of the multiplication of the arithmetic mean of the analysis of the extracted variance (AVE) and the arithmetic mean of the coefficient of determination (R^2) of the endogenous or dependent variables. As can be seen in **Table 3**, the goodness of fit index (GoF) of the analysis model is 0.454, showing that there is a good fit in the measurement model and in the structural model, thus complying with the empirical criterion that the Goodness of fit measure should vary between 0 and 1, the higher the value, the better the index [35].

The correlation between social innovation and intra-entrepreneurial social behavior represents a paradigm of educational management that is a priority in Chile, given the current challenges of higher education, it is necessary that educational organizations integrate the student in a planned way in the creation of innovations in support processes and educational services.

The management of the satisfaction of the teaching-learning process and the satisfaction with the institutional image, will influence directly and positively with statistical significance, in the identification of the student with his career. The other two variables that are part of the model have no statistical influence: satisfaction of the social-professional support process and satisfaction of the internal support process. That is, students are committed to their career, if the decisions of their managers make "profitable investment" that they perform during undergraduate, by providing quality education and simultaneously enhance the brand and corporate image that projects an education center superior (CES), variables that together influence to achieve a job placement consistent with the career.

The satisfaction for the institutional image and the satisfaction derived from the teaching-learning processes are the only ones that manage to influence the identification of the students with their university, and given their relevance in increasing the value of the HEI, through internalizing the benefits of social intra-entrepreneurial behavior, installs in its managers the challenge of managing the stakeholders that are part of their environment, because they represent providers of resources, skills and knowledge that will allow them to increasingly improve the identification of the student and its causal variables.

5. Final reflections (Conclusions)

The search to better explore the role of the university and its interaction with the actors of its environment, has been the focus of intense study during the last two decades. They have investigated from different perspectives the processes of innovation and generation of value, which would be associated with the interaction between key actors of a territory, such as the university, the State and the Industry; which is known as the Triple Helix [37].

The strategic direction contains as a supra system the Theory of Resources and Capacities, this considers the complex organization as a set of resources and capabilities that form competitive advantages. Therefore, the learning capacity becomes dynamic when the intentions and the results change. This theory focuses on analyzing the resources and capabilities of organizations as a basis for formulating their strategy. It also proposes the promotion of core competencies that allow offering products and/or services that contribute in value to the client [38].

Some authors say that entrepreneurial education must be shared throughout the university, without distinguishing it as their own only from a particular school or faculty. They also point out that at least two changes are needed to meet the objectives of entrepreneurial education: curricula must be changed and different teaching-learning methods must be developed [39].

The university, as an organization that has among its activities the generation, dissemination, and transfer of knowledge, has become a fundamental actor in the new economy, which understands knowledge as a strategic factor that generates competitive advantages to allow the differentiation of organizations and its sustainability in the context. Aware of this, the university has begun to give greater importance to one of its substantive functions: university extension or social projection, through which they hope to bring knowledge to the environment to contribute to local, regional, national, and international development [40].

Social innovation, student loyalty, and willingness to risk manage to explain the social intrapreneurial behavior of the students of the Faculty of Engineering of the University. The greater the identification of the students, the greater the fidelity they feel for their home, positively impacting the social intrapreneurial behavior of the students.

The management of the directors of a higher education center (CES) regarding the satisfaction of the process of social-professional support and the satisfaction of the internal support process, do not influence with statistical significance the identification of the student with his career, without However, this does not imply that their operational and strategic management should be ruled out, given that they provide the "minimum conditions" expected in a CES, according to the institutional accreditation standards [41].

The satisfaction for the institutional image and the satisfaction derived from the teaching-learning processes are the only ones that manage to influence the identification of the students with their university, and given its relevance in increasing the value of the CES, through internalizing the benefits of social intra-entrepreneurial behavior, installs in its managers the challenge of managing the stakeholders that are part of their environment, as they represent providers of resources, skills and knowledge that will allow them to increasingly improve the identification of the student and its causal variables [41].

The systemic management of higher education centers should focus on strengthening social innovation, strengthening students' risk-taking and improving teaching-learning processes and institutional image, thus contributing to the training of students with intra-entrepreneurial behaviors and to initiate the way to build world-class CES.

At present, the educational market is on offer, due to the increase in higher education institutions, since they are not only found in large cities but have also entered intermediate cities and municipalities; Likewise, every day the clients become more demanding and their expectations increase, not only demanding quality in the products or services, but in the added value that is around them. Reason why, the fundamental strategy is to build loyalty with the brand and this is only achieved with an organizational culture focused on customer service [42].

Student loyalty with its Higher Education Center is the key to follow the transformations that result in attitudes that go hand in hand with manifestations of

innovation in the student's thinking. This is why it is a key to satisfy students with the teaching-learning processes by incorporating modifications to the plans that are the pillars of the curriculum.

Therefore, in the CES, innovation in educational management and marketing should be assumed as a daily practice at the undergraduate level. The "profitability" of the associated investments will also be reflected in the contributions and quality of the relationship with the graduates, who are relevant participants of the external support network to improve satisfaction and the teaching-learning process and therefore also it is key in the sustainable development of the University.

Although the results of this research cannot be generalized to other Universities in Chile, it cannot be denied that other national and international research positions the student as a central actor, even without specifying it, assigning him the student-client role. For this reason, it is necessary that these educational organizations integrate it in a planned manner in the co-creation of innovations in support processes and in educational services [43].

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Chapter 4

A Responsive Higher Education Curriculum: Change and Disruptive Innovation

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Abstract

This case illustrates how a large, regional university redesigned its program review, curriculum proposal, and curriculum approval processes to maintain currency and viability and meet regional educational needs. The chapter analyzes the problem, process, and outcomes of the changes, and discusses implications for broader contexts. It introduces the concept of disruptive innovation, discusses innovation and change within higher education, provides context for the institution highlighted in the case study, and outlines the initiatives. It then reviews the innovations from a change process model perspective and considers the implications of the case analysis. The chapter concludes with thoughts on the extent of change needed in higher education to keep pace with a continually-evolving global environment.

Keywords: disruptive innovations, curricular change, change models, institutional mission, higher education transformation

1. Introduction

"Most traditional organizations have accepted, in theory at least, that they must either change or die" ([1], para. 1). While dramatic, this statement bears consideration. Higher education is a traditional organization. "For a millennium, the basic structures of how universities produce and disseminate knowledge and evaluate students have survived intact through the sweeping societal changes created by technology—the moveable-type printing press, the Industrial Revolution, the telegraph, telephone, radio, television, and computers" ([2], para. 1). However, higher education institutions "are recognizing the need to change in order to provide an affordable, high quality product to a broader population" ([3], p. 87).

Concerns with return on investment, accountability, measuring quality with seat time and credit hours [4], and competition from for-profit institutions and learning organizations are causing disruption [2]. Disruptions include competency-based learning, work-based learning, prior learning credit, condensed degrees, distance learning, Massive Open Online Courses (MOOCs), personalized learning, outsourcing of educational services, new or revamped delivery modalities such as online learning, and partnerships between industry and higher education resulting in new forms of credentials.

One of the most increasingly common disruptions in traditional higher education is online learning, which institutions typically adopt to be competitive,

economically viable, and responsive to a changing market [3]. Formerly a disruption characteristic of open universities, distance learning has now become mainstream, with the potential to transform "curriculum and learning" ([4], p. 4). In addition to delivery modalities, transformations might also involve revising current curricula and creating new curricula based on findings from review and evaluation processes and in response to employer needs.

Employers of recent college graduates value cross-cutting skills such as critical thinking, problem-solving, oral and written communication, and teamwork [5]. These skills can be developed in programs of study throughout the university. However, universities must review current courses and program offerings to determine their effectiveness and currency, both in terms of cross-cutting skills and discipline-based knowledge, and identify new programs to address changing workforce needs. Although employers continue to rate these skills highly and consider them more important than area of study, they do not feel that recent college graduates have attained these skills [5], thus a gap exists between what higher education institutions are providing and what is needed.

This case illustrates how a large, regional university redesigned its program review, curriculum proposal, and curriculum approval processes to maintain currency and viability and meet regional educational needs. The changes aimed to address issues in these processes that had been identified by stakeholders, and to ensure that program revisions and new programs were strategic in terms of the institution's ability to prepare students with appropriate cross-cutting and disciplinary knowledge, skills, and abilities. This also entailed designing a more timely curriculum approval process so that curriculum changes and new programs reflected disciplinary currency and changing employer needs. In short, innovations to the institution's curricular processes were needed to ensure that the university was providing academic programs that were current and in demand, and that it was prioritizing the right new programs for development.

The chapter analyzes the problem, process, and outcomes of the changes, and discusses implications for broader contexts. It introduces the concept of disruptive innovations, discusses innovation and change within higher education, provides context for the institution highlighted in the case study, and outlines the initiatives. It then reviews the innovations from a change process model perspective and considers the implications of the case analysis. The chapter concludes with thoughts on the extent of change needed in higher education to keep pace with a continually-evolving global environment.

2. Disruptive innovation

Higher education is considered a sustaining innovation. Until fairly recently, in many contexts, participation was limited to those with the cultural capital (e.g., knowledge, skills, behaviors, social networks) [6] to be admitted and successful [3]. However, these formerly elite systems of higher education are now encouraging broad participation [7], particularly for those from disadvantaged socioeconomic backgrounds, certain geographical locations, and ethnic groups who do not have a traditional of higher education with the aim of improving social equity [8]. Various goals have been set related to degree attainment. European countries are striving for 40% of all 30–34 year-olds to complete a tertiary education by 2020 [9], and in the U.S., the goal is for 60% of working age Americans to obtain a postsecondary degree or credential by 2025 [10].

Due to the changing landscape of higher education, and specifically the diverse populations of learners, as well as increasing competition from disruptive

innovators such as for-profit and other educational providers, some traditional institutions are becoming disruptive innovators. Disruptive innovation is defined as follows:

> *The process by which products and services, which at one point were so expensive, complicated, and inconvenient that only a small fraction of people could access them, become transformed into ones that are simpler, more convenient, lower in cost, and far more accessible* [4].

In general, disruptive innovations involve emerging technologies and related practices, which are initially unproven and appeal to a limited number of people, but as they improve, they attract more customers and displace current providers [3, 4]. Included in the category of disruptive innovations is flexible learning, including technology-enhanced and work-based/work-place learning, which provides choice in "how, what, when and where" to learn and "the pace, place and mode of delivery" ([11], para. 1, 19; [12]). Another example of a disruptive innovation is open and distance universities, which were formerly innovative in their approach to the provision of higher education credentials, but are now looking for ways to distinguish themselves because traditional universities have become more like them. The concept of disruptive innovation provides a lens through which to examine change in higher education generally and the changes discussed in this case specifically.

3. Innovation and change in higher education

Change can easily go awry, particularly when people can "choose their own balance between conformity and innovation" ([13], p. 55), which is generally the case in higher education. Not only does the faculty have considerable autonomy, but often schools, colleges, and departments operate largely independently. Higher education is loosely coupled in terms of organizational structure, which can counter efforts at standardization [14]. In the case of the curriculum, the faculty have primary responsibility due to their disciplinary expertise. However, curricular changes and particularly the introduction of new programs can be a considerable investment to an institution, which suggests the need for a deliberate approach to decision-making related to curricular change. Thus, collaboration and effective processes are needed.

Another issue that impacts change in higher education is what some refer to as initiative fatigue—this occurs when various areas in the institution want to innovate, respond to needs, embrace opportunities, and contribute to student success. "In our experience, the reason for most [change] failures is that in their rush to change their organizations, managers end up immersing themselves in an alphabet soup of initiatives" ([1], para. 2). This is evident in higher education, particularly with the expanse of technological solutions designed to solve current issues, such as the use of data-analytics to improve student retention and completion, a significant problem in U.S. institutions of higher education (30% of students admitted leave during or after their first year) [15]. With multiple areas on campus striving to improve, enhance, and innovate, change can become too much to manage and end in frustration, or in compromise and incremental tweaking rather than true innovation.

Determining where to focus change efforts and how to manage them, then, are critical considerations. Leaders must determine if they are basing the need for change on a sense of intuition, their own agendas, past experience (e.g., when I

was at my former institution, we did this and it worked wonderfully), or personal opinion, or if they have identified a new opportunity for a highly desirable future for the organization or a danger in maintaining the status quo. They also need to determine the extent to which they can convincingly show their vision to stakeholders so that the latter can see the end result. Too much consideration and failure to act, however, can have repercussions. University presidents have been fired for not pursuing change quickly enough [2]. As they prepare for change, leaders might ask:

- How are various change efforts or proposed efforts connected and which should be prioritized?
- Will the proposed change address a particular issue or opportunity or threat? How do I know?
- What is the rationale for the change and will it stand up to stakeholder examination?

A first step, then, is to identify a true need or opportunity for change, determine how it will impact other initiatives, set priorities, and anticipate stakeholder reactions.

Related to stakeholder reactions, leading or managing change requires an understanding of sources of resistance. These include an unwillingness to change habits, concerns about security (job loss, lack of required skills, possible changes in pay), structural inertia (embedded policies and procedures), group norms that influence individuals not to change, and the threat of power redistribution [16]. Other factors are complacency, immobilization (due to fear or panic), defiance, and pessimism [17]. All of these apply to higher education. Leaders must determine the best approach to persuading and influencing others as well as initiating, implementing, and sustaining change.

In a study of 26 higher education institutions seeking to implement different types of change, those most successful at transformation were characterized as follows:

1. Favorable external environments and internal conditions allowed institutions to create and control their futures in the face of outside pressure to change.
2. Leaders upheld academic values, established trust, shared credit for success, and had a long-term perspective.
3. Leaders understood the need for new practices, structures, and procedures and encouraged people to examine underlying assumptions of the status quo.
4. Leaders made adjustments in their actions as they listened to stakeholders across the institution and learned from them [18].

These findings identify commonalities in successful higher education change, but do not specifically establish how to manage change. Kotter and Cohen's 8-step model [17] provides further direction for change management, and is based on data examining instances of why change failed. See **Table 1**.

Successful change involves careful planning and effective leadership. Models such as this provide a framework through which to consider opportunities, potential barriers and derailers, and determine strategies to make change last. They provide a means of implementing a disruptive change.

Create a sense of urgency	Examine opportunities and threats. Show people the need to change – not with data and presentations but with compelling stories. Appeal to emotions
Form a guiding team	Identify change agents and stakeholders and involve them in leading the change
Get the vision right	Communicate a clear and concise vision that helps people visualize what the organization will look like when the change is implemented
Communicate for buy-in	Share, report, motivate, get feedback. Listen to people's opinions and views. Involve others
Empower action	Remove barriers. Examine policies and processes that hinder change. Provide training. Reward change behaviors
Create short-term wins	Do not start too many initiatives at once. Aim for immediate, highly visible, and unambiguous wins
Do not let up	Avoid bureaucratic practices that take up time. Create structures that empower people to innovate and solve sticky problems. Build on short-terms wins and continue the momentum
Make change stick	Cultural changes take time. Reinforce positive behaviors with recognition; celebrate; reward; embed change into the culture

Table 1.
Kotter and Cohen's 8-step model for change.

4. Context and overview

The context for this case is a large, open admission university in the United States. The university has nearly 40,000 students, of whom a growing percentage are non-traditional (first in their families to pursue a degree) and non-traditional (25 years old and older). The institution has a teaching, rather than a research, mission, and its primary purpose is addressing regional educational needs. As such, it has a range of programs—certificates, associate's degrees, applied associate's degrees, bachelor's degrees, and selected master's degrees.

This in itself is unique as most higher education institutions in the U.S. serve a community college function with 2-year technical or preparatory degrees (e.g., the latter prepare students to transfer to a 4-year institution), offer 4-year undergraduate degrees, or a combination undergraduate and graduate degrees. The university in this case study offers a wide range of degree programs. This is challenging as the inclusion of technical training along with traditional liberal arts degrees requires differentiation in terms of faculty credentials, tenure and promotion, course delivery modalities, scheduling, and other logistics. Also, due to being open admission, the university provides developmental education programs in English (reading/writing) and math. It has a range of student support programming such as a student success course, academic tutoring, and retention mentors (peers who reach out to students who may need help).

The university also holds an elective Carnegie classification as a community engaged institution, reflecting its commitment to its surrounding community and to forging mutually beneficial partnerships with local organizations and businesses [19]. As such, it provides extensive community service learning opportunities through which students apply the academic content they are studying in their courses to help resolve community or organizational issues while simultaneously gaining practical, hands-on experience.

Finally, the institution has experienced steady and consistent growth in student enrollment and projections indicate continued future growth. As such, new degree programs are added each year to respond to needs and opportunities, and new faculty members are hired with the expertise to offer these programs. The institution

reviews proposals for new programs on a regular basis and may have as many as 35 new programs or program revisions in process at any given time.

5. The initiatives

This section discusses three change initiatives, all of them related to the university's mission, and specifically, its academic programs. These initiatives address the challenge identified in the introduction—to ensure that the institution's existing academic programs are in demand and current, that new programs are appropriately prioritized for development, and that all curricular changes are made in a timely manner. The overall goal of these initiatives is to prepare graduates with the cross-cutting and disciplinary knowledge, skills, and abilities to meet regional workforce needs. For each initiative, the following is provided: problem, change process, outcomes.

5.1 Program review

Problem: Program review is required by the governing body of the university every 7 years. The purpose of the review is to examine the purpose of the program, qualifications of faculty who provide it, costs, and outcomes; in other words, to ensure that programs are effective, in demand, and are graduating students. Prior to the change, program reviews tended to focus on compliance and rarely resulted in change or curricular enhancements. Department chairs or an assigned person in the department completed the report, submitted it, and then it sat unused. When time for the next review came around, generally those responsible for completing it had difficulty finding the previous review. It simply was not meaningful.

Change process: To examine the viability of changing the program review process, a consultant with expertise in a particular curriculum prioritization model was invited to campus. He talked to stakeholders (e.g., administrators, faculty members, staff, state regent's office representatives) to share possible new directions and determine readiness for change. Based on these discussions and ensuing feedback, a guiding team led the identification of new evaluation criteria and coordinated with the office of institutional research to provide needed data in a readily accessible interactive format on its website. The criteria, or sections of the report, were as follows: department description, workforce data and analysis, institutional data and analysis, student learning outcome results, and strengths, weaknesses, opportunities, threats.

The workforce data section involved reviewing and analyzing employment trends and projections such as job openings (local, state, national), number of graduates in the state with relevant degrees, salary ranges, and year over year changes. This information is directly related to the institution's mission to meet regional workforce needs and had not been previously available. Institutional data included information about students (e.g., number of majors, number of enrollments outside the department, number of students by class standing and minority status), graduation (e.g., number of degrees awarded, number of semesters to graduation – by student population), faculty (e.g., number, full/part-time ratio, teaching loads), and costs (e.g., cost per student). The focus of this component was to examine program effectiveness in terms of student completions (by ethnicity, age, full/part-time) and also costs based on number of faculty members and their teaching loads (along with other variables).

Two departments piloted the criteria and process. The guiding team worked closely with them. Based on this experience, modifications were made after which

a second pilot occurred to test the changes. Following additional adjustments, the new review process was fully launched. It entailed all departments in a single college or school undergoing review in the same year. Each department was given a packet with the criteria and guiding questions and access to a website with their data. The data was presented in a format allowing comparisons across the college/school and at an institutional level. Department members analyzed the information and provided written comments for each criteria after which their report was reviewed by their dean and the guiding team. The process required departments to create an action plan that was reviewed annually at the dean and vice president levels.

Outcomes: As a result of this program review innovation, departments had access to new types of data, giving them a better idea of the extent to which they were supporting the institution's mission and how they compared to other units. This information was available to institutional leaders who then had a comparative, analytical snapshot of all their programs. The purpose for the review was clearer and the results more meaningful. Also, for the first time, the data could be viewed by all degree types (e.g., emphases, certificates, 2-year degrees), which enabled faculty members to view numbers of students in these programs and their graduation rates.

A key goal of the change was to integrate planning, assessment, and program review processes. The integration is reflected in **Figure 1**. The requirement for commentary on student learning outcomes assessment in the program review reports connected review and assessment processes rather than having them be separate analyses. Additionally, budget requests could be supported with program review evidence. In other words, weaknesses in a program, identified as part of program review, could lead to funding requests (e.g., more faculty, new equipment), and subsequently, additional resources. The new reporting format could also show deans and leaders, however, that some programs had more positions that were justifiable given student enrollments.

Figure 1 also indicates that program review reports no longer sat on a shelf, but that the resulting action plans were reviewed annually. For department chairs, this review occurred with the dean, after which deans reported outcomes to the vice president. Overall, the change resulted in closer connections across planning, review, assessment, and budget functions as well as ensuring greater accountability. It addressed concerns with the currency and relevance of curricular content, the degree to which students were acquiring needed content and skills, the demand for a program, and needed budgetary adjustments by collecting and examining relevant data and acting on the findings.

5.2 New program proposals

Problem: With the enrollment growth of the university and extensive business and industry development in the region, the university had to be responsive to the needs of its community, which entailed consideration of program revisions and new programs. The typical process for new program approval prior to the innovation was for a faculty member to get an idea for a program and discuss it with his department chair and dean after which the dean would bring it to the dean's council. If there was general support, faculty member completed and submitted the formal curriculum proposal form.

Nearly all ideas were considered worthy and moved forward to the formal proposal stage and were subsequently approved. There was minimal scrutiny of which programs should be prioritized; new programs were proposed throughout the year and approved as they were presented. Each proposal had budget implications—new faculty and staff positions, equipment, and office space. No one tracked what additional proposals were in the idea or development stage at the department level.

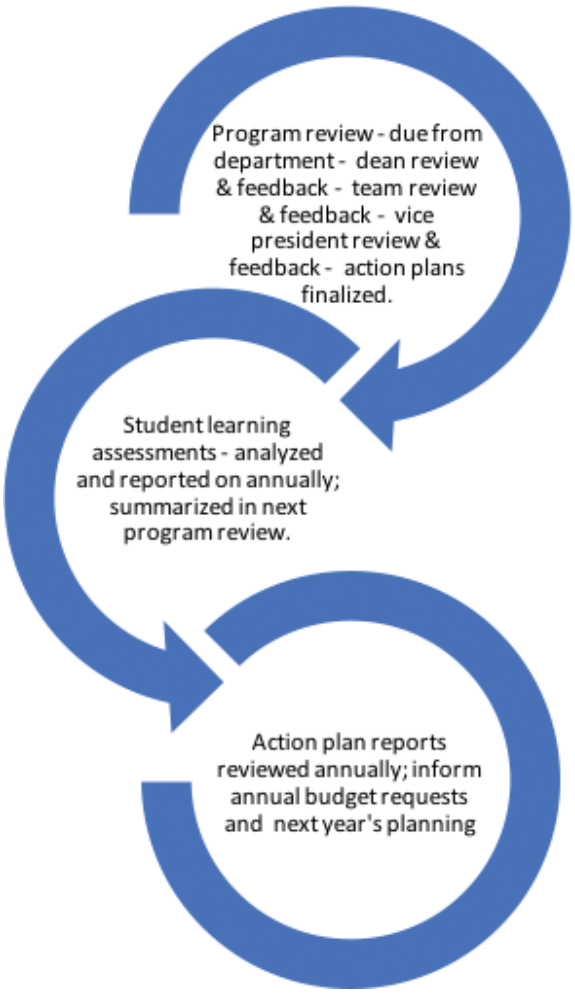

Figure 1.
Program review, assessment, and planning/budgeting cycle.

Initial proposals were simply approved when presented with no consistency in the types of information, evidence, or data provided, and even though formal proposals contained standardized information, these were generally moved forward although requests for clarification or additional information were sometimes made.

Change process: To address this issue, particularly due to the resource implications of establishing new programs and the desire to ensure their relevance, the dean's council decided to have a preliminary review of all programs under consideration at a set time each year. The review would also require specific standardized information. As such, a feasibility template was created and refined with feedback from the deans and their faculty as well as the curriculum office. The template included information needed for the full template that would be completed if the proposal was approved to move forward. The full template needed dean's council, provost, trustee, and regent approvals. Programs approved through this process also needed to be submitted to the university's accrediting body.

The feasibility template consisted of the following criteria: program name, sponsoring department/college, number of required credit hours, program type, proposed beginning term, rationale, consistency with university mission, labor market demand (e.g., Bureau of Labor forecasts, growth rate, wages, required

education, job postings over a 3-year period), student demand (e.g., number of degree completers in the region, enrollments in core courses required in the degree – if applicable), similar programs offered at universities in the region, external accreditation requirements, estimated enrollments and expenses (e.g., new positions, capital costs). Additional questions were mandatory for proposed graduate programs to ensure appropriate pathways from undergraduate programs and department capacity. These included how the graduate program would be distinct from the undergraduate program (if one existed); faculty staff, or resources from the undergraduate program needed to support the graduate program, reassignment of faculty members' workload hours from teaching undergraduate courses to teaching graduate courses, and recommended tuition rate with rationale. The required data for the feasibility template was provided upon request from the institutional research office, and partially overlapped with the data for program review.

Outcomes: In the past, the information presented for initial approval of a new program was inconsistent. Data sources varied, and student demand typically consisted of surveying students to see how interested they would be in a particular degree. The new system addressed these issues. Moreover, all ideas for new programs were reviewed annually as a set and discussed based on the standardized criteria, and programs deemed the most compelling were selected to move forward to the next step which entailed further review.

As an example, in the first round of the process, 25 initial ideas for new master's degree programs were considered based on feasibility studies. Only eight were selected to move to the next stage and the rest were put on hold for future consideration. Determination for the selections was based on projections of workforce demand, costs, and other criteria as provided in the new template. Decision-makers prioritized the programs that were of most relevance and value to students and employers. In this way, they were supporting the mission of the university and making a wise investment in the future. The changes resulted in a system that addressed the challenge of developing new academic programs based on faculty expertise or preference rather than responsiveness to external demand.

5.3 Curriculum process

Problem: One of the most critical aspects of being responsive to workforce needs, specifically the ability to create new programs, was the curriculum approval process, which was thorough and lengthy prior to the change initiative. Based on the approval steps and the number of bodies which needed to approve new programs, it could take as long as 2 years for a program to be implemented. This was particularly problematic when local businesses approached the university to request training and certification programs, and was also frustrating to faculty members who could not understand why the process was slow and entailed so many steps as well as cumbersome forms.

In addition to new program approvals, changes in existing curricula were also quite involved. Due to the detail and complexity of preparing the required documentation for a change and the scrutiny this information received, curricular revisions could take a considerable amount of time to be approved. Extensive revisions were often needed until departments got all the information right, and implementation of changes had to be far in advance of the start date of classes to account for catalog inputting and registration processes. Overall, the curriculum process was one of the most criticized areas at the university.

Change process: Similar to the process for program review changes, in this case, a consultant was involved. One reason for this was that the current system was strongly embedded into the university and previous attempts at change had not

been received favorably by those with direct responsibility for the process. Having an external perspective by one with expertise in the area was hoped to have an impact. The consultant did preliminary work by reviewing documentation prior to her visit to consider not only process, but organizational structure, roles, and responsibilities; she then engaged with constituent groups across campus during her visit. She identified a number of ways the process could maintain an emphasis on quality yet be shortened.

Subsequently, a number of changes that were under the control of the institution were made to expedite internal approvals. The primary goals were to devolve greater responsibility for curriculum processes to faculty, departments, colleges, and schools, shortening the timeline for curriculum approvals, and simplifying and streamlining the types of information required for curriculum changes. In essence, the new process allowed for a greater number of curricular changes to be approved at the department/college level and simply communicated to the university-level curriculum committee as information items rather than having to be reviewed and approved at that level.

Other aspects of the curriculum approval process, such as those involving the trustees, regents, and accrediting body were more problematic. However, the institution made a significant change to address this. Rather than allowing curriculum change proposals to be submitted only once a year, it moved to a rolling submission process. This meant that once all the needed steps had been accomplished at the institutional level, proposals could move forward to other approving bodies and be considered at their scheduled meetings throughout the year rather than at only a limited number of meetings as was the case previously. The rolling process also allowed changes to be implemented into university systems at more points during the year rather than only annually. Related changes involved new curriculum management software and a curriculum policy outlining responsibilities, roles, and process.

Outcomes: The changes had a positive impact on the curriculum process, particularly by giving it more flexibility with implementation of the rolling process and identifying consent items that did not need full curriculum committee review. Having responsibilities documented in policy was also helpful in terms of providing guidance. As such, the change addressed the challenge of the institution's inability to respond to workforce needs in a timely way. However, turnover in various positions created a lack of follow-through and understanding of what needed to occur and why. Devolving responsibility to the college level was only partially successful as the need to appoint someone responsible for this fell through the cracks at the dean level.

Additionally, existing systems and structures within the institution, such as having an annual catalog, were somewhat set in stone and those responsible for them insisted they could not change. This resulted in minor tweaks rather than the overhaul needed to be truly responsive to regional workforce needs. Business and industry representatives have difficulty understanding the slow pace of higher education. This initiative is a prime example of higher education as a sustaining organization rather than a disruptive innovator. The constraints higher education operates under need to be disrupted for true innovation to occur. This did not completely occur in this case.

6. Analysis and observations

The innovations described had the same underlying goal—to be responsive to employer needs by making curricular adjustments and developing new programs,

thereby preparing students with knowledge, skills, and abilities for their careers. In the case of program review, data on employment demand as well as student learning outcomes was included, thus addressing this goal. The same was true of proposals for new programs—the change resulted in substantiating requests with evidence of demand. The curriculum approval process change aimed to enable the university to decrease bureaucracy, increase flexibility, and decrease time to implementation. All changes resulted in some level of success.

Although a change model did not guide these innovations, it may be helpful to review the changes from the perspective of Kotter and Cohen's 8-step change process [7] in order to determine what might have been done differently. See **Table 1** for a review of each step and **Table 2** for an evaluation of the changes in terms of the model.

For most of the change initiatives, a fairly compelling reason existed but a great deal of *urgency* was not evident; the systems that were the focus of the change had been in place for a considerable time and were stable, and those closest to them did not see a need for change. Those leading the changes did not appeal to people's emotions or help people see the need to the extent necessary; thus some were unconvinced. The need for the curriculum approval process change was clearly evident to one group of stakeholders, but not to those most closely responsible for the process and who had designed the existing process, which met their goals but not the institution's goals.

Although the program review change was led by a *guiding team*, the other initiatives were largely top-down from the administration. The *vision*, or the purpose for the changes and where the university wanted to end up was clear, yet communication of the vision likely did not reach all levels of the organization nor was it touted on a regular basis by organizational leaders. They were leading a number

Step	Program review	New program proposals	Curriculum approval process
Create a sense of urgency	Some stakeholders perceived more urgency than others. A compelling need was not established for all stakeholders		
Form a guiding team	A team of key stakeholders led the initiative	Changes were initiated and led by top-level administrators rather than by key stakeholders and change agents	
Get the vision right	The vision for the initiatives was appropriate to the institution and its mission, but the intended results of the vision were not clearly established for the stakeholders		
Communicate for buy-in	Communication was uneven due to being left to unit leaders. Buy-in was somewhat accomplished due to the appeal of simplification of processes and consistency of standards, but change was primarily accomplished through compliance		
Empower action	Departments were provided with needed data, which simplified the program review process	The new proposal template provided structure and guidance	Implementation was uneven due to lack of training at department/college levels
Create short-term wins	Short-term wins were present in all cases as new procedures were initially implemented and evaluated		
Do not let up	Short-term wins were not utilized to further refine or eliminate bureaucratic processes or launch further innovations		Turnover of people in key positions resulted in limited change
Make change stick	Change was permanent largely due to the fact that the new processes were required and embedded into existing systems		Further changes to more fully expedite curriculum approvals did not occur

Table 2.
Evaluation of curricular innovations.

of initiatives and placed higher priority on some over others. Thus a consistent message about the vision was lacking. Unit leaders were responsible to convey the vision and this was uneven; thus, *communicating for buy-in* was only moderately accomplished. In the case of the program proposal change, communication was more successful, but likely because those who wanted to propose new programs had to comply with the new template. However, it also gave those proposing a program the opportunity to create a strong case and it leveled the playing field, which were advantages readily recognized.

Empowering action involves removing barriers. In the program review scenario, this was accomplished by making the process easier. Departments were provided with data for their reports and the data was consistent across programs to enable comparisons. They did not have to find their own data or request it and wait. This is an example of removing barriers. In the case of new program proposals, structure was provided in the form of procedural documents and notations on the proposal form providing guidance. In this case as well, a packet of needed data to support demand was distributed to departments. Curriculum approval processes fell short due to lack of follow through in identifying and training people at the department level to manage the approvals that had been pushed down from the centralized committee, so once again, this was uneven. The new curriculum policy, however, provided support for the changes to be stabilized.

Short-term wins were most visible with the curriculum approval process. There were a few examples early on of approvals occurring in an expedited fashion that were used to illustrate the success of the change. Program review also had some early success with the piloting of the changes, which helped others see the value of the new criteria and data sets. The program proposal process was shown to be effective in its first iteration as proposals were screened more rigorously and consistently.

Do not let up and *make change stick* were least evident in the curriculum approval change. This change was characterized by a turnover of people in key positions and much of the momentum was lost. It is not clearly evident that the new system is having the impact originally anticipated. Once the first wave of change occurred, additional change did not ensue. In the case of program review and new program proposals, the desired changes were implemented but not used as a springboard for further refinement or change in bureaucratic processes or to launch further innovations. In all cases, the changes became permanent in the sense that all the processes are required. For example, the new program review process is mandatory, and if one wants to modify curriculum, one must follow set procedures and policies.

7. Discussion and implications

Lessons learned from this analysis are that for change in higher education to be long-standing and rooted in the culture of an institution, it needs careful planning and effective leadership. Many change models exist, and most of them are based on research that has revealed why change has not succeeded. Without the guidance of a change model, change efforts will result in compromise and small, incremental change, which has little impact. Kotter and Cohen [17] explain a some of the circumstances that block change. In the case of the initiatives in the case study, the one most applicable is the focus on small modifications.

> *People without a great deal of bold strategy development experience often flounder. They can't figure out what to do because it's different from anything they have done before. They sometimes back away from the obvious because it's threatening. Or they convince themselves that small modifications in their current ways of operating will*

> *achieve the vision—eventually. Or, because they can think of no strategic possibility, they conclude that the vision is ridiculous, even though it is not* ([17], p. 73)

The basic structure of higher education with its semester system, official annual catalog outlining policies and program offerings, software management systems for processes such as registration, curriculum, and scheduling, and accreditation standards is not designed to be nimble. All of these affected the changes in this case study. The people behind these systems have been trained to ensure that policies and standards are met and are not generally in a position to encourage or make sweeping changes. Those in higher level positions often do not have the detailed knowledge of systems and how they are designed, thus a gap exists that is difficult to overcome. The experts resist and say it cannot be done and the change agents or leaders do not have the technical knowledge to counter. This inhibits true innovation.

The innovations described in this case are not disruptive, and likely do not go far enough to address what the university set out to achieve and what it needs to achieve to manage its substantial and continuing enrollment growth with limited appropriated government funding and budgetary restrictions on building projects and infrastructure enhancements. Although the changes discussed in this case resulted in subtle improvements, they fell short of true disruption or innovation due to the stability of traditional practices and culture. These hinder the university from fully meeting its mission as an open admission institution serving all students who enter its doors (e.g. a growing non-traditional student body, many of whom work full-time and are raising families as well as students with limited cultural capital), and ensuring that these students have a range of appropriate learning experiences that result in the knowledge, skills, and abilities needed by employers.

Innovations in higher education require knowledge about how to lead change and also the vision and commitment to move beyond the confining barriers within institutions into uncharted waters. Some institutions are succeeding at this, and particularly in designing responsive curriculum that addresses both student and workforce needs. Partnering with edX, a MOOC venture developed by Harvard and MIT, one institution is offering credit for completion of MOOC courses at a discounted tuition rate, sets of MOOC courses that result in micro-degrees accepted by employers, and first-year credit-bearing MOOC course packages that are accepted at a range of universities [20]. These initiatives are disruptive in the sense that they are accrediting MOOC courses and not only offering them for credit but credit at half the price of regular campus courses to improve access and cost, and not requiring payment of the fee until after course completion.

Increasingly, universities will need to come to terms with these innovations by such strategies as altering their entire course pricing structure, concentrating on their core competencies, and perhaps restructure themselves as two-year institutions that contract out the rest of their degree requirements to other providers. If they do not, they could soon be out of business ([20], para. 3). The curriculum is at the heart of higher education and as such, transformations must focus on what is taught and what is learned, and the relevance of this teaching and learning to society. The institution in this case study made strides toward this goal by implementing curricular process innovations relevant to its context. Lessons relevant to managing change were also learned.

8. Conclusion

In this chapter, we explored factors directly applicable to higher education change efforts and introduced a model for change. We reviewed three instances

of change initiatives at a large open admission university, and analyzed them to determine their degree of success. We reflected on disruptions in higher education and their necessity in order to ensure the relevance and value of higher education to its constituents.

In this particular case, although enhancements to the institution's current processes were made, the changes fell short of the types of disruption needed to fully respond to internal and external stakeholders and make curricular adjustments in a timely manner. Long-standing practices and systems can stagnate change unless needed changes are clearly envisioned and effectively managed.

Disruptions in curriculum delivery and packaging are critical to the higher education sector globally. Opportunities exist for those with the courage and boldness to take risks and innovate. Others will make incremental improvements, as did the institution in this case study, to ensure quality and valued outcomes. Institutions must determine how to innovate their curricula in order to ensure the relevance of higher education in the future. This chapter offered insights into how one institution engaged in this process. An evaluation of the case demonstrated the need to identify and follow a model for change in order to maximize the effectiveness of curricular change. Such a model is needed to ensure the success of disruptive innovations. Only by doing so will higher education institutions be able to transform practice across diverse settings, and not only meet, but anticipate, the needs of a rapidly-changing world.

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Chapter 5

Learning Innovations for Identifying and Developing Talent for University

Mel Henry, David C. Gibson, Charles Flodin and Dirk Ifenthaler

Abstract

As a response to global and local imperatives for organizational, operational, and social change facing education today, learning innovations developed by Curtin University's Learning Futures team offer examples of new technology-enhanced learning experiences used to identify and develop talent for university. The innovations presented are helping to reset school-university relationships to a focus on direct, scalable, and personalized digital learning services, delivered via interactive technologies that utilize game-based and team-based learning approaches. Two frameworks are proposed: one for collecting and evaluating evidence of a future ready learner and one for situating technology innovations across five domains of higher education learning and teaching. The case study indicates that new educational technology innovations can support an expansion of the university's mission, as well as its academic, research, and service-based strategic actions, by enabling a continuum of potential entry points for learners of all ages, accessible anywhere at any time.

Keywords: enabling programs, advanced studies, raising aspirations, challenge-based learning, university-school relations

1. Introduction

Remaining relevant and meaningful within a continuously evolving and increasingly connected world requires universities to transform how we teach, employing innovations and technology-enabled approaches to engage, motivate, and support students to succeed. The learning innovations profiled in this chapter apply technology-enhanced learning approaches to identify and develop talent for university. The chapter begins by introducing a modern Australian university, globally recognized for its strong connections with industry, high-impact research and wide range of innovative courses: Curtin University, and the context in which it operates. Three areas of transformation, driven by global shifts in education are then discussed, and exemplars presented of applicable social, organizational and operational innovations applied at Curtin.

1.1 About Curtin University

Curtin University's mission is to "transform lives and communities through education and research" (https://about.curtin.edu.au/who/vision-mission-values/),

with a vision to "be a beacon for positive change, embracing the challenges and opportunities of our times" and "provide richly interactive and personalized learning experiences" (https://about.curtin.edu.au/who/vision-mission-values/2030-2/). This agenda of education as transformational, and of placing students at the center of the educational experience, embodies the university's culture of innovation. Through its innovative approaches to learning and teaching, Curtin has embraced scalable, personalized technological innovations to reset the traditional school-university relationship, while also expanding the university's capability for academic, research, and service-based strategic actions. These innovations have arisen in response to global and local imperatives to address organizational, operational, and social challenges facing education today.

With campuses in Western Australia, Dubai, Mauritius, Singapore, and Malaysia, as well as a significant online presence, Curtin University enrolls approximately 60,000 students annually, making it the largest university in Western Australia. Curtin University's home campus in Western Australia is situated in one of the most isolated state capitals in the world, Perth, while simultaneously perched on the doorstep of the Asia-Pacific region. The university's size, campus locations, and culture of innovation have positioned Curtin well to adapt to the evolving needs of today's students, including those residing within the most populated time zone in the world.

Transforming learning at Curtin University occupies the center of the "Learning for Tomorrow" program of innovations, initiated in 2012, to dramatically shift policies, people, and practices to empower a university with global aspirations [1]. More recently, a newly articulated research focus emphasizes demand-driven research, with clear impacts on partners and the community [2]. These policy choices and commitments have given rise to new ideas about what kind of knowledge and skills are needed for students to succeed, and what role technology can play in the transformational vision.

Curtin's Learning Futures team [3] is tasked with building human and technological capacity, and leading and managing early stage innovation projects that support the university's transformational agenda. The team's innovations span formal and informal learning, create new pathways and partnerships, deliver aspirational and enabling programs, utilize and share expertise in learning analytics, promote faculty-based research and support continuous improvement. The team works across social, organizational, and operational dimensions of the university to implement the central learning and teaching area's mission *to inspire and support innovation, excellence and impact in learning and teaching.* Key innovations led by this Learning Futures team are presented in this chapter.

1.2 The transformation of higher education

Beyond the university, several challenges have arisen in the intersection of national policy and funding, state opportunities, and the needs and global drivers of economy and societal well-being [4]. Today's social and economic climates present important impetuses for change within higher education. First, the perceived *social* role and value of higher education have evolved from a traditional conduit to enlightenment, to an essential means to obtain gainful employment. There is evidence also of an emerging axiom in which students see themselves as consumers of education, who enter a transactional relationship with universities that demand a demonstrative return on investment [5]. Second, other drivers of transformation are found in the emerging digital *organization* of learning and the advancement of knowledge, sparked by the rise of the Internet, social networks, collaborative research, and big data. Finally, higher education *operations* are also undergoing transformation as a result of challenges and opportunities posed by

the technological revolution. Responding to these social, organizational, and operational transformations impacting higher education presents an innovation challenge for universities [6]. No longer can universities operate as they have for centuries, under a traditional model of standardized, objective, and predefined learning pathways. Instead, universities must explore new approaches to learning and teaching that offer increased flexibility and personalization, while simultaneously ensuring their own sustainability as organizations. New conceptualizations of who our students are, what they seek, and what makes them succeed must be considered, reframing the concept of talent, and driving essential innovations in how such talent is identified and developed. With technology offering significant opportunities to enhance access and success in higher education, furthermore, technology-enabled learning and teaching approaches present an important avenue for such innovations, facilitating unique opportunities to identify and develop talent for today's university. These significant transformations impacting modern higher education are discussed further in the following sections, before introducing a case narrative for how one university has approached this challenge.

2. Social transformations in higher education

The role of universities and of higher education in a global society is changing. Students are increasingly seeking higher education, and selecting associated courses, as pathways to employment [7]. More and more students from a wide social economic spectrum are choosing to attend postsecondary education to prepare themselves for the global workforce. The growth in access and uptake of university education specifically has conferred many benefits to growing numbers of students from a wide social spectrum, with data indicating that in Australia completion of a university degree does increase the prospects of employability regardless of gender and level of achievement at entry to university [8]. Students in greater diversity and numbers than ever before are seeking to enhance their global mobility, and to find and experience hands-on, authentic work placements integrated with their undergraduate study [9]. They want to join an institution with a strong reputation and attendant opportunities to meet and work with creative business leaders, especially those who are the founders and executives of innovative companies and organizations that deliver positive social impacts via knowledge and innovation [10].

Employers are simultaneously crying out for graduates with relevant skills and experiences to work collaboratively and creatively with diverse stakeholders and colleagues to solve complex global problems [11]. There is increasing economic and political pressure to raise the knowledge and skills of a globally proficient workforce, to respond to the requirements of the post-information age of technology-enhanced human performance [12]. In the coming age, the most sought-after people will be creative problem solvers who can work with others to design complex solutions to big challenges [13]. These *social* challenges imply the need for higher education to transform its social agenda, necessitating learning experiences that expose students to global contexts, diverse perspectives, technology, and authentic learning situations.

Alongside student and employer imperatives, the mission of universities has evolved in line with global imperatives of the post-information age, for example, leading to the establishment of the edX Consortium by Anant Agarwal of MIT [14]. The traditional mission of universities has been to educate a select few for societal leadership, and to conduct world-class research to create and preserve knowledge. The modern university's social mission, however, includes actively working toward equity and excellence for social and economic well-being of the community and world—a

mission of social transformation [15]. This evolution recognizes and builds forward from domain knowledge and excellence in teaching and research, expanding to create positive impacts on global problems, while preparing graduates for the future workforce. The new social mission has led to a focus on innovation, creativity, and entrepreneurship in order to address complex global problems, build on the university's strengths in top-ranked fields of study, and to promote and facilitate authentic work-integrated learning [16]. The transformation required to support the application of knowledge to complex problems, experiences with work-integrated learning, and to develop graduates who possess capabilities to work anywhere in the world implies that the university's relationship to the outside world also needs to change.

Students entering university today have inherited a vast array of complex global problems set in motion by the legacy of previous generations, marked by unsustainable, destructive, and isolated economic and social practices that have adversely affected global ecosystems, inflicted harm, and set in motion ongoing challenges that impact livelihoods and well-being [10]. The global workforce of the future needs the university to alert and empower young people to address these challenges. To effectively address these complex global problems, collaborative technologies such as the Curtin Challenge described further below are arising to help students learn to work with globally diverse peers, to establish a thorough understanding of associated issues, and to develop creative and workable solutions [17].

To give structure to these complex global problems, in 2015, the UN General Assembly formally accepted a new set of 17 measurable Sustainable Development Goals (SDGs), ranging from ending world poverty to achieving gender equality and empowering women and girls, by 2030 [18]. The SDGs and their targets are considered by the United Nations signatories to be essential for the ongoing viability and well-being of all people and living things. The SDGs thus form a curricular foundation of authentic complex problems that need solutions, and a key focus for higher education into the future.

3. Organizational transformations in higher education

Alongside the social evolution of higher education, the way in which learning is organized is also undergoing transformation. Learning is no longer conceptualized as a standard, predetermined pathway through which all students acquire knowledge. Today's learners seek a more personalized, accessible, and adaptive learning experience. As such, the traditional organization of higher education, primarily in multiple-week blocks of closed classes hard-coded into 3- or 4-year courses of study, is slowly giving way to shorter self-study modules, delivered at scale via technology-enhanced and automated learning systems, which are open to students at all stages of life and development [19]. Smaller modules of study may be combined into stackable combinations, forming new micro-credentials that support self-directed exploration, as well as flexible recombination of modules to suit new individual and organizational purposes [20]. Such modularization of higher education presents a more personalized learning experience, enabling a diverse body of students to access and package their education to suit their unique needs.

At the same time, the conduct of research is moving from individual "star" researcher-driven interests with short-term soft funding, to long-term, demand-driven and outcomes-focused, high-performance research team collaborations. Today's research is compelled by global problems, supported by deep integration of public and private sources for shared development of IP and mutually beneficial goals for knowledge building, development, and implementation for positive social impact [21]. These personalization and problem-focused drivers for education and research imply a need to transform higher education's organization of learning, teaching, and research.

4. Operational transformations in higher education

In addition to the social and organizational transformations in higher education, the way in which universities have traditionally operated is being challenged. A wave of closures and consolidation of small colleges in the US illustrates that where institutions do not adapt to the changing times, they face mounting challenges to their survival [22]. Artificial intelligence, to point to one of the horsemen of a potential apocalypse, presents a unique challenge, but also opportunity for higher education, offering means to automate historically complex and resource-intensive processes. Social media and the Internet, for instance, present opportunities for learners to connect with experts across the globe, offering just-in-time personalized learning experiences outside the traditional education pathway. With such opportunities at learners' fingertips, universities must clearly articulate their value proposition, and adapt to a more customer-focused approach to the management of education. Alongside the evolving social and organizational context, higher education must transform its processes to accommodate new conceptualizations of student capability and success. In particular, we believe, universities must reconsider five important dimensions of higher education learning and teaching operations: finding and selecting students; knowing learners and their expectations; just-in-time services, content, mentoring, and support; anytime, anywhere accessibility; and global connectivity.

The case narrative presented in the following sections briefly describes the innovations adopted at Curtin University, with respect to the social, organizational, and operational transformations impacting the university. The narrative shows how some innovations have become embedded in inventive products and services that prepare students for university, create greater diversity, and change the practices for identifying and developing talent. The emerging solutions at Curtin University are unified by the themes of personalization at scale; innovative challenge-based team learning; massive open online learning options; and flexible, stackable credentials delivered in new ways, supported by learning analytics, new digital learning tools and programs, and restructured learning services, while leveraging the role of the university in the broader community. Two frameworks are presented to aid the identification and development of talent for university: a reconceptualization of how future-ready learners are identified; and an exploration of the role of technology across the five domains of teaching and learning.

5. A framework for identifying future-ready learners

Curtin University is developing and improving a continuum of entry points and learning systems that expand the ways people can engage, learn, and achieve, from pre-entry into lifelong learning, as shown in **Figure 1**. Innovations are employed across the student life cycle, from partnerships and development programs with primary schools, preparatory programs with secondary schools, articulation agreements with other providers, and pre-tertiary admission and scholarship programs, to credit for advanced learning, stackable credentials, and personalized learning pathways across undergraduate and postgraduate study. Central to these approaches is a view that students and families begin identifying with and thinking about their future several years in advance of traditional admissions processes. As the university engages with the broader community, it is able to influence as well as shape the quality of preparation for success within families and school communities, enhancing the capacity for a future-ready workforce. These pathway and partnership innovations are empowered by new technology and seek to increase the number, diversity,

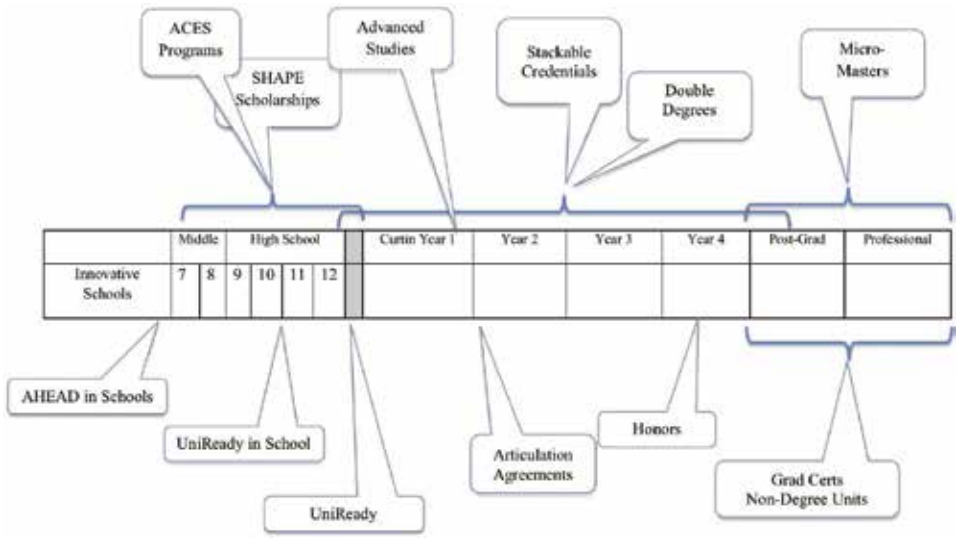

Figure 1.
Pathways and partnerships innovations for advancement at Curtin University.

and quality of talented young people who aspire to higher levels of learning, as well as to create expanded opportunities for people who have been out of school for a time, with convenient new options for retraining and lifelong learning. Our narrative begins, therefore, by exploring the realities of globally mobile learners, who can go anywhere in the world for their education, and who are the future talent of the global workforce, through a focus on primary and secondary school systems.

Figure 1 exemplifies a number of the innovative measures that Curtin University is implementing to meet the needs of a growing and diverse cohort of future students. Curtin recognizes the importance of innovating learning platforms across the breadth of an expanding student experience continuum. As a reflection of the evolution of the role of universities in society toward organizations that create capacity and mobilize communities and as key partners in offering wide access to unbundled on-demand learning opportunities within a lifelong learning and skills development paradigm, that is crucial to individual success in the twenty-first century. Some key pathway and partnership innovations focused on the identification and development of talent for entry, which support the social transformation of higher education, are presented below.

5.1 The AHEAD program

Addressing Higher Educational Access Disadvantage program (AHEAD) is a multifaceted program that works to create and implement practical solutions to the university access challenges faced by those community and school groups that are traditionally underrepresented in higher education. AHEAD has a proven track record in effecting change for its targeted demographics in improving access to university and positively impacting attitudes associated with aspiration for higher education [23, 24]. The AHEAD school partnerships target students from primary to year 12 in regional, remote, and access-disadvantaged situations. Long-term relationships are built with students, parents, and school staff to support the aspirations of promising young people. The program offers a range of services to help students envision and achieve their goals for postsecondary learning. A key function of AHEAD is to provide a safe context that includes time and language-appropriate information about careers, pathways, and access options to

support students working through the complex problem of university selection [25]. Students become known to the university through multiple engagements and innovative technologies, which help create a digital portfolio of evidence for their strengths, interests, and aspirations. This evidence portfolio is linked to attributes of successful university students and "future-ready" learners, reflecting collaboration, creativity, personal knowledge, problem-solving, and global sustainability knowledge and skills.

A set of indicators grounded in research and practice are embedded in AHEAD program offerings and online learning experiences, used to assess and evaluate student learning, as well as program focus (see **Table 1**). Five "attributes of future-ready learners" with 19 indicators form the backbone of an assessment framework embedded in the Curtin Challenge technology platform (described further below) and help to organize evidence of learning from a wide variety of school, community, and university offerings that engage students and develop talent. The research underpinning the attributes is founded in well-documented projects with global reach; for example, the attributes of "collaboration" and "problem-solving" come from the assessment framework of the Program for International Student Assessment [26]. Evidence of learning anytime, anywhere goes into a portfolio that is later used to award recognition, scholarships, and support services to the student.

The AHEAD program also supports professional development in schools and communities to improve counseling, pastoral care, and youth development as well as the knowledge and skills needed for success in higher education and lifelong

Attribute	Indicators
Collaboration [30]	Establishing and maintaining shared understanding
	Taking appropriate action to solve the problem
	Establishing and maintaining team organization
Creativity [31]	Idea generation
	Design and refinement
	Openness and exploration
	Working creatively
	Creative production
Personal learning [32]	Sharing experience
	Examining diverse concepts
	Articulating, applying and building understanding
	Communicating new powers and creations
Problem-solving [33]	Exploring and understanding
	Representing and formulating
	Planning and executing
	Monitoring and reflecting
Global sustainability [34]	Recognizing and valuing the needs and cultures of others
	Active involvement in addressing global needs
	Supporting the development of the social, economic, and environmental pillars

Table 1.
Attributes of future-ready learners.

learning. In planning is the "AHEAD Academy" which will offer direct learning services to both adults and students and will enhance the existing catalog of workshops, campus visits, mentoring, and case management support to the disadvantaged communities and the practitioners and professionals who work with them.

The AHEAD program is an expression of the university's corporate social reasonability portfolio, which contributes to positive outcomes on three important dimensions: community development through the promotion of tertiary affinity [27], undergraduate work-integrated learning [28], and more broadly the university corporate culture [29].

5.2 ACES programs

Achievement Centered Engagements for Students (ACES) is the university's accreditation program for university, school, and community offerings that enable students to evidence their learning from participation using the portfolio process and assessment framework outlined above. ACES accreditation serves as a tool to verify both quality and alignment with Learning Futures' goals in the provision and recognition of pre-tertiary activities that promote knowledge and capabilities beneficial to successful transition and completion of a university degree. Students benefit from informal and formal learning opportunities offered by a wide range of community partners and recognition of their commitment and completion of such programs through eligibility for SHAPE Awards (see below). Community partners and schools benefit by additional recognition, support, and promotion of their offerings. AHEAD activities, in addition to other supportive learning activities offered by the school community, local museums, and interested educational organizations, are accredited by the university as "ACES programs."

ACES programs can be offered by Curtin University, a school, or any community organization working with the university. The process of accrediting offerings involves a detailed self-examination of the learning opportunity by the candidate organization, which examines and seeks to improve how students are supported to reflect on and draw lessons from their experiences. University staff provide feedback on the self-assessment by an organization seeking ACES accreditation, using a scoring rubric with specific learning objectives, linked to broad conceptualizations of intelligence, performance, interest-driven learning, and personal initiative. The aims of the ACES programs are advanced and supported by:

- Repurposing outreach activities toward recognition of learner development.
- Recognizing a broader scope of learning beyond the classroom.
- Incorporating new focus on developing learner capabilities.
- Adding value to third-party programs by recognizing their role in developing the learner.
- Building engagement in learning through partnership and collaborative models.
- Creating linkages between student engagement and relevance to the student as a global citizen through challenge-based, games-based, and real-world learning experiences.

Examples of ACES-accredited programs include the AHEAD programs suite of aspiration, awareness, and capability-raising activities offered at the university, as well as external program offerings such as UNAAWA Global Citizenship and Sustainability program, a state-recognized school curriculum, and the UNEP-DHI Eco Challenge, a global serious game competition that develops awareness of water resource management issues.

5.3 SHAPE awards

Scholarships for High Achievement and Performance Engagement (SHAPE) rewards and recognizes the commitment of students to self-development in pursuit of advancing awareness and capabilities directly related to the pursuit of higher education readiness and success. SHAPE provides participants the opportunity to showcase extracurricular achievement that may not be captured within their university application. In so doing, it provides appropriate recognition for that activity and affirms a wide array of knowledge and capability acquisition that is highly beneficial to the success of a broad spectrum of student's access, transition, and completion of university. Such awards provide a framework of endorsement that promotes the undertaking of ACES-aligned activities and underscores the benefit to the individual of their completion. Students place evidence from ACES activities into portfolios that can be submitted for SHAPE awards. The SHAPE program offers awards of up to $3000 for innovation, creativity, and entrepreneurship demonstrated through ACES programs. The SHAPE awards include one-off awards as well as a series of smaller awards that build slowly over time to accumulate to a maximum of $3000 per student.

5.4 UniReady in schools

UniReady in Schools provides high school students with a structured higher education course and unit experience that allows them to prepare for a successful university learning experience. The four-unit course of study, which is typically undertaken over one or more semesters, helps to establish accurate expectations and supports students to test their readiness for higher education. Academic writing, for example, and all other courses in the program are taught and practiced with the same rigor as students will encounter at university and help students to develop associated skills and expectations so that they are ready to study and succeed at the university. The program is designed with a core of two required units—academic writing and communication—and a selection of two other units from six options that can be flexibly combined to give the best introduction to the major fields of study at the university. The university licenses schools to deliver the UniReady curriculum primarily online, within a monitored classroom led by a master teacher in the school trained and supported by the university. Marking practices and grades across all sites are monitored and moderated by the university. Schools are allocated a limited number of places in the program and make a commitment that the program will be used to enhance and not detract from the existing pathways to university. Schools that wish to utilize the program are carefully selected, trained, and monitored through a close working relationship, underpinned by mutual strategic commitments to lift the performance of targeted students and increase the number of capable students enabled to enter university. The program builds upon a successful broader program called *UniReady.*

The *UniReady* program is open to anyone post-high school, except for students who have completed *UniReady in School*. Students are aged 18 and older who are

seeking to demonstrate readiness to succeed at university. Successful program completion enables students to meet the minimum entry requirements for most undergraduate programs at the university. The program is comprised of two core courses (referred to as "units"): academic writing and communication; and a choice of two other units that introduce students to the first-year expectations of particular discipline areas: health sciences, business and law, indigenous studies, humanities, and science & engineering. Units are designed to meet specific requirements of their desired faculty and subject area and enter programs with confidence, skills, and experience. For example, a degree program such as engineering that requires a high level of mathematics includes a high-level mathematics UniReady unit.

5.5 Innovative schools consortium

Schools that demonstrate high levels of innovation and wish to strategically partner with Curtin University are invited to join the Innovative Schools Consortium (ISC). The 15-member ISC enables schools to identify, develop, and support high-potential students by working toward mutually agreeable strategic objectives and offering pre-university learning credits, scholarships, learning challenges, and alternative entry pathways. Together, the university and school develop and implement project-based learning experiences and curricula that incorporate digital technologies, as well as STEM (science, technology, engineering and mathematics) and STEAM (science, technology, engineering, arts and maths) approaches focusing on scientific knowledge and skills, and arts and humanities interdisciplinary integration with scientific fluency, in collaboration with university academics and industry partners.

As an example, a STEM curriculum development workshop was held at Curtin University at the request of Scotch College, one of the founding ISC partner schools. Subject matter experts from the university met with teachers and senior leaders from the school for three intensive days, to develop and design a curriculum for a new cross-disciplinary STEM subject empowered by technology. The innovative new curriculum integrates action research and learning practices through the incorporation of learning challenges that encourage students to reflect on the UN Sustainable Development Goals, while demonstrating creativity and innovation. The program has been scaled to several grade levels and has led to additional strategic actions by both the university and the school, including plans to offer high-level maths offerings to regional and remote schools and expand the professional development role of the school in promoting the adoption of international baccalaureate programs by schools in WA and elsewhere.

The ISC forges connections between schools, universities, businesses, government departments, and community partners. It has established a community of like-minded organizations committed to teaching, learning, and work readiness, to ensure student employment and support a sustainable future. The ISC allows students to remain responsive to changes in technology, while building strengths in innovation, creativity, and entrepreneurship through practical action learning challenges and experiences. Ultimately, the consortium advances the idea that imaginative teaching approaches—supported by advanced technologies and collaborative learning—best equip students to become the leaders of tomorrow.

5.6 Learning futures network

Established in 2017 to meet a growing interest by K-12 schools to have a meaningful and engaged relationship with Curtin University and other educational partners, the *Learning Futures Network* (LFN) now has over 130 member organizations. The

process of membership is less intensive than in the ISC and is open to all schools and educational organizations. The organizations and schools share mutual interests in improving learning, education, arts and culture, the future of work, global sustainable development, and science and technology foundations. Through the LFN, the university supports a new social infrastructure with resources to develop more authentic and future-aware processes to enable transformation and collaboration across student learning, and school and staff development. The LFN is a common ground for making connections between and across higher education, industry, culture, and community. Schools in the LFN learn about the expectations of higher education, alternative entry pathways, portfolio entry processes, teacher professional learning, and postgraduate opportunities. The digitally facilitated network makes it easy for innovators in schools to be more proactive in developing collaborative engagements with higher education. The network coordinates the recognition of ACES activities, and to date 18 activities have been granted recognition for supporting a broadened conception of intelligence, developing promising students for further education, increasing school engagement and encouraging student aspirations for further education.

6. A framework for technology innovations across five domains of learning and teaching

Supporting the wide range of initiatives focused on talent development and new pathways into Curtin, the university's vision for learning and teaching is undergoing several technological transformations. These technical innovations focus on five domains of higher education learning and teaching, as well as new and rebalanced roles of corporations as partners in demand-driven research. The technology platforms are evolving to facilitate unbundling of content and personalization of learning at scale and the operational innovations are evolving from a mindset of curriculum as primarily a sequence of units, courses, and degrees to one of lifelong, anytime, anywhere learning. Global and local business partnerships are increasingly becoming significant long-term research collaborations that are co-inquiring and co-developing transferable solutions for smart campuses, smart businesses, and communities of the future [1, 35].

The five domains of higher education learning and teaching illustrate where technology enhancements are poised to make significant contributions to transformation:

1. Developing talent: understanding the market, creating personalized recommendations, and transforming community engagement.

2. Personalizing at scale: personalizing support services, proactively managing engagement and retention, and personalizing communications.

3. Emergent curriculum: adapting content to learners in near real-time, delivering engaging content at scale and integrating content with rapidly changing global workplace needs.

4. Dynamic delivery: analytics-led understanding of student learning needs, adaptive assessments, and a managed outcomes framework anchors curriculum delivery.

5. Global networks: strategic employment of graduates, alumni networks that support entrepreneurship and innovation and targeted recruitment into research areas are empowered by technology.

These five domains were developed in 2013 and 2014 as part of the "Transforming Learning at Curtin" initiative [1], based on a university-wide strategic project that conducted international comparisons, literature research, focus group interactions, and workshops. Pilots have been continuously spun out of the model since 2014 and in part have led to innovations such as the Curtin Challenge described below. Looking ahead, with automated processes and artificial intelligence likely to eventually form part of these domains of operations of learning and teaching, a strategic vision of technology-enhanced operations (see **Table 2**) guides thinking, shapes conversations, and engenders new ideas for the future. In the vision for technology-enhanced operations are statements of "end state" visions for specific goals within each of the five domains. A discussion of all the goals is beyond

Developing talent	
Market understanding	The university generates profiles of in demand skills in the market, tracks education trends, and reacts accordingly
Personalized recommendations	Student and market information are used to aid course selection and align student expectations
Community engagement	The university's market knowledge is reflected in its outward facing marketing and community engagement
Personalization at scale	
Personalized support	Support services use interaction history to learn from interaction and become tailored to individuals
Proactive retention management	Students with high attrition risk are identified early and receive targeted preventative interventions
Personalized communication	Learning materials are targeted at students based on learning style and level of attainment
Emergent curriculum	
Adaptive curriculum	Curricula are dynamic, adapting in real time to student needs and the external environment
Scalable delivery	The latest technologies deliver content to all students & staff and allow near-real time feedback and decisions
Integration with industry	Curricula are designed to deliver the competencies in demand and allow relevant work place learning
Dynamic delivery	
World leading pedagogy	Analytical research into student cognition and teaching method are used to define the university's practices, and drive student self-awareness
Adaptive assessment	Student evidence of learning is measured continuously, allowing targeted, dynamic assessment
Managed outcomes framework	Students are assessed against a granular framework, allowing for an iterative approach to learning
Global networks	
Strategic employment	Market analysis and a unique assessment framework allow students to secure positions with high prestige employers
Alumni communication	Alumni are engaged with information on market and industry trends and opportunities for further study
Targeted recruitment into research	Engagement in research is developed from specific analysis of history and student competency

Table 2.
Vision for technology enhanced operations.

the scope of the article, which is focused on the first goal—talent development—but the full framework is offered here to form a broader context to understand how the university is thinking about its future.

Common to the organizational transformation of education across all five of the domains is a conception of using technology to digitally enhance learning at scale. Enhancement at Curtin is based on two primary strategies: (1) unbundling and recognizing learning at "micro" levels (micro-credentials and micro-masters) and (2) offering personalized and team-based learning digitally at scale [20, 36]. New gamified self-paced individual and team-based learning experiences are constructed on the university's *Challenge* platform—an authoring and learning experience deployment system for highly interactive online learning. The use and promotion of technology to innovate learning for undergraduates has been criticized for over emphasizing its real-world impact, as the lived experience of the students' use of technology can be characterized as only creating digitally augmented process efficiencies, for example watching/re-watching video, digital library access, online curriculums guides, etc. [37]. However, Curtin's approach emphasizes the focus and commitment to innovating learning and teaching through team-based activities and hyper-connected learning offerings, creating the potential for significant digitally driven students' learning transformations. Challenge-based learning [38] is applicable to all levels of education, is flexible for any level of team project or individual learning experience, and is thus making its way into capstone projects and other project-based learning experiences in formal and informal offerings of the university and its partners. In addition, the university's massive open online course system and membership in the edX Consortium [14] support large-scale deployment of learning experiences. The following section will describe Curtin Challenge in more detail and link it to the global aspirations of scalable delivery of digital learning experiences.

6.1 Curtin Challenge

Curtin Challenge is an interactive online learning platform that uses game-based elements to motivate individual and team learning [39]. The platform supports self-directed learning at scale with automated feedback and assessment in real time, at the point of learning. It promotes active engagement to enable deeper learning, evidence of which is captured via fine-grained data collection by a learning analytics engine. Challenge has the capability, for example, to identify and track who does what during team work to promote individual responsibility among participants. It can also engage students in peer feedback, supporting development of critical thinking and reflection skills, as team members work toward solving a wide variety of challenges.

Originally built for the university's own students but now offered worldwide, the Challenge platform offers teachers new ways to create, administer, and evaluate learning experiences, which extend beyond the traditional classroom, with capacity for students to work collaboratively with others across the globe. Challenge is designed to support the development of graduate attributes, such as leadership, employability, and global sustainability, in both informal and formal learning contexts. The innovation projects outlined earlier are actively reworking their face-to-face and traditional e-learning offerings into the Challenge platform.

Learners are offered rewards and/or recognition, based on evidence of achieving objectives, creating work products, and participating in self-scoring throughout their challenge. Educators are enabled to monitor and collect valuable data to verify achievement, as well as to evaluate and enhance learning design. Four learning pathways grounded in real-world problem-solving are currently available through the platform, focusing on leadership skill development, career planning, English

language proficiency, and preparation to study abroad. These challenges are made up of 12–14 modules that each takes about an hour to complete, and can be stopped and started at any time. Each module includes around five interactive activities. Students engaged in these challenges to date have completed over 186,000 activities, with over 10,000 modules completed in the Careers Challenge and around 22,000 modules of the Leadership Challenge completed, since their launch in 2014 [40]. With such massive uptake, the cost of delivering these learning experiences amounts to "pennies per student."

Challenge allows educators to author their own customized modules and activities and link these to their Blackboard units. Challenge is also successfully being used by international students, with new programs currently piloted with Hong Kong universities and a Perth high school. Challenge is part of Curtin's digital learning and teaching ecosystem that includes edX (massive open online courses) and Blackboard (learning management system) delivery systems. These delivery systems are supported by the university's Analytics Insight team who work with the UNESCO Chair of Data Science in Higher Education Learning and Teaching [41] to provide global context for data, establish and manage international research projects, promote local pilots, and propel momentum for innovation in learning and teaching.

7. Conclusion

As a response to global and local imperatives for organizational, operational, and social challenges facing education today, learning innovations developed by Curtin University's Learning Futures team are examples of new technology-enhanced learning experiences used to identify and develop talent for university. The innovations, set in the context of a vision for using technology in all areas of the university, are helping to reset school-university relationships to a focus on direct, scalable digital learning services delivered via interactive technologies utilizing game-based and team-based learning approaches created with a new authoring, delivery, and analytics platform. The educational technology innovations support the university's vision of academic, research, and service-based strategic actions by offering new options along a continuum of entry points for learners of all ages to access from anywhere at any time.

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Section 2

Operational Innovations That Transform or Advance Practice

Chapter 6

Planning for Improvement: Leadership Development among University Administrators

Tracy L. Morris and Joseph S. Laipple

Abstract

Information on the professional development of university administrators is relatively sparse, yet effective leadership and management are essential to sustaining high quality environments for faculty, staff, and students. This chapter discusses the use of professional development plans and multi-source feedback among higher education administrators. Results from a large national study of university deans and department chairs are presented and practical strategies for improving leadership development and fostering positive organizational change are illustrated through case examples. Given the high cost of failed leadership, greater attention to the preparation, support, and evaluation of individuals serving in administrative leadership roles is likely to provide dividends to all involved.

Keywords: leadership, organizational change, professional development, higher education, administration

1. Introduction

Few empirical studies have been conducted on the preparedness of university administrators (e.g., department chairs, directors, deans) or the strategies they use to improve their leadership skills. What is known is that few academic administrators have received any formal leadership training prior to commencing the leadership and ongoing systematic leadership development efforts are scarce [1–5]. In a recent study of chairs of departments of psychology [6], over half reported their institution provided no formal training for the role and only slightly more than one-fourth of chairs received more than a semester of mentorship.

This state of affairs in higher education stands in stark contrast to the investment in leadership development initiatives in private sector settings [7, 8]. Leadership and management success is no less critical to the success of a university than it is to a major corporation.

The range of responsibilities of department chairs is often vast, encompassing financial management, mentoring, hiring and supervision of faculty and staff, mediating conflicts, courting donors, managing building space, classrooms, and laboratories, developing entrepreneurial revenue, course scheduling, and strategic planning to name a few. Yet department chairs are drawn from faculty—individuals who trained (and excelled) in their specific academic fields—not business executives or human resource officers. Imagine a mathematician or geologist suddenly

thrust in an administrative leadership role: is it any wonder so many struggle with the transition? Now imagine those serving with a poorly prepared leader—and the effects on productivity and morale.

Research has shown that academic administrators who had completed undergraduate or graduate coursework in business administration, human resources/leadership, industrial-organizational psychology, or behavioral psychology reported feeling more prepared for their subsequent leadership role and experienced higher levels of job satisfaction [4]. Of course, it is unreasonable to expect all new leaders to have competed such coursework. There are successful and satisfied leaders without such educational backgrounds (and vice versa). The point here is that inclusion of principles from such domains in leadership development efforts with deans and department chairs is beneficial—and much less risky than leaving proficiency up to chance.

Satisfaction with one's job is a key predictor of job turnover. Turnover can be quite disruptive and costly to an organization [9, 10]. Conducting a search for a new leader takes time away from the unit's core activities. Progress on departmental or institutional efforts often is stalled until well after the new leader is in place and acclimated. Approximately 20% of department chairs leave their position each year [4, 5, 11]. Some are selected to move upward in university administration; others come to the end of a planned term of appointment and return to the faculty or retire. A not insignificant number of academic leaders will abandon or be forced out of administration prematurely due to performance problems. For this latter group, insufficient preparation, high stress, and low job satisfaction are primary contributors to leadership derailment [12–14]. Issues of satisfaction and turnover go beyond the leader. Leader behaviors also influence turnover among employees [15–17]. Faculty turnover and intent to leave the university have been found to be predicted by the social skills, empathy, and situational awareness of their department chairs. Losing good faculty as a consequence of poor leadership is bad business with its concomitant cost of replacement, deleterious effects on students, and potential hit to research and academic rankings.

In addition to the provision of leadership development sessions, coaching, and mentoring, another improvement strategy higher education may borrow from contemporary corporate culture is the more extensive use of multi-source feedback for leaders. Though student ratings of instructors are routine in universities, frequent feedback is much less likely to be provided for department chairs, deans, or provosts. Multi-source feedback, also known as 360° feedback, includes soliciting performance ratings from subordinates, peers, and supervisors, as well as self-ratings. A critical component of the feedback review is examining areas of congruence and incongruence. Noting ways in which perceptions of others differs from one's perception of self can be an important developmental tool, fostering better social awareness and promoting positive change [18]. An intriguing finding from previous work [13] was that deans whose self-ratings were incongruous with ratings received from their department chairs perceived themselves to be much higher on leadership skills than deans who saw themselves more consistently with the way they were seen by chairs. Such incongruence may be reflective of poor self-appraisal and lower emotional intelligence—characteristics that likely interfere with receiving and acting on constructive feedback and increase the likelihood of leader derailment.

Human capital is the core of any educational institution. Unfortunately, a minority of academic administrators report feeling enthusiastic and good at their job every day [4]. Rather than expecting that academic administrators will merely sink or swim on their own, universities would do well to invest in leadership development. Anecdotal comments regarding such initiatives at various institutions as well as the recent report of a leadership development framework underway at

Rutgers University [19] are heartening, but far too many people in leadership roles remain unserved. Later in this chapter strategies individuals may practice on their own to further improve their leadership performance are discussed.

Data reported here are drawn from a larger longitudinal study of academic administrators. In the first year of the study information was collected from a national sample of academic administrators on the level of preparation for, and experience of, their administrative roles and identified differences among department chairs and college deans on a number of leadership and management variables [4, 20]. In the second year, the relationship among leadership skills, organizational cultures, and job satisfaction [13] was explored. The subset of data discussed in this chapter focuses on strategies used by administrators to improve their leadership and management skills. The overarching goal of this series of studies is to inform practical efforts toward the better preparation and support of academic leaders, which in turn will have positive benefits for their faculty, students, and staff. Following the presentation of empirical results, practical strategies for implementing feedback and improvement plans are discussed.

2. Method

2.1 Participants

Participants were 1142 academic leaders (716 department chairs/heads, 56 directors, 232 associate deans, 117 deans, and 21 associate provosts; 721 men, 421 women) surveyed from the Carnegie ranked U.S. public research institutions; 895 of these participants also had participated in the first year of the investigation and 247 were new participants for year two. Racial-ethnic composition was 89.5% white/European-American, 3.6% Asian, 2.9% Hispanic, 2% African-American, 0.6% American Indian/Alaskan Native, and 1.4% multiracial.

2.2 Measures

The full survey consisted of 105 items. The first section included demographics (gender, age, etc.), background questions on administrative positions held (e.g., role, years of service) and strategies used to develop or improve leadership skills. Detailed results on job satisfaction and preparedness for the administrative role are reported elsewhere [4, 13, 20]. In this chapter, we focus on a subset of items related to planning for improvement. Key variables here included:

Feedback and development plans. Six yes/no items inquired whether participants received formal annual evaluation of their leadership and administrative performance, made use of development plans (for themselves and their direct reports), solicited regular feedback, or made use of 360° feedback methods.

Areas for improvement. Four open-ended items asked participants to indicate (a) in which area they had improved over the past year, (b) what behaviors they wished to start doing over the next year to improve in leadership and management, (c) what behaviors they wished to stop doing over the next year, and (d) what strategies they used to inspire others.

Additional measures included:

Preparation for administrative role. Using a 5-point Likert-type scale participants rated the extent to which they felt prepared in 10 areas of responsibility prior to beginning their current administrative position (e.g., managing staff members, handling the financial budget). Higher scores represent greater perceptions of preparedness.

Leadership skills. Participants provided self-ratings for 15 specific behavioral categories (e.g., setting clear expectations, providing helpful feedback). These items were drawn from extensive literature review and have been used extensively in a consulting context across a broad range of management and leadership development interventions. Responses were rated on a 5-point Likert-type scale. Higher scores represent greater skill endorsement.

Burnout. Job burnout was measured through the 16 items of the Maslach Burnout Inventory-General Survey (MBI-GS) [21]. The MBI-GS includes three scales: Exhaustion, Cynicism, and Professional Efficacy. The MBI has been extensively validated and is the most widely used measure of burnout. Lower scores are preferable for Exhaustion and Cynicism; higher scores are better for Professional Efficacy.

Job satisfaction. Six items, rated on a 5-point Likert-type scale, addressed satisfaction with administrative role (e.g., feeling happy and fulfilled, high degree of autonomy, adequate compensation). Higher scores represent greater satisfaction.

2.3 Procedure

Email addresses were obtained from university websites for all department chairs and deans of Colleges of Arts and Sciences in all public research universities ranked by the Carnegie Foundation. Potential participants were sent an email message describing the study and inviting their voluntary participation through SurveyMonkey, an online survey management tool. A single automated reminder was sent if no response had occurred within 14 days. Participant representation was obtained from all 145 U.S. Carnegie ranked public research institutions.

Individuals who had participated in year one of the study were asked to indicate whether they had changed administrative positions within the past 12 months and provide background information related to the new position. Participants who indicated that they had retired within the past year were presented with an abbreviated set of items. When a participant indicated they were no longer serving in the same position as they had been in year one, the person who replaced them in that position was identified from the university website and new chairs/deans were sent an invitation to join the study in year two.

3. Results

Mean age of participants was 56.5 years (range 39–74). Mean number of years in current position was 4.74 (SD 4.31, range 1–35). The majority (83.7%) remained in the same administrative role they held in the previous year; 8.1% had started a new administrative position within the past 12 months (with 93.1% of those within the same institution), and 8.1% no longer served in any administrative capacity. Of those who reported they no longer served in an administrative capacity, the reasons cited were: wishing to return to a faculty position full time (56.3%), retirement (11.3%), involuntary-not renewed (11.3%), end of term with no option for renewal (8.5%), and other-personal leaves, etc. (12.7%).

Those who had left administration by year two reported being less well prepared, less skilled, and more distressed on the initial survey than those who remained in an administrative role in year two ($F = 5.56$; $p < 0.01$). For those continuing to serve in a leadership role, burnout increased—and job satisfaction decreased—from year one to year two for 73.9% of participants.

The most commonly reported strategy for improving leadership skills was to seek advice from senior colleagues (endorsed by 91% of participants), followed by reading about leadership and administration (68%). Approximately half the

sample had participated in related seminars at their home institution and 41% had taken workshops through professional organizations. Few (4%) had sought the services of a paid professional consultant. Perhaps disconcertingly, over 3% reported that they had not participated in any form of leadership development activities.

The majority of participants (72.9%) received an annual evaluation of their leadership/administrative performance. However, only a minority reported having a development plan or goals document (35.1%) or use of 360° feedback methods (13.1%). These rates did not vary by gender, but deans were more likely to receive a 360° evaluation (25%) than associate deans (15.6%), or chairs (10.9%); $X^2 = 13.656$ df = 2 $p < 0.001$.

Open-ended responses to the question of which area they had demonstrated the most improvement in over the past year were coded into the following categories (percent endorsement follows in parentheses): time management (27.4%), perspective/stress management (23.8%), leading/managing (22.9%), managing conflict (12.7%), financial aspects (4.7%), research productivity (1.5%), and "other" (2.6%). Sadly, 4.4% reported that they had not improved in any area or had actually regressed. Areas of improvement did not vary by gender. However, those who said they improved most in leading/managing reported the highest job satisfaction scores and burnout was highest among those who said they either had not improved in any area or had regressed.

Open-ended responses to the question of what participants would start doing over the next year to improve in leadership and management were coded into the following categories (percent endorsement follows in parentheses): time management (15.4%), professional development activities such as workshops (12.6%), better self-care (11.5%), delegate more of the work (9.4%), planning ahead (8.3%), emotion regulation (6.4%), allocate more time for thinking (5.2%), improve listening and communication (4.7%), seek feedback (3.7%), and spend more time mentoring faculty (3.5%). Woefully, 15.1% reported they were unsure what they could start doing to improve, or would do nothing at all, and 2.2% said the best thing they could do was quit the administrative position.

Open-ended responses to the question of what participants would stop doing over the next year in order to improve were coded into the following categories (percent endorsement follows in parentheses): affect-related (e.g., stop getting upset/angry; 27.5%), getting overextended (13.2%), procrastinating, (12.5%), putting out fires (7.9%), electronic time sinks (e.g., email, surfing online, etc.; 5.7%), doing what should be delegated (4.4%), having too many meetings (3.7%), and health-related behaviors (2.6%). However, the second most frequently reported response category was that they were unsure or there was nothing they could stop doing in order to improve their performance (19.7%). A significant gender difference was noted with more women providing affect-related responses than men (32.6% vs. 24%), $X^2 = 21.518$ $df = 10$, $p < 0.05$.

Open-ended responses to the question of how participants worked to inspire others were coded into the following categories (percent endorsement in parentheses): by example (56.1%), encouraging/praising (22.1%), vision/high goals (5.0%), being present (3.9%), communicating rules/expectations (3.9%), creating opportunities/playing to their strengths (3.1%), humor (1.1%), tangible rewards (0.6%)—and 4.2% of participants said that they do not inspire others (with some adding that they did not believe it was their job to do so). Gender differences were noted on strategies for inspiring others with men more likely to report using tangible rewards than women (60.3% vs. 49.4%) and women more likely than men to report creating opportunities/playing to their strengths (29.9% vs. 18.5%). Inspirational strategies did not differ by administrative role type, $X^2 = 16.21$, $df = 8$, $p < 0.05$.

4. Discussion

This study provides descriptive data on leadership development strategies employed by academic administrators, use of development plans and multi-source feedback, and targets for improvement as well as predictive associations among preparation for leadership, burnout and turnover rates, and job satisfaction across a 1 year interval. Our sample is representative of leaders within U.S. research institutions and thus may not be entirely applicable to all organizational settings. Though we assert that findings from leadership research conducted in corporate settings are largely transferable to academic institutions, there may be unique features of higher education systems that merit specific focus. Our findings also may be limited by the self-report nature of the survey. The research discussed here is part of a larger multi-year investigation of academic leadership. Additional results from year one and year two of the longitudinal study are reported elsewhere [4, 13, 20]. Notably leadership skill was predicted by administrative preparedness, self-awareness, and self-regulation and job satisfaction was predicted by leadership skill and the working culture of the organization.

A minority of participants reported use of formal performance feedback mechanisms. Among higher education administrators it is not uncommon for evaluative feedback to be solicited only during a perfunctory 5-year review. This is in contrast to the private sector in which the use of multi-source feedback surveys is more widespread. Further, leaders who wish to have more positive impact would do well to shift from merely providing feedback to requesting feedback.

The top three areas for which participants reported they had most improved over the past year were time management, stress management and leading/managing. It is promising that individuals are reporting progress in these areas and they provide a roadmap for others seeking to improve. Improvement in leading/managing is a bright spot in the findings particularly given the reported higher rate of job satisfaction for those who have seen improvement in this area. Ideally, organizations and teams can put strategies into practice that increase the chances of improvement in leading/managing. In the absence of organizations taking the lead on implementation of such strategies, individuals or subgroups of individuals can take action now using quick, practical strategies to improve leading and managing. Building these changes into a daily or weekly operating rhythm can also help ensure these changes are sustained.

Improvements in stress management can be leveraged to address primary areas reported under the "stop doing" targets for change (affect related, being overextended, and putting out fires). Using a growth mindset [22, 23] can encourage wider adoption of change strategies that have an impact on the leadership capabilities of administers and their teams. Given the relatively high rate of participants who were unsure what to start doing in order to improve—or who reported that they planned to do nothing—shifts toward a growth mindset may lead to positive change. The research on growth mindset also offers a point of view on the need for planning for continuous improvement.

The finding that more than half of all respondents inspire others "by example" perpetuates the challenges of leading in administrative roles. If the most frequently reported strategy for inspiring others is to do so by example, let us look at the quality of the actions that are observed. Administrators are self-reporting challenges of the job and leading others. If those inspiring "by example" are doing so with less than effective leadership models, potentially ineffective actions are being perpetuated.

Results of prior research [20] demonstrated that deans who engaged in inspirational motivation had chairs who were higher in leadership skills and professional efficacy. Conversely, chairs reporting higher levels of burnout had deans who

engaged in passive leadership styles. Such effects are likely transactional; part cause and part selection. Unengaged leaders have a ripple effect across the individuals they supervise—and the faculty and students with whom they come in contact in turn. One means by which such effects perpetuate is through processes of self-regulation.

Self-awareness is a necessary component of effective self-regulation [24]. Self-awareness entails not only recognizing one's affective states, but how they fit within a chain of behavioral antecedents and consequences [25]. Such skills have been found to more prevalent among transformational leaders [26]. Self-regulation involves establishing internal standards of performance, evaluating discrepancies between those standards and outcomes, and formulating steps for resolving such discrepancies in order to meet one's goals [27].

5. Practical strategies for improvement

The findings from our empirical work lead to a number of practical suggestions. A paramount implication is that we must better prepare academic administrators for the challenges of the role. Improvements must be implemented at organizational and individual levels.

5.1 Organizational, system, or process changes

5.1.1 Developmental plans linked to performance evaluation

Personal change plans are an approach that supports deliberate personal change related to performance reviews and in response to formal (360°) or informal feedback from others. A few elements of developmental plans include: What will you commit to improve or change? What actions will you take to get there? How will you apply this change to your daily routine? What results do you hope to see in a specified time period? Making progress with these personal commitments requires making it part of a practice and requires scheduling behaviors and actions as part of a daily or weekly routine.

The following are sample actions from developmental plans where leaders have reported progress over a 6-month period.

- Reflect for 30 minutes each Monday to ensure I am more proactive, deliberate and strategic.

- Use coaching questions to discuss accomplishments and success stories at the start of my 1:1 s with direct reports.

- Schedule 15 minutes each day to look back and reflect on yesterday and look ahead, predict and prepare for a good day today

- Build resilience among my team by helping them prepare, regulate and reflect during 1:1 s and team meetings

5.1.2 Multi-rater feedback

Formal multi-rater feedback on leading and managing offers a way to provide information on the leader capabilities, areas of strength, and opportunities for improvement. This works well when the information is gathered, shared,

understood, and acted upon. Ensuring those who provided candid feedback feel heard is also important. How this feedback is acted upon is important. Three steps guide effective use of multi-rater feedback. (1) Understand the feedback and name it. (2) Identify 1–2 areas to improve. (3) Take action and create new habits.

Some of the best action plans have these characteristics. Focus on 1–2 behaviors with persistence, demonstrate them daily or weekly to increase the probability they will become habit. Ensure you can see it work. Keep it simple. Build in a plan to follow up and follow through with persistence.

5.1.3 Formal role description

Include inspiring, coaching and developing others as part of the job description both on paper and in practice. Also make it a regular practice to encourage all leaders to have an area to improve upon. This helps to shift the focus away from developmental plans being about fixing a problem toward an approach where all leaders strive to get better and improve.

5.2 Team or group changes

The research on psychological safety and Google's Project Aristotle offer recommendations that teams or groups can put into practice now to have impact on team effectiveness, stress management, burnout and retention [28]. Google conducted studies to identify commonalities among the most successful project teams within its organization. The best teams ensured there is psychological safety within the team. Psychological safety refers to the extent an individual believes they can engage in interpersonal risk taking [29, 30]. In work environments with high psychological safety individuals feel they can share their ideas and that team members will be supportive. It is important that each member of a team contribute to group discussion and that group members listen without engaging in personal criticism.

5.3 Individual changes

Given that organizations will not invest immediately in some of the strategies listed above, individual strategies can be implemented on your own. Below are a few examples of individuals' strategies.

5.3.1 Regulating self and others

This includes using bottom up, top down and relational strategies to manage stress and emotion. In bottom up regulation, the strategies signal "safety" to the brain. Examples include taking a walk, managing breathing, relaxing in a quiet place. In top down regulation, the strategies shift thinking to decrease stress. Examples include reframing stressors, visualizing positive outcomes, having advanced plans for high stress situations, or practicing mindfulness. In relational regulation, the strategies use positive interactions with others to regulate. Examples include demonstrating empathy, actively listening, practicing expressing appreciation, and quick positive conversations with people you trust. All of these strategies can be used to regulate self and importantly help regulate others in your work place whether it is a peer, direct reports or other leaders. Effectively managing stress and emotion can ensure both the administrators and his or her team is regulated and capable of tapping into their best thinking and decision making.

5.3.2 Resilience building

Recent research on resilience building among adults offers some guidance that can help with leading/managing others, stress management, reactivity, burnout, and feelings of being overwhelmed [31]. Resilience is defined as how we respond to challenges and stressful experiences. Resilience includes a swift and thorough recovery, sustainability of purpose in the face of adversity, and learning from adversity.

Recommended actions that can be used to include:

1. Prepare and identify how to make things happen. Focus on anticipating unexpected problems and build capacity for flexible responding rather than merely preventing problems. Awareness of prediction influences the outcome of interactions. Predict and make good outcomes happen.

2. Use top down, bottom up and relational techniques to regulate self and others. Relate by using brief positive interactions build connectedness and protection. Reframe threats as challenges and opportunities. Amp up positive emotion to keep negative emotion in check.

3. Reflect by looking back on actions that helped during challenging situations. Get good at noticing and reinforcing incremental change. Reflect on what makes it more predictable and controllable. Talk about the purpose—value, vision, mission—of what you are trying to accomplish.

5.4 Case example: highlighting important interactions

Erica was the chair of a department that was struggling to meet their goals in student engagement and retention. She was interested in "activating" her faculty and staff with very focused, value-added work. Her goal was to encourage her department members to take a more proactive approach to their days and weeks and ensure they could make improvements incrementally. She knew that many people on her team were anxious about all the work they had to do and how overwhelmed they felt with all the input coming into their physical and electronic mailboxes. She did something very simple that made a huge difference:

Erica started each Monday by asking a few people in her department with the following question to describe their three most important interactions of the week with students, colleagues, or community members. Once she figured out the most important interactions, she asked them what they planned to do in the interactions and what their contingency plans were in case the initial approach did not work.

Finally, she asked them to follow up with her after one of the three most important interactions to let her know what happened. She walked away from the Monday touch point knowing what was important to each person she spoke to for that week and with their commitment to follow up with her later in the week. She checked in informally on Friday for a brief progress check to see how the week went.

Erica used this brief (15 minutes or less) Monday stand up interaction to highlight the three most important interactions of the week and planned multiple check-ins during the week. By using this approach with members of her department, Erica created a less transactional and reactive team and one that was able to incrementally improve their proactive thinking and execution. Within a year of implementing this change in her Weekly Operating Rhythm, Erica's department was on track to becoming one of the best in the College on target metrics of engagement.

Most importantly, through this approach, she was able to help her faculty and staff plan good days and have improved interactions with students and colleagues across the University and broader community. The focus on the big three interactions also helped her team identify what was important. Erica believed that her department would be successful if each person was able to improve three important interactions each week and the results supported her approach. In the end, small daily and weekly changes added up to important results.

5.5 Case example: multi-rater feedback

Geoffrey was in his first year as department chair. When the dean would ask how things were going in the department he would say "Great! Everything is going really well and we are making lots of progress." However, over the course of the year, several faculty members complained to the dean that they did not think things were going well at all. Other administrators across campus also remarked that they were concerned that Geoffrey did not seem to be doing well in his new role as chair and questioned whether he should remain in the role. Toward the end of the year a decision was made to solicit feedback from members of Geoffrey's department through an online survey. The survey included ratings of Geoffrey's skills in 30 specific areas (e.g., setting clear expectations, being fair and objective, working to achieve consensus, communication of policies and procedures, etc.) as well as open-ended comments. Geoffrey also completed a self-rating. Results of the feedback process revealed significant discrepancies across multiple areas. Through discussion of the results it became apparent that Geoffrey thought things had been going well because he perceived the department was making swift progress on developing a new curriculum. What Geoffrey had been oblivious to was that the faculty were feeling disengaged from the process. Their perception was that Geoffrey was ramming through changes without allowing sufficient opportunity for their input. This was hard for Geoffrey to hear. He thought getting the curriculum changes in place so quickly was evidence that he was performing well in his administrative role. Through reflection on the feedback results and really listening to what his faculty valued, Geoffrey was finally able to see how his well-intended efforts had gone awry. Without the feedback process, Geoffrey was at high risk for being removed as chair. Instead, he committed himself to paying better attention to his faculty and asking for frequent informal feedback. Geoffrey's willingness to address his desire to improve with his faculty went a long way toward rebuilding trust. Results of a 360° evaluation conducted at the end of his second year as chair demonstrated how appreciative his faculty were of his openness to change. The department was now hitting its objective targets while also maintaining a more positive working culture.

5.6 Case example: accelerating change through performance coaching

Jackson is a Dean of a College with 600 faculty and staff members. Just prior to his appointment, the College had participated in a culture survey that measured employee engagement. The survey results for the College were well below the University's average.

Jackson was appointed to lead the College at the same time a new head of Human Resources was hired. Together they teamed up to improve results in a sustainable way. That meant improving productivity while improving the culture. The focus was on helping to hold all leaders and influencers accountable for driving results in a positive way. It also meant dealing with poor performers objectively, quickly and persistently. Jackson is a numbers guy who also had a vision for the College that included getting good results and doing so the right way through a connected coaching culture.

Jackson and his Human Resources partner developed an implementation plan using real time performance coaching as one of their key tools to create positive change. They experienced incremental change over the course of the first few months. It was slow and steady. Jackson believed it was a solid foundation that he and his team could maintain. They made the kind of progress most teams make: some leaders were making the tools part of their day-to-day routines, some leaders were having some success with the tools, and some were barely complying with the minimum requirements. The initial roll out included pockets of success and more than a handful of good examples, but not widespread cascading and adoption.

And then something happened. Jackson and his team saw acceleration in the rate of change, with improvements in both culture and productivity. Let us explore what happened with Jackson, his department chairs, office managers, and staff supervisors. What they did offers lessons for other groups who want to see this kind of change stick.

5.6.1 How they got started

Jackson and his team of leaders made commitments using a real time coaching approach. Each leader (the dean, 3 associate deans, 16 department chairs, 21 office managers, and 47 supervisors) served as a "coach" to each of their supervisees and agreed to hold five 3-minute coaching conversations each day. These conversations were focused on what was working to help regulate and connect with the agents. The conversations could be held with at level and across reporting relationships. The leaders would ask questions and show that they did not just approach employees when things were not working or when there were problems. The questions were intended to have a positive impact on faculty and staff and to build positive relationships within the College.

They also agreed to share their best examples each week during group coaching sessions. Each group of managers would meet with their team of supervisors, who shared what they were trying to accomplish, what happened during the conversation, and what they did to have a helpful interaction. They also gave each other feedback on what they liked and offered suggestions to improve their conversations and coaching. The primary goal of the sessions was to reflect and learn specific tips from each other that could be spread across teams and the center.

Jackson and his team saw some incremental progress using these tools in the way described above. Leaders were approaching their faculty and staff not just when there were problems but when things were working. Leaders were starting to be viewed as helping and as able to drive change in a positive way. But Jackson was not satisfied with the rate of change. He was interested in accelerating the rate of change and in spreading the process and impact across more leaders and more employees.

5.6.2 What they did to make it work

1. *Daily operating rhythm.* Chairs, office managers, and supervisors were struggling with the commitment to five 3-minute meetings per day. Not because they did not want to or they did not think it was important, but simply because they were not including it in their daily schedules. Eventually, they simply blocked off two 15-minute segments or one 30-minute segment each day and conducted as many 3-minute coaching conversations they could during these segments. The goal here was to see an increase in repetition and to make coaching part of their daily operating rhythm. They also did something to fit this into their typical days: they added these segments to the front end or back end of other meetings they had when they had to travel to other parts of the facility. It was on their schedule, but it wasn't on their peoples' schedules.

2. "*You know the drill.*" Jackson made a commitment, like his chairs and office managers, to spend 30 minutes out among his staff each day. Keep in mind that he works in a culture where there are meetings and conference calls booked all day. He'd approach supervisors when they were walking across campus or in their offices. At first, he'd ask them a simple question like "what's your best coaching interaction you've had today?" After a few weeks, he changed it to: "you know the drill." Initially people responded with "what do you mean?" He'd then say something like "I've been coming around asking the same sort of question for a few weeks now. What have I been asking about?" The supervisor or manager would say something like "my best example from today or this week?" and then Jackson would sit back and hear their best recent example. After a period of time, he'd just walk up to them and they'd begin sharing their best example without being prompted by a question or by "you know the drill."

3. *Good results plus specific behaviors*. Jackson's team got good at conversations that connect the behavior (the how) to best achievement or outcome from that day or week. It wasn't just about being positive or saying "good job" to someone. The conversations were simple: asking individuals to identify a good outcome and to describe how they did that. Being specific helped here: "how did you manage to handle that student situation quickly and ensure you provided good service?" This was a significant breakthrough for the supervisors who started to see their balanced results improve. Most of their agents knew how to answer this question because they figured out how to do something productively, with good quality and good impact on the students and faculty they served.

4. Two essential benefits here were: (a) that coaches started to gather very specific tips that could be shared immediately with others who are struggling to find out how to do something well and (b) this line of questioning helped all employees improve their self-management and self-direction, which increased their individual accountability for making something happen on their own.

5. *Practical real time coaching*. Chairs and office managers agreed to be on the floor at least 30 minutes per day. They asked their supervisors to be on the floor for longer periods of time coaching, developing and influencing other staff in positive ways. They wanted supervisors to help. Real time coaching was put in place as an all-hands-on-deck period of time when all leaders were out on the floor for a 60- to 90-minute period each week. The goal here was for coaches to demonstrate mostly positive coaching during this time period. This also provided time for office managers and chairs to see the coaching in action. When they first started this process, there was concern for others watching these real time interactions. Initially, individuals were nervous and were reluctant to show what was really happening. After a few weeks of this approach and daily commitments by supervisors to coach more often on the floor (especially asking about what was working), supervisors started to say "Watch us all you want. This is what we do every day. The conversations are mostly positive, so what would be the downside to have someone watch us in action."

6. *Embedding the* approach *into naturally occurring meetings*. Departmental leaders also made efforts to build the positive examples into other naturally occurring meetings. They would also reference an occasional real time coaching example in other meetings to share best practices.

Individual	Organizational
Emotion-regulation	Articulated role descriptions
Reframing threats as positive challenges	Development plans linked to performance evaluations
Use of short positive conversations	Multi-rater feedback

Table 1.
Major identified areas for improvement at individual and organizational levels.

5.6.3 Now what

The point of this story is to provide you with an example of how one group figured out how to accelerate change and how they spread real time performance coaching across hundreds of employees. The majority of staff in this College can describe to others what their results are on any given day, week or month, and importantly they are able to describe what they are doing to handle customer or coaching interactions well. The key here is that this team stressed accountability for each employee, at every level. In particular, individuals here are more self-directed as the leadership focused on regulating and connecting as part of their coaching culture (**Table 1**).

6. Conclusion

This chapter presents data from a longitudinal study of a large national sample of academic administrators in U.S. public research universities. The overarching objective of the investigation is to gain a better understanding of the preparation and experiences of leaders in academic settings in effort to facilitate strategies for positive change. This phase of the project identified improvement strategies used by deans and department chairs including but not limited to seeking advice from senior colleagues, reading about leadership and administration, participating in seminars and workshops, and use of paid leadership consultants. Further, the deans and department chairs perceived that the necessary targets for change included time management, professional development, better self-care, delegation, planning ahead, emotion regulation, allocating more time for thinking, improving listening and communication, seeking feedback, and spending more time mentoring faculty. Effective leadership is critical to the success of the higher education enterprise. Case examples are included to illustrate the importance of soliciting feedback and developing regular coaching plans.

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Chapter 7

Talent Management as a Core Source of Innovation and Social Development in Higher Education

Atheer Abdullah Mohammed, Abdul Hafeez-Baig and Raj Gururajan

Abstract

In the new millennium, talent management (TM) has become more important and has received attention from institutions that seek a foundation on the map institutions of excellence. Higher education institutions are represented by their possession of highly qualified employees who are able to show initiative, creativity and excellence in performance. Those individuals are the core resources of innovation and social development. It is apparent that there is a great competition among institutions in this modern technology era, driving an increase in knowledgeable employees along with vast market changes. Consequently, academic institutions have started to rethink their procedures and policies to achieve better attraction, development and retention of those employees. Therefore, this chapter aims to improve the theoretical and pragmatic comprehension of TM as an essential source of innovative and educational development. Through pragmatic use of elements of previous research approaches combined with a comprehensive qualitative study, this study concludes that higher education institutions are aware of innovation sources that are currently used in managing talent in their divisions and faculties. These were talent attraction, talent development, and talent retention. Both empirical research represented by the case study in the higher education sector and previous research confirm that the best practices of TM are considered as attraction, development and retention of talent.

Keywords: talent management, talent attraction, talent development, talent retention, higher education

1. Introduction

The new-millennium has witnessed the appearance of an infinite number of developments in strategic administration-thinking as a result of the "information technology revolution", and the appearance of the term "knowledge economy", which looks at the institution's excellence not only in terms of quantitative or qualitative productivity, but also in terms of the quality of knowledge that exists in its human assets, represented as talent. Therefore, management as a contemporary science has changed its language to focus on mental abilities where talented

individuals institute a strategic resource in an institution [1]. Talent is a primary source of competitive advantage for institutions [2–6]. As a result, there are many practical benefits for institutions that focus on talents [5–9]. For example, talent assists in increasing rankings and profits of higher education institutions [8, 9]. To explain, universities' rankings are aligned with the talent of high-performing employees [8–12]. These talented individuals contribute significantly to a university's performance by attracting new students, conducting high-quality teaching and learning, conducting high-level research and securing funds for further research [8–12].

Over the past two decades, there has been a dramatic increase in TM studies [13]. TM has become a common term since the McKinsey group first mentioned it in their 1997 report 'The War for Talent' [14–21]. Then, Michaels et al. [22] discussed TM in more detail in their book [19, 23, 24]. Since then, the topic has attracted enthusiastic interest from scholars in various fields and sectors [17, 21]. In the higher education sector as an industry, TM as a primary component of strategic human resource management can improve a university's performance over the long term by advancing its strategy and enact it through its talented individuals [12, 25, 26]. Thus, TM is a key for institutional success by making it possible for institutional systems to achieve higher goals [27–30]. Consequently, it is considered a core resource of innovation and social development [12, 21].

Nonetheless, new research in the strategic human resource area is urgently needed and rapidly expanding, as institutions have encountered significant challenges associated with TM [21, 26, 31]. These key challenges are faced by higher education institutions which need to give high-quality assurance in their technical expertise and activities [32–36] and their ability to be a leading exporter of international education [35–38]. Bradley [12] has suggested that a key solution to meet these challenges in Australian higher education could be the application of TM programmes. Such programmes include processes such as attraction, development and retention of talent, which are keys to growth and success of higher education institutions within their industry [12, 26, 39–41].

The review of the chapter is covered into five sections. The introduction of the chapter is provided in Section 1. Next, the TM theory and a brief explanation of this concept are provided. It discusses the conceptual identity and intellectual frameworks of TM. Talent management practices (TMPs) are reviewed and addressed in Section 3. Here, the practices that are included in the review are attraction, development and retention of talent. Section 4 discusses the innovations of TM in higher education. Finally, Section 5 concludes this chapter.

2. Method

The authors adopted both theoretical and practical approaches. Theoretically, a systematic review that includes empirical and theoretical studies on TM which have been published between 2007 and 2017 in scholarly research has been adopted. A total of 35 academic works were involved in the review [42]. Practically, the authors carried out an empirical qualitative study in six Australian universities to understand the best processes that are currently used in managing talent in the higher education sector [43, 44]. It comprised qualitative multi-method studies including (i) a brainstorming session to develop sets of questions, (ii) a focus group session to define the scope of individual interviews and (iii) individual interviews to obtain an in-depth understanding on the subject [45–47]. Qualitative methods were enough to comprehend the best practices of innovation that are currently utilised in

managing talent in the higher education environment. The sample consisted of 6 participants for brainstorming, 11 in the focus group session and 6 individual interviews.

3. The conception of talent management

In today's business world, talents are considered strategic resources for meeting institutional demand for increased competitiveness [4–9, 41, 48, 49]. Prior to reviewing TM, it is essential to describe the term talent [21, 50]. Iles et al. [14], Barron [51], Blass [52], Li and Devos [53], Cannon and McGee [54], Tansley et al. [55], Festing and Schäfer [56] and Naim et al. [57] all introduce talent as high-performing employees who have been considered to have significantly contributed to the progress of an organisation and its future development. Others like Rudhumbu and Maphosa [39], Harstad [58] and Sparrow and Makram [59] consider these as employees who are capable to add value by increasing organisational production. Having experience, mastery, knowledge, the skills, ability and the potential for development are all considered by Silzer and Church [60], Gümüş et al. [61], Beardwell and Thompson [62], Silzer and Dowell [63] and D'Annunzio-Green [64] as indications of talent.

Similarly, Baublyte [65] and Macfarlane et al. [66] have defined talent as those who exhibit leadership qualities that play a pivotal function within the organisation and show superior behaviour. Some other characteristics ascribed to the talent of human capital are that it is beneficial, unique [67, 68] and a major institutional resource [69, 70]. According to Scaringella and Malaeb [31], Ross [71] and Butter et al. [72], talent is an innate ability to learn things in an effortless and skilful manner inherent in these intelligent and creative individuals. Other researchers, such as Murongazvombo [73], Chuai [74], Kravtsova [75], Kramer et al. [76] and Kaliannan et al. [77], have defined talent as an essential driver and success element for an institution both short and long term [21].

As a concept, in the higher education environment, TM as a primary component of the strategic human resource management can improve a university's performance over the long term by understanding the strategy enacted through its talented individuals [12, 25, 26]. This is a key for institutional success by making it possible for institutional systems to achieve higher goals [27–30]. In the literature, there are six common perspectives on TM, which are [21] *(1) process, (2) strategic, (3) developmental, (4) cultural, (5) competitive and (6) human resource planning perspectives* [53, 65, 78].

4. The process perspective

This was defined by Iles et al. [14], Blass [52] and Cappelli [79], for whom TM appears as a complex set of processes that operate in large institutions so that the institutions and individuals within them can meet current and future needs with overall benefits for the institution. In a similar vein, Dessler [80], Tansley et al. [81], Blackman and Kennedy [82] and Ali et al. [83] portray the TM process as needing full integration, in order to become a standard practice to attract individuals who have high potential for creative development and to retain them in order to generate a unique value to the institution. In other words, it is a specific method for attracting and retaining abilities and essential knowledge for the future [80–83].

5. The strategic perspective

TM is a strategy to attract the right talent and provide workers with potential contributions via strategic workforce planning and high-quality development experiences that build institutional capabilities [59, 84]. In the same way, it is a strategic function for identifying talent gaps and managing succession planning, along with attracting [85], selecting, motivating, developing and maintaining highly qualified individuals [86, 87]. TM can be useful in empowering employees to understand their essential capabilities and to produce an effective climate which professionally empowers them to underpin, capture and develop these talents into individual productivity [59, 71]. Therefore, TM should inform the selection of high-performance incumbents to fill positions [88, 89].

6. The developmental perspective

TM is a strategic priority for business institutions and is perceived as a crucial driver in developing institutional performance [90, 91]. Similarly, Cannon and McGee [54], Silzer and Dowell [63] and Moczydłowska [92] explain TM as a set of procedures, programmes and activities applied to highly qualified employees who are characterised by high potential in their development in order to achieve an institution's goals now and in the future. The reason for this is that, if an institution fails to provide talented development and training, it may lose available talent [93].

7. The competitive perspective

As perceived by Beamond et al. [94], Tomany [95] and Meyers and Van Woerkom [96], TM is an engine of sustainable competitive advantage, which is tricky to simulate, is rare and valuable and cannot be replaced by competitors. From the same perspective, Iles et al. [14], Al Haidari [50], Gelens et al. [68], Collings and Mellahi [88], Waheed et al. [97] and Yap [98] define it as activities, processes and development of skills which require individuals to achieve a sustainable competitive advantage and institutional success by providing competent and highly qualified individuals who are more capable than competitors in other institutions.

8. The human resource planning perspective

Cui et al. [17], Beardwell and Thompson [62], Cappelli [79], Nissler [99] and Lewis and Heckman [100] introduce TM as a tool of human resource planning to develop a plan to meet institutional human resource needs, in order to attract employees with the appropriate skills in the appropriate areas of work. This involves a number of procedures designed to attract, develop and retain extremely talented staff to meet institutional needs. In other words, TM anticipates the necessity for human resources and then builds a strategy to meet it.

9. The cultural perspective

According to this perspective, TM focuses on social and cultural contexts of available human resources within a range of qualities [101]. These qualities

No.	The study	Country	Sector/industry	Method	TMPs															
					Talent selection	Talent engagement	Talent attraction (recruitment)	Talent development	Leadership development	Succession planning	Talent acquisition	Support and training	Talent retention	Compensation and reward	Talent identification	Skills gap analysis	Workforce and talent planning	Performance management	Career management	Talent evaluation
1	[109]	South Africa	ICT	Quantitative			*	*		*			*			*				*
2	[110]	Thailand	Private	Qualitative					*					*	*					
3	[111]	South Africa	Hotel	Quantitative	*		*		*			*	*	*			*			
4	[112]	India	Business services	Quantitative			*						*	*				*	*	
5	[113]	—	—	Theoretical				*	*	*			*					*		
6	[114]	Iran	Manufacturing	Quantitative		*		*					*	*	*					
7	[115]	Malaysia	Private	Qualitative	*		*					*						*		
8	[116]	Switzerland	Private	Quantitative			*	*		*			*							
9	[117]	Czech Republic	Private	Quantitative				*			*		*							
10	[118]	Several European countries	Private	Qualitative				*					*		*					
11	[119]	Uganda	Private	Quantitative			*	*					*							
12	[75]	Czech Republic	Private	Qualitative			*	*		*		*	*	*	*					*
13	[120]	Sweden and Romania	Private	Quantitative	*		*						*							*
14	[95]	United Kingdom (UK)	Private	Mixed	*		*	*		*			*	*						
15	[121]	Denmark	Manufacturing	Qualitative			*	*					*							

No.	The study	Country	Sector/industry	Method	TMPs															
					Talent selection	Talent engagement	Talent attraction (recruitment)	Talent development	Leadership development	Succession planning	Talent acquisition	Support and training	Talent retention	Compensation and reward	Talent identification	Skills gap analysis	Workforce and talent planning	Performance management	Career management	Talent evaluation
16	[104]	Norway	Manufacturing	Qualitative			*	*		*				*	*		*	*	*	
17	[122]	Pakistan	Private	Quantitative		*				*				*	*					
18	[123]	Pakistan	Banking	Qualitative		*	*						*							
19	[70]	—	—	Theoretical			*	*					*	*		*		*	*	
20	[124]	Ghana	Banking	Quantitative				*		*				*		*				*
21	[125]	Kenya	Banking	Quantitative			*	*					*						*	
22	[126]	USA	Private	Quantitative			*	*		*			*					*		
23	[127]	China	Manufacturing	Qualitative			*	*					*							
24	[50]	Arab Gulf countries	Banking	Mixed				*					*		*					
25	[128]	—	—	Theoretical		*	*	*					*							
26	[129]	—	—	Theoretical			*	*					*	*						
27	[80]	—	—	Theoretical	*		*	*		*				*				*		
28	[130]	Egypt	Banking	Quantitative	*		*	*					*							
29	[131]	Pakistan	Banking	Quantitative	*		*	*					*							

No.	The study	Country	Sector/industry	Method	TMPs															
					Talent selection	Talent engagement	Talent attraction (recruitment)	Talent development	Leadership development	Succession planning	Talent acquisition	Support and training	Talent retention	Compensation and reward	Talent identification	Skills gap analysis	Workforce and talent planning	Performance management	Career management	Talent evaluation
30	[77]	Malaysia	Private	Qualitative			*	*					*	*						
31	[132]	Portugal	Private	Qualitative			*	*				*							*	*
32	[133]	—	—	Theoretical				*			*		*							
33	[134]	—	—	Theoretical	*		*													
34	[135]	*South Africa*	Higher education	Qualitative			*	*					*							
35	[26]	Malaysia	Higher education	Qualitative			*	*					*							
Total					7	4	24	24	2	8	2	4	25	11	7	2	2	3	4	5
Percentage (%) of research studies					20	11.4	68.5	68.5	5.7	22.8	5.7	11.4	71.4	31.4	20	5.7	5.7	8.5	44.4	14.2

Source: Prepared by the researcher based on the above sources.

Table 1.
The TMPs according to the opinions of authors and researchers.

include innate ability, intelligence and creative skills [31, 71, 72, 102]. Proponents of this perspective propose that individuals are successful only when they have sufficient talent and believe that the success of institutional work will be followed by their own success [101, 103]. **Table 1** shows a summary of perspectives on TM.

To conclude this section, the scope of TM is restricted to the strategic perspective for three reasons. First of all, the strategic perspective includes all the perspectives above [104]. Secondly, this perspective outlines how an institution can efficiently implement TMPs [104, 105]. Finally, TM is a function of attraction, development and retention processes which contribute strategically to an institution's success [105–107].

10. Talent management practices: a critical review

In the twenty-first century, TM has become more important and has received attention from institutions that seek a foothold in the institutional map of excellence. High-performing institutions are identifiable by their talented individuals who are able to show initiative, creativity and excellence in performance [27–29]. In higher education environments where high-performing organisations are identifiable by their talented individuals who are able to show initiative, creativity and excellence in performance. TMPs assist higher education institutions regarding such as the development of the talent pool, improvement of the productivity of individuals, support for effective planning and improvement of human resource management [40, 41]. Besides, attraction, development and retention of talent are strategically the keys to growth and success of higher education institutions [12]. The reason for this is that competitive advantage can be maintained by attracting, developing and retaining highly qualified individuals in key positions [3, 41, 49, 108]. Therefore, a majority of institutions have started to rethink their procedures and policies to achieve better acquisition and retention of individual talents. It is obvious that there is a strong competition between institutions in a technology-driven modern era, which has caused an increase in knowledge workers along with vast market changes [27–29]. In the scope of TM literature, several studies through the period 2007–2017 have shown in **Table 1**.

As shown in **Table 1**, it is obvious that many scholars have focused their empirical and theoretical attention on attraction, retention, and development of talent. Of all articles reviewed, talent retention is the dominant process with 25 articles (68.5%) of TMPs research have concentrated on, followed by both talent attraction and development with 68.5 per cent (24 articles), and talent attraction with 22 articles (73.3%). The least attention was paid to the TMPs of leadership development, talent acquisition, skills gap analysis, workforce and talent planning and performance management with two or three articles each.

Overall, as mentioned in the method section of this chapter, the authors carried out an empirical qualitative study in six Australian universities to understand the best processes that are currently used in managing talent in the higher education sector [43, 44]. This study explored the best TMPs of innovation in the aforementioned sector. (1) Talent attraction (social domain and institutional excellence), (2) talent development (performance management, coaching talent and leadership development) and (3) talent retention (benchmarking, job satisfaction, nonmonetary rewards, employee empowerment and employee motivation) were selected as best processes of TM in the higher education sector.

10.1 Talent attraction

In modern knowledge-based institutions, talent attraction is one of the most essential success elements [105, 136, 137]. Higher education institutions, for example, are strongly based on the attraction of experienced staff to fill key positions [9, 12, 36]. They primarily aim to attract talented candidates from the internal or external labour market [130]. However, there are some difficulties and challenges in attracting qualified staff to higher education institutions [9, 36]. These issues include safety and security, workloads [36] and conflicting opinions [9]. To meet these challenges, Beardwell and Thompson [62] highlight the following approaches that have been identified as effective for attracting talent:

- *The job-based approach*: this includes writing a comprehensive description of a job which is filled by an employee, and then creates the desired person specification, which is based on that job description. However, this approach is inflexible because the changes that can occur in the main tasks or list of responsibilities of the main job are not taken into consideration.

- *The person-based approach*: this focuses on identifying individual attitudes sought by an institution. It can be adopted in order to recruit individuals to fill a vacant job and participate in achieving the broader business targets of the institution.

- *The competency-based approach*: this tries to recruit people by, for example, specifications, knowledge, experiences, skills and personal values that are attached to a job and used as a guide for an individual. However, this approach can encounter practical implementation difficulties and therefore may not achieve the institution's goals.

Talent attraction can be divided into two sub-variables: (1) social domain and (2) institutional excellence. Throughout the chapter, the term 'social domain' is used to refer to support in difficult times, social innovation and work-life balance. An institution can attract more talented employees by providing them with social support in critical areas, for example, motherhood and monetary difficulties [138]. In regard to work-life balance, the last decade has seen a growing trend towards family-friendly workplaces [139]. Thompson [137] defines work-life balance as a personal perspective that is related to compatibility for talented employees inside and outside their workplace. Socialising with colleagues, lifestyle opportunities or appropriate locations are determinant factors for attracting new talented individuals, because they add work-life balance to institutions, which in turn contributes increasingly to their productivity [98, 136, 137, 139].

In the literature, the term 'institutional excellence' is generally understood to mean a strong tool and a key driver that assists institutions to achieve their strategic and operational aims [140, 141]. Excellent institutions adopt managerial attitudes that focus on total quality in all internal processes to attract high-quality individuals [53, 142]. As previously stated, the qualitative study explores a number of excellence-related factors that contribute to attracting new talents to higher education institutions. These factors include talent branding, the reputation of an institutions, institutional culture, institutional climate and work environment.

Talent branding as a key element of talent attraction enables institutions to manage talent of employees through an institutions' identity, loyalty and culture, as

a means of attracting high-potential individuals [53, 142–145]. Institutional branding depends on the available resources for employees' recruitment. In order to achieve financial and time goals, institutions have to consider particular resources in terms of where to obtain the profile required. In order to be excellent and successful in attracting talent, institutions need to follow appropriate strategies, adopt ethical principles in each phase of their current practices and build a strong and distinctive reputation in the labour market to be competitive [74, 123]. There are two different strategies for recruiting talent to an institution [53, 80, 146, 147]:

(1) Internal brands: An institution relies on its candidates. This will decrease the risks connected with the recruitment process and will save costs. An institution may know or can observe a candidate's strengths and weaknesses as well as the fact that current employees are possibly more committed to the institution. In particular, avoiding external advertisements enables institutions to save costs of external channels. However, Dessler [80] argues that rejected applicants may become discontented, and it can also waste time since often the manager already knows whom they want to hire.

(2) External brands: Institutions cannot always get all the employees they need from their current staff and therefore need to tap into external sources to find candidates [53, 80]. However, online recruitment channels may encourage excessive numbers of applications to reach a limited audience (online job search), or the process is seen as too impersonal, discouraging some candidates [62, 80]. Therefore, institutions should develop a strong and distinguishable employer brand, which links institutional values to the employee management strategy and the institution's brand [62, 121]. This can attract the best possible talent by promoting a unique combination of mental and practical benefits in the work place [62, 121].

Indeed, an institution that has excellence in its activities builds a good reputation, which then allows it to attract the best talents [125, 145, 148, 149]. This view is supported by Horseman [10] and Cruz-Castro et al. [150] who write that reputation and university ranking are key elements of institutional excellence to attract talented individuals. Furthermore, a desirable institutional climate is a determinant of attracting new talented employees [125, 137, 151]. Similarly, a supportive institutional culture with innovation can be an excellence-related factor for attracting qualified employees [140]. In regard to consideration of the work environment, this is a driving force for attracting talent [98, 125]. Working environment factors such as improved health, stress reduction, autonomy, job security and satisfaction within an institution are considered determining aspects for attracting talent to the institution [136, 137, 139, 151].

In summary, it has been demonstrated in this review that talent attraction is a basic factor of innovation and success in various sectors in general and in the higher education sector specifically, because of the key role that talent attraction plays in the functioning of higher education institutions. Thus, talent attraction in educational institutions is a function of social domain and institutional excellence.

10.2 Talent development

In a perfect business world, because of strong competition, institutions should develop their talented employees to enable them to become productive more rapidly [152]. Hence, the talent development process needs to be embedded within staffing progress and be regarded as a successful measure for institutions to improve the skills of their highly qualified individual staff members [40, 74, 142, 153]. Talent development is considered a critical resource of differentiation and sustainable

competitive advantage [62, 153]. It is strategically important for an institution's success [108, 153, 154]. For instance, the development of talent working within higher education institution also assists in retaining talented employees [153], which in turn assists in increasing university rankings and profits [8, 9]. University rankings are aligned with the talent of high-performing employees, and these talented individuals contribute significantly to a university's performance by recruiting new students, conducting professional teaching, conducting high-level research and securing research funding [8–12].

The development process of talent involves three elements: (1) performance management, (2) coaching talent and (3) leadership development.

1. *Performance management*—As one of the key processes of talent development, this assists in filling the gap between the current and planned performances of highly qualified employees [153–156]. It evaluates the current performance of talents to assist them in identifying their competency level and then developing their capabilities [125, 130]. Through this process, training needs can be identified to develop talent [156, 157]. Institutions should offer their experienced staff appropriate development strategies to improve their strong points and hence improve their total performance, including particular competencies, strengthening their motivation and boosting their career development [40, 158, 159].

2. *Coaching talent*—This is the second sub-variable of talent development. The existing literature on coaching talent is extensive and focuses on learning and development of talent [160, 161]. Even though coaching talent can be a significant tool for achieving high talent development through learning skills and creating knowledge, the difficulty in transforming these skills from outside an institution has been a disadvantage [142, 162]. Coaching talent through internal job rotation can develop individual knowledge and experience from different departments and divisions within an institution [163–165]. Training and mentoring programmes are valuable tools for developing talent [160, 166, 167]. These programmes can be offered online [130] and can also include face-to-face learning and teaching courses for academic staff [168] to gain required knowledge and skills [130, 168]. In addition, leading institutions provide their talented employees with career development opportunities [98, 104, 161, 169].

3. *Leadership development*—This is a key process of talent development [153]. It assists institutions in achieving overall institutional sustainability [160, 169, 170]. Effective and developed leadership is a key element of institutional sustainability [171]. Institutional sustainability through leadership assists institutions to strategically generate intrinsic values and wellbeing for all stakeholders [171]. The leadership development process includes 'coaching, multi-source feedback, stretch assignments, mentoring, international job assignments and formal development programmes' [169], as well as succession planning [164, 172, 173]. In academic institutions, high-level leadership provides talented individuals with sufficient opportunities in regard to functional planning programmes [12, 154]. Conversely, a lack of formalised institutional leadership training could negatively affect employees from achieving their advancement potential [166]. Therefore, the leadership development process enables leaders to obtain the skills and competencies necessary to be effective through role assignment leadership programmes [169, 170].

In brief, it has been shown in this review that talent development is a critical source of innovation and sustainable competitive priority in various sectors in general and in the higher education sector specifically. It assists in retaining highly qualified employees and increasing university rankings and profits. Thus, talent development in academic institutions is a function of performance management, coaching talent and leadership development.

10.3 Talent retention

Talent retention becomes a progressively worthwhile process of building an institution's ability to acquire and maintain a competitive advantage [118, 174, 175]. It is focused on retaining talent among an institution's staff so they remain with an institution [130]. Due to fierce competition to attract talent among leading institutions in all sectors in general and particularly in the higher education sector, the retention of talented staff in higher education institutions is problematic [12, 166, 176, 177]. This is partly due to constant growth in the economy that makes job opportunities for academic talent almost unlimited [12, 177]. Retention of talented individuals is mainly aimed at enabling an institution to keep a high-value workforce and to build a unique source of competitive advantage, which can lead to institutional growth and success [124, 178]. Talent retention is constructed using five sub-variables: (1) benchmarking, (2) job satisfaction, (3) nonfinancial rewards, (4) employee empowerment and (5) employee motivation.

First of all, benchmarking can broadly be defined as a key tool for setting aims by utilising learning and external standards from other institutions, which can act as the best practice for performance [10]. This tool has received considerable attention within Australian institutions [179]. It is seen as a beneficial way of retaining talented staff within higher education institutions through assessing the current strategies of talent retention from the best performing institutions [10, 180]. There are several types of benchmarking within the higher education sector [10]: internal benchmarking compares performance to other divisions of the university, competitive benchmarking compares performance against a chosen group of peer universities, sector benchmarking is a comparison with all universities in the same country and strategic benchmarking involves a comparison with overseas universities. Competitive compensation is considered as an essential element of success towards retaining highly qualified individuals within an institution that seeks to achieve a competitive advantage [181, 182]. Thus, institutions should have a competitive benchmarking system, which is a determining factor for retaining their highly qualified staff [125, 142, 182]. The second sub-variable of talent retention is job satisfaction. It was not until the late 1930s that historians began to consider job satisfaction as worthy of scholarly attention [183]. Job satisfaction involves a positive emotional attitude in workplaces to assist higher education institutions to retain experienced staff and achieve a competitive advantage [11, 166, 184–186]. It can be understood in terms of work environments, work conditions, relationships with supervisors and career opportunities [177, 184, 186]. Existing high-quality working environments and conditions promote job satisfaction, which assists the improvement of performance at both individual and institutional levels [166, 177, 184]. Therefore, high job satisfaction of talented individuals in academic workplaces is a reflection of existing effective retention strategies [166, 177].

Thirdly, nonfinancial rewards can play a crucial role in assisting an institution in retaining its talented staff through increasing productive time and engagement among individuals and consequently improving their overall productivity [125, 158, 187–189]. Nonmonetary rewards improve retention rates of highly qualified employees working in higher education institutions [176]. Those rewards involve

certification, genuine appreciation and recognition [158]. Likewise, Hina et al. [188] hold the view that nonfinancial rewards include personal growth, interesting work, participation, flexibility, acknowledgement, significance of a role and achievement. Nonfinancial rewards in higher education institutions constitute funding external education, promotion and participation [190]. Employee empowerment is the fourth element of the talent retention construct. A large and growing body of literature about 'human relations movement' has been developed since the 1990s [175, 191, 192]. Employee empowerment practices are an essential element of motivating and retaining highly qualified employees for a long time within an institution [83, 193, 194]. Employee empowerment in academic workplaces assists in retaining talented staff, both academic and professional [192, 193]. It improves the satisfaction levels of an institution's employees through granting them self-efficacy in their workplaces [195, 196]. Successful institutions that seek to increase their productivity should empower employees through encouraging creative ideas and involvement in decision-making [175, 189, 194, 197]. Thus, employee empowerment is a process which values employees by providing them with sufficient responsibility and authority to manage their work professionally [194]. The fifth and final subvariable of talent retention is employee motivation. Motivational and valued work, professional advancement and supportive learning environments are seen as the key to retaining talented employees [11, 123]. In higher education environments, employee motivation plays a key role in retaining valued staff [11, 166, 177, 198]. An institution should offer proper financial rewards to its employees to ensure employee motivation [159, 199]. Career advancement is a creation of opportunities for highly qualified individuals that could lead them to improve and develop their career paths [137, 152]. These created opportunities are essential for retaining talented individuals [98, 104, 161, 169].

In summary, it has been shown in this review that talent retention is a main area of interest within the field of TM. It is a key source for innovation and sustaining competitive advantage in various institutions in general and educational institutions specifically. Thus, talent retention is a function of benchmarking, job satisfaction, employee empowerment, employee motivation and nonfinancial rewards.

To conclude this section, a review of the TM literature identifies a number of processes in various sectors and institutions. The most common practices of TM are attraction, development and retention. This view is supported by the outcomes of the qualitative study that has been conducted in a case of the higher education sector in Queensland, Australia [43].

11. Discussion

TM is considered a form of investment because talented individuals are viewed as the core source of innovation and social development [12]. The practices of TM are positively associated with improving innovation of institutional performance [200–202]. These practices play an essential role in nurturing the appropriate conditions for channelling and motivating employees towards the improvement of innovation activities [202]. Consequently, when an organisation fails to redefine its staff value proposition, it will continually have issues in attracting, developing and retaining talent [39]. Thus, TM can provide considerable benefits to an institution [5–9]. For example, it improves the institution's overall performance, its ethos, its competitiveness and talent retention, which in turn prevent risks to the institution [203]. TM assists development of the talent pool, improvement of the productivity of individuals, support for effective planning and improvement of human resources management [40, 41]. Furthermore, attraction, development and retention as key

practices of TM are strategically the keys of innovation to growth and success of the higher education industry [12], as a competitive advantage can be maintained by attracting, developing and retaining highly qualified individuals in key positions [3, 41, 49, 108].

TM can affect and adjust the behaviours and abilities of individuals to innovate [202]. Talented individuals have become a competitive weapon and resource of innovation for institutions in obtaining a sustainable competitive advantage [204–206]. A majority of higher education organisations have realised that talented individuals are strategic assets because they play a key role in the success, innovation and growth of the higher education institutions over the long term [9, 12, 39, 40]. These individuals assist higher education organisations with cultural adaption through identifying the challenges of public perception and the development of active learning environments [26, 89, 207]. Highly qualified employees constitute a critical resource of creativity, innovation and therefore future revenues for institutions [12, 106]. In addition, increase in the strategic importance of human resources management for competitive advantage can be achieved by talented individuals [206, 208, 209]. As a result, innovation is a complicated task, which requires high professional ability in knowledge-intensive positions [202]. Hence, talented individuals play a significant role in an institution's survival and innovation in a dynamic environment [201, 208, 210, 211].

This study provides a clear and inclusive outline of the extant scholarly research from the period 2007–2017. Reviews in this period provide an opportunity to learn from prior experiences in TM. Most importantly, this empirical research is one of the first few studies that extended the previous investigation of TMPs in various sectors to the higher education sector. Both empirical qualitative research represented by the case study in the higher education sector and previous research of TM confirm that the key practices of TM are considered as attraction, development and retention of talent. Looking to **Table 1**, it is apparent that the vast majority of research is outside the higher education sector; the few studies from within are in non-Australian contexts. This finding is supported by the previous studies. For example, Paisey and Paisey [25] find that TM studies in the higher education sector are limited. The majority of TM studies focus on theoretical frameworks with little focus on pragmatic studies [95, 212–214]. Furthermore, practical studies on TM are either quantitative or qualitative [20, 213]. On the other side, the findings of **Table 1** is supported by the previous research that TMPs 'can be grouped into five core groups: (i) recruitment, attraction and selection; (ii) training and development; (iii) retention; (iv) identification and (v) performance management of talent' [21, 53, 116, 126, 213].

Observing at **Table 1**, many scholars have given empirical attention on retention, development and attraction of talent [121, 131, 205, 206, 213, 215–218]. One of the key reasons behind this attention is that talent attraction, retention and development are strategically very essential in today's ephemeral knowledge economy, as they firstly assist an institution to achieve strategic business goals and meet basic business requirements and they form the foundation for the implementation of business strategies [21, 97, 106, 165, 172, 218–220]. Secondly, institutions that establish their principal competence in talent attraction, talent development and talent retention guarantee their own steadiness and growth among other competitive institutions in the same business sector [21, 107, 108, 221]. Finally, attraction, development and retention of talent are essential for growth and success of higher education institutions over the long term by enacting their strategy through their highly qualified employees [12, 21, 39, 40]. In addition, **Table 1** shows that the least attention was paid to the TMPs of acquisition, leadership development, skills gap analysis, workforce and talent planning with one or two articles each.

In general, the results of the three core themes of TM above are in line with Bradley [12], Kamal [26], Rudhumbu and Maphosa [39] and Wu et al. [40] who emphasise that attraction, development and retention of talent are strategically essential for educational success and growth. This view is supported by Waheed et al. [97], Kim et al. [106], Tatoglu et al. [165], Hejase et al. [172], Ford [218], Rothwell [219] and Rothwell et al. [220] who point out that 'attraction, development, and retention of talent are strategically more important in today's volatile knowledge economy; because they help an institution achieve strategic business aims, meet basic business requirements, and form the foundation to implement business strategy' [21]. Similarly, van den Broek et al. [107], Mwangi et al. [108], Xue [127] and Kataike [221] state that an institution 'that established its core competence in attraction, development, and retention of talent guarantees its own stability and success among other competitors in the industry' [21].

Overall, although the findings of our case study are consistent with some of the prior studies, there are major variances. This study is one of the first studies that examine TMPs in Australian higher education. The consistency with the previous research was partially conceptual, theoretical or regarding methodological matters. In conclusion, this section has attempted to provide a discussion of both an empirical case study and literature relating to the innovations of TM in the higher education sector. TM is a strategic source for sustaining competitive advantage in all kinds of institutions. Therefore, talent is an essential management for innovative institutions [21, 222–224].

12. Conclusion

This chapter has attempted to provide a clear explanation of the literature relating to TM. It aims to improve the theoretical and practical understanding of TM research in the higher education sector. The principal conclusion of the empirical study is that higher education institutions are aware of innovation sources that are currently used in managing talent in their divisions and faculties. These were (1) talent attraction (social domain and organisational excellence), (2) talent development (performance management, coaching talent and leadership development) and (3) talent retention (benchmarking, employee motivation, employee empowerment, nonmonetary rewards and job satisfaction). As a result, those individuals contribute significantly to a university's performance by attracting new students and securing funds for further research. These themes are positively associated with innovation speed of the higher education institutions. TM is an integrated management system that starts with the practices of attracting, developing and retaining talents. So that institutions can benefit from this in the form of products (commodities/services) that have difficult characteristics of imitation and competition. This is because of the expertise and knowledge possessed by their efficient human resources. Although the scholars and researchers differ in determining a unified concept of talent, the specialised literature produces two trends in its definition, some of which are traditionally based on high intelligence, while the modern trend is based on excellent performance, mental ability, technical and dynamic skills, creative thinking and leadership abilities. In addition, the review of literature included various views of talent, but all the scholars and researchers agree that talent is a valuable resource of innovation for all institutions. The literature also identified six common perspectives on TM. From the literature, the strategic perspective was identified as most relevant to achieving the research objectives.

The generalisability of these findings is limited to the Australian university sector in Queensland. This study recommends that there is further research to be

done in the higher education area, especially in relation to talent using empirical methodologies. More specifically, mixed method research should be used to fill the gap in the TM literature. As the least attention was paid to the practices of leadership development, talent acquisition, skills gap analysis, workforce and talent planning, and performance management with two or three articles each. This requires more attention in the future research to fill the gap in the TM literature. It would be useful to investigate the current methodology and topic of this research in other countries in order to generalise the findings within the global context.

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Chapter 8

An Integrated Model for Invigorating Innovation and Entrepreneurship in Higher Education

Teboho Pitso

Abstract

The growth trajectories of innovation and entrepreneurship within higher education have largely followed discrete paths such that each developed independent of the other. The structural locations of innovation and entrepreneurship within higher education institutions have a lot to do with this strategic discrepancy. In some cases, entrepreneurship is mostly located within business schools and its focus is on teaching students' business basics and entrepreneurship basics, while innovation is located within any of the variants of university innovation hubs and technology transfer units. Innovation is also used as a buffer to shield real change and transformation in higher education especially in reference to innovative teaching, innovative education and so on, which, in essence, can best be described as improvements rather than innovation. It is also important to note that one of the critical plinths of entrepreneurship—creativity—has generally been marginalised in the core activities of higher education. While entrepreneurship has, over the course of more than three decades, gained legitimacy traction within higher education, innovation has fairly been on the margins of core university strategies but is becoming increasingly pertinent in higher education albeit in ways requiring critical reflection. However, creativity remains largely on the margins of core higher education activities, and its explicit teaching has not yet gained strong academic legitimacy. It is not clear why creativity, innovation and entrepreneurship have assumed discrete growth paths within higher education when there is such a palpable mutual reinforcement amongst these concepts. In this chapter, I report on the study I conducted in purposively selected Scandinavian and South African universities, which was aimed at: (1) better understanding how innovation and entrepreneurship are nurtured and developed in these institutions as well as the role of creativity in all these endeavours (2) identifying the key drivers of this nascent interest in innovation and entrepreneurship within higher education and why creativity remains on the margins even when the academic legitimacy of innovation and entrepreneurship increases (3) developing a more integrated model that could better coordinate the differentiated activities of not only innovation and entrepreneurship units but also those of faculties so that there is greater mutual reinforcement and shared responsibilities that could optimise the social impact of higher education academic activities and those of innovation and entrepreneurship units. Five Scandinavian universities and three South African universities were selected, and fifteen Directors of innovation hubs and entrepreneurship centres

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were interviewed. While there are overlaps amongst faculty activities, innovation hubs and entrepreneurship centres, these overlaps are informal and poorly coordinated, which vitiates their total impact on society.

Keywords: creativity, innovation, entrepreneurship, higher education, social impact

1. Introduction

Entrepreneurship has had quite a chequered relationship within higher education across the globe [1–3]. It has sought academic legitimacy since the early 1940s including "dressing" itself in well-established academic nomenclature of other disciplines and has struggled to develop its own distinct scholarship although there are important positive pointers towards that direction in more recent times [4]. In the study of the history of entrepreneurship education in higher education, Pitso and Lebusa [4] describe the undergirding of entrepreneurship education on Economics and Psychology and, why this was essentially a problematic conceptualisation although it led to its gain in legitimacy as an academic discipline [1]. The origins of entrepreneurship education can be traced to the introduction of "The Management of New Enterprises" course, which was part of the 1947 Harvard Business School MBA Programme. Entrepreneurship in higher education has tended to assume this conceptualisation so that entrepreneurship came to be understood as part of business management and thus its education focused on business basics such as market analysis, business plans, franchising, and new enterprises management until in the 1970s when focus shifted to entrepreneurship basics. The vestiges of the original conception of entrepreneurship education are still visible in most university business schools that still accentuates market analysis as a means of discovering new markets and detailed business plans. Under this conceptualisation of entrepreneurship education, the dominant business logic has been that of causal problem-solving and causal strategies that have perennially been guiding managerial thinking and its variant of strategic thinking.

In the next section, I problematise and critique this entrenched conceptualisation of entrepreneurship education and argue that it has been at the heart of developing entrepreneurship within higher education in ways that marginalised creativity and innovation. Furthermore, I make a case that the definitions and processes of entrepreneurship within higher education have largely marginalised the very plinth of entrepreneurship, which are creativity and innovation, which have had an even more chequered relationship with higher education than entrepreneurship. The discrete developmental trajectories of especially entrepreneurship and innovation in higher education are outlined in the next sections. I also delve into the definitional challenges of entrepreneurship and innovation within the higher education context and suggest alternatives that could better lead to a more integrated approach to entrepreneurship and innovation. Based on these meanings of entrepreneurship and innovation, I conducted a qualitative study with senior staff members of selected universities that are responsible for business schools, centres of entrepreneurship and innovation hubs on their own experiences, perspectives and understandings of how entrepreneurship and innovation are positioned in their respective universities and how that either leads to greater fragmentation or integration as the main pattern of evolution. An integrated model that is likely to invigorate and collectively harness the strength of innovation and entrepreneurship is described and shows how it links with core university activities of curriculum and research.

2. Entrepreneurship and innovation in higher education: history, meanings and contexts

2.1 Entrepreneurship in higher education

2.1.1 The historical trajectory

While some authors trace the origins of entrepreneurship education to the early 1970s [1, 4], the most probable time for the introduction of entrepreneurship in higher education can be traced to Myles Mace who introduced entrepreneurship as a course in the Harvard University Business School MBA Programme in 1947. The course was called The Management of Enterprises. Thereafter, entrepreneurship education remained largely within the ambit of university business schools with a curriculum that was mostly undergirded by Business Basics content that accentuated market analysis, business strategy and business plans as earlier stated. The dominant pedagogy was one driven by Business content with a strong mimetic pedagogy. A mimetic pedagogy accentuates the passive transmission of prescribed learning content from an expert, as the custodian of this sacrosanct knowledge, to the novice who was expected to acquire and master that knowledge. The variants of this mimetic pedagogy in entrepreneurship are coaching and mentoring where seasoned entrepreneurs guide novice or budding entrepreneurs. This approach to teaching and learning drew from the dominant research paradigm of the time, which tended to eschew human agency and action in preference of establishing a clean, universal knowledge [5]. In a very useful Ph.D. study on the dominant teaching method that drives entrepreneurship education within the Scandinavian universities, Hagg [6] identified learning-through-action as central to such endeavours. In other words, the teaching of entrepreneurship in Scandinavian countries accentuates action-oriented focus where practical learning activities and taking responsibility for one's study are the underlying learning processes of developing entrepreneurs. This approach to teaching entrepreneurs is similar to andragogic epistemologies that emphasise self-learning, strong action-oriented learning, real-life experiences of trying out things and the motivation to hold something tangible at the end of the learning process. Hagg study does not oppose this mode of teaching entrepreneurs but find it limiting in the sense that reflective critique or what he prefers to call *reflective thinking* is not integrated into this approach to teaching. He sees reflective critique as crucial in the learning of entrepreneurs in that budding entrepreneurs could learn to discern critical aspects of their practice, identify flaws and curate knowledge that could be beneficial to their practices. He also argues that this approach to teaching could build the knowledge base of entrepreneurship education and its scholarship, which is a similar point we raise in our own book chapter [4]. Teaching entrepreneurs, in the South African context, is different as it is dominated by the epistemology of mimesis where students become passive recipients of Business and Entrepreneurship Basics knowledge as premised on causation rationality and market discovery mores with the business plan as an end-product. Sarasvathy as shall be shown in the next sub-section had already challenged this approach to entrepreneurship and had advocated for effectual logic as the underlying rationality that ought to drive entrepreneurship in the twenty-first century. This approach to entrepreneurship guides entrepreneurship education in Scandinavia, other European and US regions, and is becoming the plinth of entrepreneurship all over the world since the acceptance that entrepreneurship can be taught.

While I agree with the view that entrepreneurship can be taught, my sense is that it can actually be learnt through engaged practice. Engaged practice emphasises action, active agency and relevant-to-context theoretical knowledge. However,

entrepreneurship courses, while they have increased substantially from around 2005 [1] and are becoming increasingly ubiquitous in higher education across the globe, have been beset by a curriculum that accentuates the teaching of business basics and entrepreneurship basics. This means that the underlying logic of entrepreneurship courses in higher education has been causal rationality, which foregrounded positivistic and post-positivistic philosophical underpinning. This philosophical outlook suggests that knowledge can be generated through careful observation of discrete set of ideas (variables) that are tested experimentally or via surveys in ways that lead to discoveries of universal laws and broad generalisations about the nature of reality. The nature of reality, under this view, is deemed to be objective and independent of human agency and action [5, 7]. Knowledge generated this way has guided entrepreneurship curricula over time and has led the focus of entrepreneurship in higher education to be on discovering markets through market analysis, business strategy and crafting of business plans as already indicated. It compelled entrepreneurs to think and resolve problems within the cause-effect logics such that examining causes that influence business outcomes became the mantra of entrepreneurs' training. The variant of this logic was that of business strategy that relied on understanding of the current market through in-depth market research and the formulation of a clear business plan with specific goals to be achieved over a 5-year period with clear timelines of expected outcomes and assigned responsibilities. This approach is increasingly becoming irrelevant in the twenty-first century with the advent of advanced technologies, internet of things, 3D printing and so on which disrupt long-term thinking, compel a different mindset and coping with uncertainties of the ever-changing markets. The traditional approach to business was thus premised on predictability and certainty of markets drawn from causal rationality. This approach is becoming increasingly obsolete in the twenty-first century as people need to ready themselves for dealing effectively with very volatile, unpredictable and uncertain markets where rapid advances in technology change market conditions very fast. A new thinking approach has become inevitable. Entrepreneurship curricula that are driven by business basics content such as market analysis, business plans, business strategy crafting, management control, cost analysis and financial statements as well as entrepreneurship basics such as meanings and processes of entrepreneurship, characteristics of entrepreneurs, types of entrepreneurs, business coaching and mentoring, opportunity discovery and exit strategies have become inadequate in this century. Around the early 2000, Sarasvathy [3] challenged the way entrepreneurs were trained and the then focus on developing entrepreneurship scholarship on "borrowed" concepts from other disciplines. Sarasvathy [3] suggested a different rationality from the one that accentuated the selection of means to achieve pre-determined goals. She advocated for the rationality that imagined possible ends based on available means and called it effectual logic [3]. In the next section, I elaborate on this effectual rationality but argue that this kind of logic, while representing a huge mindset shift in entrepreneurship, is up for disruption as society prepares for the digital age.

2.1.2 Effectual entrepreneurship

About a decade ago and in her Ph.D. study, Sarasvathy challenged the entrenched causal problem-solving approach to entrepreneurship and suggested an alternative rationality in attempting to create business value, which she called effectuation. Effectual Entrepreneurship is the decision-making heuristics that draws from extant human capability and available means (expertise, experience, existing resources and networks) to create markets (as opposed to discovering them through market research and analysis) and constantly crafting opportunities

that grow the business once it is established. It is very much premised mostly on disruptive innovations. Effectual entrepreneurship is based on effectual rationality and effectuation principles developed by Sarasvathy [3] and has since become a global phenomenon in entrepreneurship noting its presence in the US, Scandinavia, Europe and gradually in Africa. It represents a huge shift in entrepreneurship curricula in that it accentuates a different entrepreneurial mindset that illuminates opportunity crafting and market creation through using own human capabilities and the means at one's disposal, hence emphasising active human agency and action in entrepreneurship. Effectual entrepreneurship is, thus, based on a pragmatist philosophical underpinning with its emphasis on:

- knowledge generation that arises out of actions, situations and consequences in lieu of antecedent conditions that define the objectivist traditions
- practice and what works at a particular point in time and thus allowing for possibilities and continual reimagination of the business enterprise
- real problems rather than on specific methods of resolving the problem. Pragmatists opt for multiple methods and approaches to resolving problems. Pragmatist perspective does not commit to a specific nature of reality rather remains open to all forms of knowledge that can help resolve the real, practical problem
- active human agency and action in providing solutions to complex problems
- the historical, social, political and contextual nature of the problem.

Curricula that are based on effectual entrepreneurship accentuate the explicit development of risk mitigation abilities (for example, using the principle of affordable loss when crafting market opportunities), leveraging available resources, valuing innovation and creative problem-solving, learning from failure, building networks and adapting to change quite quickly [3].

2.1.3 Entrepreneurship in the digital age

Resolving complex problems has always been at the heart of entrepreneurship, and this will become even more central in the activities of entrepreneurship moving forward. What will significantly change will be the conditions, timeframes and means of resolving these problems. We are moving towards smart solutions and a society that hinges on advanced and intelligent technologies [8]. In the study of forces that will disrupt how society and business function authors, Daugherty and Wilson [9] identify 15 forces that will disrupt and shape societies over the next 5–25 years. The first of these forces entail the mindset, while the other forces relate to advanced technologies. Within the entrepreneurship field, these forces will shift the business of opportunity crafting and value creation in ways never imagined before. These shifts in mindset and technological advances compel a different thinking in terms of how entrepreneurs ought to be educated and trained. Building on Sarasvathy's emphasis on entrepreneurship mindset, the digital age entrepreneurship education and training would accentuate entrepreneurial mindset and technological savvy as the underlying curricular epistemology that drives the education and training of entrepreneurs.

While the entrepreneurial mindset curricular epistemology tended to focus on value innovation, opportunity alertness, risk mitigation, networks and resource leveraging as earlier stated [10], the entrepreneurship curriculum will be affected

and shaped by the 15 forces of disruption [7]. Paul Daugherty and James Wilson identify these forces as consisting of significant shift in mindsets and the increased role of advanced intelligent technologies as stated already. Entrepreneurship education will have to inculcate a growth-focused mindset in students, which will enable them to embrace and leverage opportunities that advanced intelligent technologies provide such as human-machine collaborations in co-creating value and creating smart human conveniences. Furthermore, it should shift business focus away from profits towards social impact of its activities so that a strong moral ethics drive the plinth of business. There will also be a strong emphasis on cybersecurity. Entrepreneurship in the digital age will renegotiate meanings and models of creative problem-solving as shall be conceptualised in ways that renegotiate relations between humans and smart machines, lead to smart innovations as well as business products, services and models that reflect the leveraging of artificial intelligence capabilities and human ingenuity. The entrepreneurship curriculum will also prepare students to feel comfortable with the uncomfortable and uncomfortable with the comfortable, thus preparing them to deal effectively with uncertainty.

2.2 Innovation in higher education

While there is the general consensus that innovation refers to the conversion of a promising idea to tangible results, the traditional meanings of innovation as disruptive and sustaining are being challenged in light of developments in artificial intelligence capabilities. There is a tendency towards understanding innovation within the framework of smart service innovation, which draws from the interconnectedness of service systems, intelligent technologies and human ingenuity to co-create value within the smart service ecosystems [11]. However, this meaning of innovation perpetuates a historical problem, that of defining innovation within the framework of Science and Technology as well as R&D. You will recall that innovation has developed distinct from entrepreneurship mainly because each evolved from different fields with entrepreneurship tracing its origins from SMEs [10]. Given that Science and Technology, R&D as well as SMEs occupy different strategic positions in higher education, which account for their fragmentation, a need has arisen to integrate innovation and entrepreneurship. First, defining entrepreneurship outside innovation makes no sense. Innovation is the intermediate stage of entrepreneurship with the foundational stage being a generated creative idea with a statistical rarity, which must be converted to tangible results during the innovation stage before being commercialised as the outcome of combined efforts of creativity, innovation and entrepreneurship. Second, the evolution of innovation from the "push" linear model towards innovation systems meant that innovation evolutionary trajectory moved from Science and Technology to national levels where all activities relating to innovation whether in private R&D, universities and governments were organised in a national systems format [12]. This approach to innovation further moved innovation away from entrepreneurship, and this strategic schism compelled me to conduct research in Scandinavia, which is quite strong on this innovation systems approach. Scandinavian countries are considered national innovation leaders, and it was particularly important to find out whether these huge strides in innovation were linked to entrepreneurship growth. As shall be shown in the findings section below, while national innovation is heavily funded by Scandinavian governments including all its activities in universities, it remains strategically alienated within universities and mostly delinked from entrepreneurship.

2.3 Towards an integrated approach

Creativity, innovation and entrepreneurship are better understood within the framework of the value creation spectrum. Creating value whether individually, collectively or collaboratively means meeting, at least, three conditions. First, whatever economic transformation that occurs from turning inputs into sellable outputs should be irreversible, that is, it cannot be restored to its original state. Once the transformed entity (product, service or business model) has been created, it has to be disruptive of existing and entrenched economic entities, that is, it has to create some levels of chaos or disorder, which makes the economic space uncertain and unpredictable. This is the state of economic entropy and represents the second condition for value creation to occur. The third condition relates to the fact that all efforts of value creation must lead to some kind of an economic entity (artefact) that is fit for purpose, that is, that meets or exceeds customer expectations and creates greater usefulness to customers (human conveniences). Competitiveness in value creation emerges from the reality that some value creation types and methods are far superior to others, and the essence of becoming competitive depends on creating economic entities that are distinct from those of your competitors and developing means of securing a kind of monopoly by ensuring that what you sell solved a unique problem or provides unique solutions to known problems. It is axiomatic that in order to create value, one has to develop unique and superior skills and processes. My sense is that the creation of uniqueness, that is, economic entities with statistical rarity begin with ideation. Ideation itself relies heavily on creative problem-solving abilities. Given that higher education institutions continue to generally marginalise creativity, the need has arisen to establish a unit that can serve as a link between faculties and the Science and Technology Parks of universities or any similar innovation hubs or units such as those responsible for technology transfers. This unit has to provide conducive conditions for the development of critical and creative thinking as well as conduct scoping reviews of existing research using credible scoping review protocols such as PRISMA-P so as to make it relevant to the value creation loop as described in this chapter.

The unit could also play an advocacy role in promoting critical and creative thinking within faculties. Armed with these initial ideas, I conducted a study that sought to better understand the current state of value creation from faculty through to IP commercialisation understood as consisting of creativity, innovation and entrepreneurship. Such value creation compels a design of an integrated approach to invigorating innovation and entrepreneurship within higher education as well as refine this approach into a model that can be implemented in the most efficient way.

3. The research study

3.1 The research design

The study was mainly qualitative in nature and targeted senior university staff that manages university units or centres on innovation and entrepreneurship. It also used the latest report on innovation competitiveness of South African universities as ways of identifying South African universities that participated in the study. A snowball sampling technique was used in the case of selecting staff from Scandinavian universities to participate in the study. I spent more than 3 months in Scandinavia for the purpose of this research, and the entire study took more than 6 months.

3.1.1 Sampling and selection

The non-probability snowballing technique was used to select research participants. I linked up with my connection at one Scandinavian university who is a Professor in the Centre for Engineering Education. We had met on a research project that involved determining the constitution and transformative potential of the Scholarship of Teaching and Learning (SoTL) in both the South African and Swedish contexts, which resulted in a book in which both of us contributed a chapter. I was appointed as a visiting researcher in the Centre for Engineering Education for 3 months. On my arrival, I met up with the Dean for Collaborations at this university who, in turn, introduced me and secured me meetings with the directors of the innovation hub, centre for entrepreneurship and a niche-focused engineering innovation hub within her university. Once the interviews with these Directors were completed, I requested them to link me up with other Directors of cognate structures spread over the Scandinavian universities. In total, 15 directors were interviewed over the course of 3 months. Eight of these directors managed innovation hubs, one director managed a niche-focused innovation hub and the rest of the directors managed centres of entrepreneurship. By means of this snowballing sampling technique, five Scandinavian universities participated in the study.

The 2017 Clarivate Analytics study of the most innovative universities in South Africa was used to select South African universities for this study. The Clarivate Analytics study focused on the partnerships that each South African university established with industry to drive innovation, the number of research outputs that were converted into innovation, patents filed and IP portfolio. The first three top universities were selected for this study. Senior managers of units of these three top innovative universities dealing with innovation, technology transfer and entrepreneurship formed part of the research participants.

3.1.2 The interviews

The study used semi-structured, qualitative interviews to elicit the views and perspectives of senior managers in innovation hubs and centres for entrepreneurship or similar units. The semi-structured interview schedules were used because key themes were identified in advance and related to better understanding:

1. The conditions under which each unit operated and how that either fostered or hindered the carrying out of the mandate of each selected unit. The key sub-themes that were identified in advance included the geographical conditions under which each unit operated, idiosyncratic circumstances under which each manager functioned and particularised situations. The main objective of this question was to better understand the institutional and national contexts under which each unit operated for subsequent juxtaposition and contrasting of how different institutional cultures serve to nurture or constrain the growth and development of innovation and entrepreneurship.

2. The degree of interactions that each unit facilitated with national or regional formations (government units, associations, private companies R&D), local communities, relevant cognate private entities such as the science park or similar formations, similar units within the higher education sector and faculties of the university within which each unit operated. The sub-themes identified were the multiple relationships each unit developed and how it contributed in the carrying out of each unit mandate, encounters that each unit had with their faculties and possible cooperation or resistance and sources of conflict if

any and formal accords (MOUs) signed. This question focused on the type of partnerships that each unit developed (triple, quadruple or n-tuple helices).

3. The activities of each unit in relation to broader goals of the university, region and national government. This question relates to purposeful intent of each senior manager of each unit as understood within institutional and national policy framework.

4. The intended outcomes or impact of each unit on the university and nationally. This question sought to find out the value propositions of each unit, that is, whether each unit is fit for purpose and return on investment.

The open-ended questions were intended to explore other themes or sub-themes that could emerge from the interviews and observations.

The interviews were conducted in the respective innovation hubs and entrepreneurship centres, which also allowed opportunities to observe the actual activities that took place at the time of visit but were contextualised for me by each interviewee. I also got to meet with aspirant innovators and budding entrepreneurs as they tackled their respective projects that were at different stages of becoming a prototype or spinout company. I was also given the opportunity to interview them on their projects, level of support from the structures and degree of confidence that each project will become a reality. I also observed pitching sessions where students shared and defended their ideas prior to their further processing in the innovation or entrepreneurship structures. Ten of the students that attended the pitching session and presented their ideas were interviewed in terms of the degree to which they believed they were properly prepared by the centre for this pitching session, the likelihood that their ideas can turn into a real business opportunity and the support they believed they would get from the centre in launching their businesses.

In South Africa, I interviewed Directors of Technology Transfer and Innovation units as well as directors responsible for entrepreneurship located mostly in business schools.

In order to do an analysis of the collected interviews data, an analytic coding mechanism was adopted as based on grounded theory specifically on the 1990 work of Corbin and Strauss [5], which identifies four master themes on analysing qualitative data as conditions, interactions, strategy/tactics, and consequences. Each of these themes were elaborated above and directed questions of this study. The data that emerged from the open-ended questions were analysed in terms of whether they broaden the scope of the already identified themes and sub-themes or whether contours of a new master theme are emerging. Each data piece got critically analysed on whether it fitted existing categories or whether it was a pointer to a new category.

3.1.3 The results and elucidation

The critical issues that came out of this exercise are:

1. That innovation and entrepreneurship in both these contexts are located in different units within the same university, resulting in the strategic discrepancy and discrete growth paths. For instance, in Scandinavian universities, innovation hubs and niche-focused innovation hubs, such as those of engineering are located in different units, have their own independent mandates, and the relationship between them is fairly informal and generally weak. In the South African context, innovation hubs have an independent existence to university business schools such that the latter tends to be considered as part of the

university core, while the former is reduced to supporting units. It is important to note that entrepreneurship is located within the university business schools in the South African context.

2. That in the case of Scandinavian universities, there is a greater push for innovation within universities driven by the government as part of its National Innovation Policy. The government fully finances the innovation hubs including paying for innovation hubs staff salaries, providing physical infrastructure and some seed funds. There are, however, a number of seed-funding units scattered all over the Scandinavian countries that provide secondary service to that of the government. Innovation hubs within South African universities are funded within the university funds and serve as supporting university units. While there are government-run innovation hubs in South Africa as well as those run by private companies, the relationship amongst them range from weak to non-existent.

3. That each of the participating Scandinavian universities had a holding company that invested in start-up companies and that the Chief Executive Officer (CEO) was often the director of the innovation hub. That university holding companies in the South African context are similarly located within the innovation hubs or units of the university.

4. That there were no direct linkages between faculties as well as the university innovation hub and entrepreneurship centre in both contexts such that a detailed value chain of entrepreneurship from faculties through to innovation hubs was not available such that faculties, Innovation Hubs and Entrepreneurship Centres functioned mostly independent of one another with generally weak interactions.

5. That staff and students accessed innovation hubs and entrepreneurship centres on a voluntary basis such that innovation and entrepreneurship remain largely on the margins of core university activities in both geographic contexts.

6. That there is no policy of integration amongst faculties, innovation hubs and entrepreneurship centres/business schools in both contexts.

7. That the infrastructure for innovation and entrepreneurship is one of the best in the world within Scandinavian universities as it is fully funded by the government. The South African university's innovation and entrepreneurship infrastructures are also quite good but could become even better with more government-focused support.

8. That both innovation and entrepreneurship do not form the plinth and core of the faculty activities in all the participating universities. There appears to be an aura of legitimacy crisis for innovation and entrepreneurship within both contexts.

9. Innovation and entrepreneurship are increasingly gaining traction within both contexts and more could be done to strategically position them within the core university activities as well as develop greater integration amongst faculty activities and those of the innovation hubs and entrepreneurship centres.

10. There is also a gradual interest on setting up innovation hubs by the private sector mostly through the corporate social responsibility vehicle, but the phenomenon is not yet ubiquitous in the South African context whereas a Science

Park appears to be the most preferred approach by Scandinavian private sector. In the Swedish context, the privately owned Science Park is located closer to the university's Centre for Entrepreneurship and has closer relationships and greater interaction between their senior managers.

There appears to be consistency between how innovation and entrepreneurship evolved within universities as discrete concepts and how they exist within Scandinavian universities. While innovation appears to have gained legitimacy traction within universities in both contexts, its position within faculties remains precarious but mostly marginalised mainly because change efforts within faculties are hampered by academic autonomy and professional identities [12–14]. There is thus a need to conduct a sociocultural study that attempts to understand these complexities, and how new ideas and concepts get integrated into the faculties mores. Based on these findings, I suggest a model that could integrate activities of faculties, innovation and entrepreneurship in such a way as to generate the least resistance, which thus substantially increases the success rate of the model. The model assumes that higher education institutions are not always malleable to changes that attempt to alter their strategic plinth and cultures of disciplines developed over the years and based on hard facts, and this is not without legitimate warrant. First, the change efforts often describe future possibilities often without adducing substantive evidence. It thus become untenable that well-established mores as undergirded by solid scientific foundations should be altered on the basis of informed conjectures. Second, future possibilities are uncertain, unpredictable and epiphantic, that is, its outcomes cannot be confirmed and guaranteed in advance. Third, there is often an ontological conflict between cultures of most disciplines and higher education visionaries (innovators and entrepreneurs). Cultures of disciplines are based mostly on the principles of generating clean, objective and universal knowledge via strict research protocols and procedures while that of visionaries rely on pragmatic considerations that focus on what practically works. To think of it, we need both in some kind of productive tension where cultures of discipline could be rid of knowledge and ideas that are at their crepuscular glow [13] and fetishistic visions could gain from scientific content. In the model that is presented in the next section, this productive tension forms the basis of the suggested model.

3.1.4 The integrated model for fostering innovation and entrepreneurship in higher education

The model consists of three key elements, which are faculty activities, activities of the innovation hubs and those of the entrepreneurship as they map out within higher education context. In terms of this model, faculty activities revolve mainly around research and curriculum, that is, on generation of new knowledge and teaching of existing, known knowledge. Faculties are assumed to be good at these two activities and have developed safety mechanisms of protecting these activities from unjustified and sometimes legitimate encroachment through asserting their academic autonomy and professional identities. In this model, these faculty activities are not encroached upon and faculties are expected to continue to do what they know best. The model, however, identifies a delink between faculties and innovation hubs as well as centres of entrepreneurship. It thus proposes that a unit be established that could serve to develop stronger links between faculties and the innovation and entrepreneurship units. The main purpose of the unit would be to provide a service to both the faculties and the innovation and entrepreneurship units. This service would be two-pronged. First, it would provide service in the area of Research Scoping Reviews using well-established Scoping Reviews Protocols

such as PRISMA-P. The purpose of the scoping reviews would be to go through huge research data that have been produced by the faculties so as to convert some of it into research data that can be useable during the ideation stage of innovation. For example, a recent study by Northwestern University Psychology researchers sifted through 1.5 million research data on personality types using advanced computational capabilities and came up with only four distinct personality types [11]. The psychiatric units are now grappling with ideas on how these findings could be used in practical situations to solve patients' problems and this could also lead to development of new psychiatric medical products and improved psychiatric services. This is an example of how scoping reviews studies could open new avenues of converting research into innovate ideas and exploration of new possibilities.

The unit could also assess the degree to which critical and creative thought are explicitly taught within faculties. Studies show that critical thinking and to a larger extent creativity are not necessarily priority skills worthy of being explicitly taught in faculties. While critical thinking is often considered to be implicit in faculty teaching, its explicit teaching based on the understanding that it is an emerging area of scholarship with its own nomenclature has not gained sufficient traction. Creativity has generally been eschewed within faculties [15] mainly because of the dominance of mimetic epistemologies that are deeply ingrained especially at undergraduate levels. The unit could thus provide two distinct services in these areas. First, it could serve as an advocacy for the explicit teaching of critical and creative thought within faculties. Second, it could explicitly teach these skills in order to prepare students for the ideation stage of innovation. Critical thinking helps students to develop the capabilities of constantly monitoring their thinking for significant problems in such thinking and attempting amelioration up to a point where students could function as practising thinkers [15]. Furthermore, critical thinking helps students to evaluate ideas for soundness and efficacy in resolving real, protracted problems which comes handy during the ideation stage. Creativity helps students to increase their capacity to generate ideas with statistical rarity which is an essential element of innovation during ideation stage. The unit could offer similar services to communities which include private and public sector companies as well as local communities. It is clear that the model attempts to integrate faculty work and innovation activities especially the ideation stage of innovation in ways that are non-confrontational which also goes for communities. This means that faculties and communities can continue with their apodictic activities as the unit could serve to evaluate, at the point of contact between the unit and faculties/communities, what needs to be done to achieve readiness for the first stage of innovation (ideation). It could be that some ideas/individuals/teams are ready for the second or even third stages of innovation (design and testing) or such ideas have not been judged for statistical rarity which means that such ideas will have to go through the ideation stage. In our case, the ideation stage is facilitated through measuring the creative abilities of individuals or teams by means of the standardised Torrance's Tests of Creative Thinking (TTCT) and the TRIZ-based creativity model is used to test the potential efficacy and statistical rarity of such ideas [16]. The TRIZ model is also used to ensure the statistical rarity of ideas and for increasing the ideas generation of individuals and teams coming from faculties and communities. This is integration at level 1 which I prefer to call *Integrate 1*. *Integrate 1* represents the most crucial point of the linkage which can inform the rest of the innovation and entrepreneurship value-chain. It is because embedded in its essence is a certain level of epistemic and mindset disruption with the potential to alter loyalties to certain ways of thinking, reasoning as well as commitment to certain ontological and epistemological positions. *Integrate 1* is about accentuation of active human agency and action [17] in lieu of commitment to certain conventional knowledge. It involves certain degrees

of disobedience and, to a point, demands higher levels of open-mindedness that allows exploration beyond known knowledge precincts and thus represents some kind of an intellectual and mindset crossover into new intellectual territories such that the familiar becomes strange. The strange can be frightening and intimidating and without some level of tutelage can become a negative energy that is inimical to innovation and entrepreneurship. Without properly handling *Integrate 1*, anxieties and resistance can be generated and could be counterproductive as it could affect the entire innovation and entrepreneurship value-chain. I thus counsel for involvement of highly trained change experts/practitioners to help individuals and teams from faculties and communities to ease into innovation and subsequently into entrepreneurship. Recent studies on faculty cultures show that academic freedom and professional identities are so strongly entrenched that attempts on changing faculty cultures could take years to yield results [12] hence *Integrate 1* is more about letting faculties continue with their work and setting up a unit to make faculty work (research and curriculum) ready and relevant to innovation efforts.

The next level of integration is between innovation hubs and centres of entrepreneurship (*Integrate 2*). Within higher education and as earlier stated, innovation and entrepreneurship assumed discrete locations and development, which resulted in a kind of a strategic schism. This was counterproductive as innovation is the lifeblood of entrepreneurship as creativity is to innovation. As stated earlier, in Scandinavian universities, innovation and entrepreneurship remain located strategically in discrete units and coordination efforts are, at best, very informal and not necessarily mutually reinforcing despite good intentions of senior managers in these units. A similar picture can be painted in South African universities. *Integrate 2* is thus about bringing greater coordination between these two entities in ways that are mutually reinforcing and could increase the value propositions of innovation and entrepreneurship within higher education. *Integrate 2* is thus about linking the design and testing processes of innovation closer to their social impact through scaling and commercialisation, which are entrepreneurship territories. When greater synergistic linkages are established between these two entities then both entities are able to share their process constraints and collectively attempt solutions. There is no point of prototyping and testing what cannot be scaled because eventually efforts of innovation and entrepreneurship are about social impact, that is, creating new or improved value propositions for society so that better human conveniences are developed.

The third level is between entrepreneurship centres and higher education holding companies. In Scandinavian universities, university holding companies are more linked to innovation hubs in lieu of entrepreneurship centres and the CEOs of these holding companies are often executive directors of innovation hubs. My sense is that the role of a holding company whose main purpose is to invest in spinout/start-up companies is mostly linked with scaling up of successful innovation outputs and inclines more within the entrepreneurship sphere; hence, it should rather be a negotiated sphere between both the innovation hubs and entrepreneurship centres so that the board of the holding company should be representative of both entities plus external stakeholders. This approach would also strengthen *Integrate 3* as there will be greater collaboration between the innovation hubs and entrepreneurship centres.

The fourth level is between all these higher education innovation and entrepreneurship activities operating as an integrated whole and the broader developmental agendas of society. The main purpose of any innovation and entrepreneurship endeavour is to make more people economically active, economically independent, lessen inequality and poverty, reduce unemployment and broaden the tax base.

The main purpose of this chapter was to share the study that sought to better understand conditions under which maximum social impact could be derived from activities of faculty, innovation hubs and entrepreneurship centres. Based on

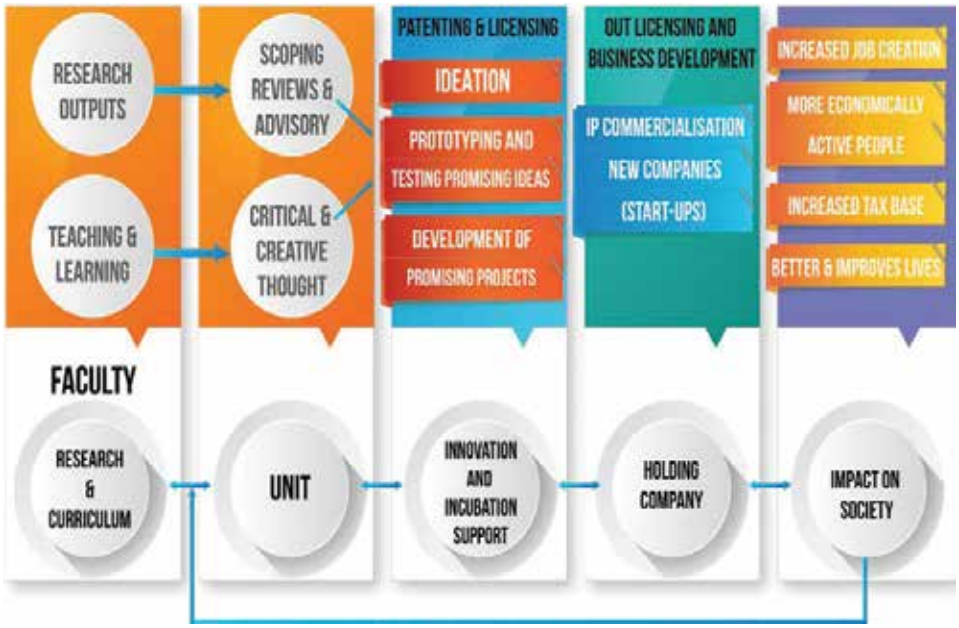

Figure 1.
The integrated model for fostering innovation and entrepreneurship in higher education.

the study of selected higher education institutions in both Scandinavia and South Africa, the emerging perspective is that of integration as holding better prospects as a pattern of evolution towards greater social impact of these higher education entities. Based on these results, I developed an integrated model of innovation and entrepreneurship that could better increase the university capabilities that could lead to greater social impact (see, **Figure 1**). The model is already shaping the policy direction of our university as the value of an integrated approach is increasingly being appreciated.

4. Areas for future direction of research

- There is a need to conduct more qualitative semi-structured interviews so that the master themes developed by Corbin and Strauss could be expanded. There are important signs that emerged in this study that point to such a possibility. These signs point to a *pattern of evolution* as a possible theme but requires further evidence.

- More research is needed with regard to academic legitimacy of both innovation and entrepreneurship and, what it will take for them to form core university activities.

- The model developed here requires further research and critical analysis.

- The epistemology that drives innovation and entrepreneurship teaching and training requires further critique and research.

- The role of government policy on innovation and entrepreneurship in relation to universities requires further systematic inquiry.

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Conflict of interest

To the best of my knowledge at the time of writing this chapter, there are no known conflict of interests.

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Higher education contributes to the development of countries and their competitiveness in a global marketplace. However, to remain relevant and meet the demands of an ever-changing world, institutions and their operations must progress in unison with the changing world in which they function. Innovation can play a critical role in transforming and advancing practice and therein address socio-economic, organizational, operational and social challenges. The complexity and scope of higher education opens up the possibilities and potential for innovations to transpire in diverse settings and contexts. This book is a collection of easy-to-follow, vignette-based innovations that have transformed or advanced practice and in doing so contributed to ensuring the relevance and value of higher education in a continuously changing world.

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