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Developing a Research Culture in the Faculty of Engineering and Information Technology at the Central University of Technology, Free State: Implications for Knowledge Management

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***Abstract*—**The 13th year of the Central University of Technology, Free State's (CUT) transition from a vocational and professional training orientation institution (i.e. a technikon) into a university with a strong research focus has neither been a smooth nor an easy one. At the heart of this transition was the need to transform the psychological faculties of academic and research staffs compliment who were accustomed to training graduates for industrial placement. The lack of a research culture that fully embraces the strong solid ethos of conducting cutting-edge research needs to be addressed. The induction and socialisation of academic staff into the development and execution of cutting-edge research also required the provision of research support and the creation of a conducive academic environment for research, both for emerging and non-research active academics. Drawing on ten cases, consisting of four heads of departments, three seasoned researchers, and three novice researchers, this study explores the challenges faced in establishing a strong research culture at the university. Furthermore, it gives an account of the extent to which the current research interventions have addressed the perceivably "missing research culture", and the implications of these interventions for knowledge management. Evidence suggests that the capability of an ideal institutional research environment, consisting of mentorship of novice researchers by seasoned researchers, balanced effort into teaching and research responsibilities, should be supported by strong research-oriented leadership. Furthermore, recruitment of research passionate staff, adoption of a salary structure that encourages the retention of excellent scholars should be matched by a coherent research incentive culture to growth research publication outputs. This is critical for building new knowledge and entrenching knowledge management founded on communities of practice and scholarly networking through the documentation and communication of research findings. The study concludes that the multiple policy documents set for the different domains of research may be creating pressure on researchers to engage research activities and increase output at the expense of research quality.

***Keywords*—**Central University of Technology, performance, publication, research culture, university.

I. INTRODUCTION

UNIVERSITIES of Technology (UoTs) are a consequence of the major reconfiguration of the higher education landscape in South Africa that has taken place since 2004. A process of transforming and restructuring South Africa's higher education institutions resulted in the merger of 36 universities and technikons into 23 universities comprising 6 comprehensive universities (arising from the merger between traditional universities and technikons), 11 traditional univeristies, and 6 UoTs (created from unmerged technikons) [1]. Given the history of technikons in South Africa, such as merging of differentiated educational systems with different research production capacities, poor track record of research output and lack of infrastructure and varying resource constraints created opportunities for former technikons with limited research productivity to develop research publication skills and assimilate the prolific research culture of research-oriented institutions. However, there has been a backlash to this reconfiguration, as some experienced staff resisted the "performative" research orientation of these reconstituted institutions. There were a number of challenges and these did not only relate to staff resistance but other issues as well such as the progression of junior academic staff to professorship and the CUT's dependence on research output few academics.

The existing conditions within the South African UoTs have had a huge impact on the research activities of these institutions. Over the past 15 to 20 years the South African UoTs have grappled with the legacy of limited financial support, dating back to the apartheid era and the dearth of a research culture [2]. Institutions have nonetheless made attempts at addressing these challenges. For instance, the CUT has introduced multiple initiatives, such as the Research and Development Plan 2014 – 2020, Scholarship of Teaching and Learning, CUT and University of Free State (UFS) Joint Research Programme, Research Entities (Centres, Units and Groups Project), the National Research Foundation (NRF)/ CUT Flagship Programme, and the Graduate Attributes Programme to advance research. These CUT initiatives are yet to overcome the dearth of a tradition of scholarly research. It was observed that some long-serving CUT academic staff members have never been part of a "research culture", which gives rise to the institution's limited research productivity [3]. Similar to other UoTs, CUT is still confronted with the challenge of the progression of junior staff to professorship, where there is a small cohort of the professoriate, comprising 16 associate professors and 11 full professors [4], the progression seems to be stalled by the lack of a strong research

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culture.

The development of a research culture is key to the success of any higher education institution. Reference [5] notes that a research culture includes the inculcation of disciplinary and interdisciplinary ideas and values, and fosters an environment where researchers can flourish as individuals within their own research capacities. A research culture also includes the excitement of academics to engage themselves in research projects [5]. Drawing from the above, one realises that the CUT research culture experience is an exceptional one. Judging from the number of full-time and permanently employed active research staff, publications in top journals in disciplinary fields and successful applications for the NRF rating of researchers, the reality at CUT is that the multiple research policies, research programmes and institutions have not sufficiently accelerated cutting-edge research at the institution.

If a research culture relates to the development of a framework in which students and their supervisors, in collaboration with stakeholders and/or funding bodies, collectively build capacity and intellectual capital [6], it can be argued that the CUT research culture has been contradictory. The number of master's and doctoral completions at the institution has almost doubled from 2010 to 2016, as 53 master's degrees were awarded in 2016, compared to 27 in 2010, and 19 doctoral degrees were awarded in 2016, compared to the six in 2010. This impressive growth is, however, marred by stunted growth in other research areas. For instance, the institution has only secured a few successful NRF grants and one South African Research Chairs Initiative (SARChI) Chair from 2010 to 2016 [7]. In addition, there has been a sluggish growth in the number of NRF rated researchers, which has only increased to seven, six and nine during 2013, 2014 and 2015 respectively [4]. The numbers of NRF rated researchers were also impacted upon by retirements, resignations and exits.

One of the most fundamental pillars of a research culture at a university is the presence of research-active academics. It is therefore vital to examine the presence and significance of this pillar at the CUT. Over the past seven years, the Faculty of Engineering and Information Technology (FEIT) at the CUT has put concerted effort into building a critical number of research-active academics through the recruitment of reputable and well-established researchers, as well as by encouraging and supporting staff to acquire higher degrees [8]. In spite of these initiatives, the CUT, similar to other UoTs, is still confronted with the challenge of building the capacity of a young generation of researchers. Furthermore, limited evidence exists of intense research collaboration between emerging academics and experienced academics. For instance, in the Faculty of Management Sciences and Humanities, where a few research-active senior academics are mentoring some postdoctoral fellows, the postdoctorate appointments only took root in 2017.

The current study sought to answer the following questions:

1. What research interventions are currently in place to advance a research culture in the FEIT at the CUT?
2. What challenges are hindering the establishment of a strong research culture in this faculty and what are their implications for knowledge management?

II. Research Background

The building of a research culture at the CUT should be drawn on the research highlights, current research interventions and the research blockages at the institution. The available data on research strides show that the CUT generated 55.02 journal credit units, 13.02 published conference proceeding units and 0.44 scientific book units in 2014, with the institution also receiving an NRF Excelleration Award for attaining the most improved research performance over recent years [9]. Moreover, the Centre for Rapid Prototyping and Manufacturing (CRPM) was established in the FEIT and launched officially by the Minister of Science and Technology, Naledi Pandor, in 2015. The NRF also awarded a South African Research Chairs Initiative (SARChI) to Prof Ihar Yadroitsau at CUT, in recognition of the phenomenal research that his team is conducting in Medical Product Development through Additive Manufacturing (AM). In 2015, three academics (two from FEIT; and one from Faculty of Management Sciences) were successful in their NRF rating applications, while five academics (four from Engineering and one from Education) were promoted from Senior Lecturer to Associate Professor, and one academic staff member from Associate Professor to Professor in Management Sciences in 2016. These research achievements are laudable and should ideally lay the foundation for a sustained institutional research culture. The reality, however, is that the CUT faces some systemic fissures that point to a constrained knowledge generation and transfer capacity. Research growth is not yielding an increase in academic and research staff participation. For instance, there is an encouraging research growth rate within the FEIT; yet this growth has neither yielded an increased participation of staff in research, nor a deepening of a research culture through the production of quality research outputs. This suggests that the professoriate should engage with all activities associated with research participation and productivity to bring emerging researchers on board. Institutional interventions, such as the establishment of new research centres, units and groups, are starting to gain broader recognition and legitimacy at the institution. These initiatives are designed to advance the research capacity and have had a limited impact in placing emerging academics at the core of the development of a research and publication culture. Since the research initiatives were only implemented in 2014, pundits claim that it is too early to expect huge research outcomes from them [7]. Nonetheless, it is uncontested that the three-year life of such initiatives has not yielded the best of results in the institution's research activities. In addition, the aforementioned 2014 research outputs represented a weighted output of 0.24 units per academic staff member [9], demonstrating a skewed distribution of research productivity and knowledge production among staff members at this university. This disproportionate publication record and limited staff

participation in research confirms the paradox evident in attempts at building a research culture at the institution. For example, knowledge production is inadvertently concentrated in the small nucleus of senior and experienced academics and in ways that exclude junior academic staff.

The existing limited research activity and production of outputs reflects negatively on the research status of the CUT. The prevalence of permanently employed academics that has not published suggests the prevalence of a "juniorisation" of research at the institution. This condition ironically arises in a context where the Department of Higher Education and Technology (DHET) has stated the need to grow the number of publication outputs to about 75% of the norm by 2020 (the current norm is 1.1 credit output unit per full-time academic staff at CUT) [10]. The current low ratio of research output to academic staff members indicates systemic institutional blockages and personal constraints in the existing knowledge transfer models at this institution. Furthermore, the potential research experience gap between the current, retiring leaders (senior researchers and professors) and emerging researchers is not only disturbing [11], [12] but also demonstrates the lack of a solid research tradition that enables intergenerational transfer of knowledge at UoTs. The UoTs were primarily designed to offer sectoral knowledge derived from specific occupational and industrial sectors, on the one hand, and specialist disciplines, on the other. As a result, the UoTs have traditionally specialized on teaching, and the conducting of applied research required by industry partners and employers [13], rather than the production of scholarly research-based knowledge, which is the domain of traditional research-intensive universities. Hence, in view of their academic institution history, the skewed knowledge production and management of UoTs cannot be taken for granted.

III. Problem Statement

The function of the faculty in higher education institutions embraces threefold roles of teaching, research and community service/engagement. University faculty members are expected to fulfil primary roles of teachers, researchers, and service-oriented professionals. The progression of junior staff to professorship at the CUT, where there is a small cohort of the professoriate, comprising 16 associate professors and 11 full professors [4], has been stalled by the lack of a strong research culture. Statistics show that out of a total employ of 276 permanent members of academic staff, there were only 9 NRF rated researchers in 2014 [4]. Furthermore, one of the discomforting features of CUT's research culture is the institution's dependence on the research output of few, prolific and experienced senior academics (mostly the ageing professoriate in their 60s). This reality shows that there is no compelling evidence of inter-generational and trans-generational transfer of research knowledge that will sustain the necessary research culture in the long term.

IV. Literature Review

A. Research Culture in Higher Education

According to [14], a research culture in higher education is shared values, beliefs and the basic assumptions that members of a university discover or develop in learning to cope with its challenges of external adaptation and internal integration, which would be appropriate to be considered valid, and therefore accepted and recognised as a valued research activity. In the context of UoTs, this would mean the transition from a strong professional and vocational orientation and teaching of specialised programmes to embracing the ethos of conceptualising, researching and documenting, and the dissemination of world-class research. This ethos is achievable through publishing in top research journals, building research capacity through successful postgraduate completions, fostering postgraduate research experience, and the establishment of a strong research mentorship of junior academics and novice researchers. Reference [15, p.4] further notes that "The research culture is the structure that gives [research behavior] significance and that allows us to understand and evaluate the research activity." A structure which fosters a strong research culture should, therefore, comprise systems, processes and practices that give rise to cutting-edge research and allow researchers to contribute significantly to their different fields of expertise.

The change from a Technikon to a UoT has called for teaching to become interwoven with research and research principles [15]. This transition necessitates the infusion of research into teaching practices to ensure that research sufficiently informs teaching methodologies and practices. Reference [15] also advocates for the intertwining of research, teaching and knowledge transfer, an approach in which research embraces the systematic generation of knowledge, the development of new ideas, and the experimentation with new techniques. Such an approach provides an intellectual platform for academics and researchers to engage in knowledge transfer in the same way teaching and learning explicates a body of ideas. Furthermore, this platform should be informed by available research and instil habits of inquiry that reflect the provisional nature of knowledge.

The cultivation of a research culture in a university is a long-term process which requires an appropriate institutional climate that takes full cognisance of strategic planning, committed leadership, and a conducive climate. While the institutional climate provides an environment in which individual research expertise can be recognised and honed, research is also considered to be an individual-driven activity [16], as it is initiated, planned and conducted by individuals or small group of researchers in universities [17]. As such, universities cannot take the research orientation of academic staff for granted. The research orientation should be integral to the recruitment and selection of academics and researchers [17] if a rich research culture is to be cultivated in the university. For this reason, the qualifications of academics and researchers should be measured by their publication records and the frequencies of publications, as these provide

reasonable proxies of applicants' inclination towards productive research [18].

The reality, that higher education is deeply embroiled in knowledge management processes, such as knowledge creation, documentation, dissemination and transfer, suggests that higher education institutions can be conceived as knowledge-creating organisations. Moreover, the fostering of a research culture cannot be insulated from the domains of teaching, research and knowledge management, since the scope and objectives of higher education are consistent with knowledge management principles (knowledge creation through research, knowledge transmission through teaching, knowledge documentation and curation through their libraries) as postulated by [19]. Therefore, the generation of scholarly research, engagement in critical inquiry, and the dissemination of research knowledge through teaching, postgraduate supervision, and library-based informational repositories, are all integral to the building of research capacity and the promotion of a research culture at UoTs.

Effective research mentorship is one of the effective ways through which a solid research culture can be established. Reference [20] argues that well-reputable researchers may instil strong research interest and productivity in mentees through their adoption of the role of mentors who critique novices' work constructively. Moreover, the fostering of working relationships between research mentors and mentees that is founded on collegiality, mutual interdependence and trust is integral to building a sustained research culture in a university [21]. Mentors should instil a sense of self-efficacy in mentees during their execution of research work, while mentees should consider the research advice of mentors, as this will ground mentees in research processes, practices and ethos critical for the establishment of seasoned researchers. Reference [22] further argues that formal and informal interaction with colleagues who have established themselves as researchers may also motivate young academics to improve their research and enrich their own research profiles. Therefore, the systematic arrangement of activities that provide opportunities to interact with renowned researchers might be useful to fostering the conduct of cutting-edge research among academics [18].

B. Critical Success Factors for the Building of a University Research Culture

Successful development and factors that build a research culture within a teaching-focused academic faculty will include the research mentorship programmes, research funding, nurturing a research climate for leading research, networks and collaboration for faculty members.

1. Research Mentorship Programmes

Research mentorship programmes encourage experienced faculty members with research skills to share their expertise with those who need assistance in developing their competence for research. Reference [23] argues that at the core of improving research capacity is the provision of a connected interactive environment that allows for individual reflection and collaborative networking of research processes between experienced and novice researchers. This argument mirrors [15, p. 6] the claim that "it is the intersection and interaction of research mentoring networks that builds and strengthens the research culture. He further elaborates that a mentorship programme has the potential to support a unit's culture of research by building departmental research capacity, fostering strong personal and professional relationships among colleagues in the context of research development, and providing recognition of a particular faculty with excellent research skills". From this it can be inferred that, while the building of a research culture can unfold top-down through the knowledge investment of seasoned researchers into emerging researchers, the implementation of mentorship requires shared intentionality and distributed leadership among a core research group comprising the heads of departments, seasoned research leaders, their research peers and students.

2. Research Funding

The provision of internal and external funding is significant to the development of a conducive research culture. Institutions can develop and maintain a culture of research by providing academic and technical support for research grant applications. Institutions can also provide more direct support to faculty researchers by allocating adequate funds to research and development, facilitate access to state-of-the-art libraries with a subscription to key local and international journals, adopt reasonable sabbatical leave policy that enables frequent and or extended research time, and facilitating access to high-quality laboratories, high specification computers to run software applications that deals with a great amount of data analysis and other facilities [24]. Reference [25] proposes special support, especially for new junior faculty, and the allocation of research start-up funding. Additionally, senior researchers can guide junior staff in grant proposal writing and prepare grant applications jointly with junior staff.

3. Nurturing a Research Climate for Leading Research

Reference [26, p. 238] identifies two mechanisms that executives could effectively utilise to enhance institutional reputation (with funders and other partners) and improve research performance. These are:

1. The revision of policies to emphasise the significance of research productivity
2. The complementation of this tacit pressure by incentives to "promote and reward strong research effort on the part of individuals and whole academic units"

Flagging the significance of research performance could take the form of emphasising the quantity (i.e. numbers per year) of research publications for emerging researchers and foregrounding both quantity and quality (impact factors of journals, citation indices such as H indices) of publications for senior academics and researchers. The performance and promotion systems can also be tied to the quality of publications, rather than just considering DHET accreditation of journals. In addition, [27, p. 281] observes that "suitable management of researchers within an ideal environment would

ensure the right combination of recognition and reward". Hence, the performance management processes and academic practice monitoring should foreground research and publication incentives as well as opportunities at the expense of sanctions and retribution, since individual academics do not respond well to relentless scrutiny and pressure.

4. Networks and Collaboration

A culture of research in higher education institution is supported by faculty interaction between novice and seasoned researchers and interdisciplinary research collaboration. Reference [28] maintains that successful researchers have a network of like-minded scholars with whom they discuss their projects. The authors further point out that this network does not have to be restricted to a given faculty member's unit or institution. Hence, the CUT and other UoTs must develop strong structures to support the development of faculty networks through activities such as:

1. Sponsoring faculty participation in scholarly conferences (both nationally and internationally).
2. Hosting national and international conferences and seminars.
3. Establishing institutional relationships with other universities, professional bodies, and government departments.

V. The Proposed Framework

"A culture of research provides a supportive context in which research is uniformly expected, discussed, produced, and valued" [24].

Reference [29] argues that developing a research culture is concerned with the dynamics of the interrelationships among three domains (see Fig. 1). For [29], *Domain 1,* the trifocal function, comprises the university faculty's task of research, teaching, and community engagement. This traditional trinity is expected to interact in different ways for each faculty member. *Domain 2,* the individual attributes and output, focuses on the role of individual determination and passion to engage in scholarly research. The strategic directions of the higher education institutions influence the level of concentration on faculty member's readiness, capacity, and experience in undertaking research in order to broaden one's knowledge horizon or to ascend the career ladder. *Domain 3,* the institutional attributes and policies, relates to the research policies and financial support for research set by the institution for the purpose of focusing on what the institution puts in place to enable research. Furthermore, each higher education institution develops policies and criteria to evaluate the extent to which a faculty member is an effective professional, productive researcher, and active university citizen. Firstly, it can be inferred that the development of a culture of research rotates around the collaboration between Domain 1 and Domain 2. Although an equal balance among the three tasks in Domain 1 would be essential, it is undeniable that the discretion of the faculty is exercised within the three trifocal functions, which is influenced by faculty members' own perception of these functions. Faculty members' output in Domain 2 is based on their knowledge and skills about scholarly research production. This also interacts with the way in which faculty members view the trifocal function, Domain 1, and the issues that they address in sustaining one's academic career and their scholarly research activities. There is, therefore, a clear interaction between Domain 1 and Domain 2 adapted from the nature and processes of educational and social inquiry by [29].

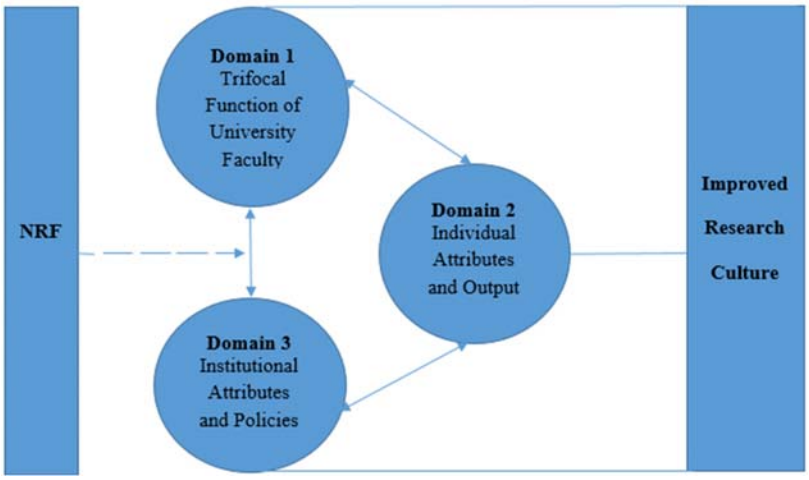

Fig. 1 Framework for Understanding Research Culture in HEIs

Secondly, a culture of research depends upon the reciprocal processes involved in the interaction between Domain 2 and Domain 3. Although the reality in Domain 2 must pave the way for the improvement or changes in Domain 3, Domain 3 influences the nature and extent of scholarly research productivity in Domain 2. Therefore, the research activities resulting from Domain 2 should generate knowledge that would provide context for Domain 3 [30].

The link between the domains leads to the construction of meanings related to research and the associated research

culture. The interaction between Domain 1 and Domain 2 constitutes a frame of meaning that will enable faculty members to fulfill their trifocal function, whereas the interaction between Domain 2 and Domain 3 produces a second frame of meaning that will be constructed by the faculty members as they view the institutional research policies and assimilate their research functions. These frames of meanings also occur in the interaction between Domain 1 and Domain 3. Finally, as indicated by the double-headed arrows, the faculty members' research knowledge and skills, and the performance of their trifocal task, should also influence the institutional policies in the same way that institutional policies affect the other two domains.

It should be noted that the NRF exerts a level of influence on policy formulation at the institutional level. However, the interpretation of NRF directives is based on the context of the institution and the frames of reference of institutional leaders. In addition, policies, mandates, and principles, as represented by the dotted line, are open to interpretation, with the interpretation being carried out in the interest of both the institution and its major players, the faculty members.

Reference [30, p. 6] maintains that the development of a research culture cannot take place overnight. It entails careful planning and a constant process of development. A university faculty would perceive time, a strong belief in the research endeavours, faculty involvement, a positive group climate, working conditions and organisational communication, a faculty development programme, research infrastructure, a decentralised research policy, research funding, and clear institutional policy for research benefit, careful planning, incentives, as well as a constant process of development as vital components of a research culture, enhancing research productivity. These components can be classified into the elements of the framework proposed in this article.

Domain 1 (Trifocal Function): The university has three globally defined mission statements: *Research* (generation of new knowledge), *Teaching* (transfer of existing knowledge), and *Community Engagement* (application of new and existing knowledge). A range of strategies is needed to encourage the full professors, full-time and part-time faculty, to spend more time on research. The strategies should address the nature of research being carried out by the faculty in order to distribute the workload. The strategies could, for instance, make provision for research assistants or junior researchers. Institutions could analyse the percentage of workloads assigned to teaching, research, and community engagement. In addition, the faculty should also strive for proper time management in order to allocate their time appropriately to cater for all three functions.

Domain 2 (Individual Attributes and Output): The benefits of conducting research may, for the individual member of the faculty, be related to reward structures within the institution. Organisations typically provide two types of rewards: extrinsic rewards, such as salary and promotions, and intrinsic rewards that are associated with the actual process of work [31]. In the case of intrinsic rewards, benefits may be associated with the satisfaction arising from completion, for example, of a research project, and the achievement of a personal goal, such as publishing a research paper. Institutions should, therefore, consider the reward structures to increase the participation of staff in research and seek measures that will reach out to those who are not participating in research at all.

Domain 3 (Institutional Attributes and Policies): The two important elements of an improved research culture, as perceived by the faculty, may be classified under Domain 3. These elements are: institutional research policies and financial support to do research**.** Research must be presented as a faculty requirement in non-intimidating ways to create a positive group climate. Research expectations should be clearly made to faculty aspirants particularly at the department level. Departmental research strategies and priorities should be broadly defined and research standards should be expressed explicitly. Research strides and successful individual research projects should be tracked and publicised to serve as motivation to every academic professional. Such initiatives could motivate the active researchers as well as those not involved in research and hence, as stated by [32], an environment of "intellectual synergy" can then be created.

Domain 3 and NRF. The component of *Research funding* involves the institution, the NRF, and the Department of Higher Education and Training (DHET). Funds are indispensable for supporting and enhancing research productivity. Financial support can be in the form of the funding of research projects and attendance of international conferences for paper presentations. Such support enhances research by demonstrating to the faculty that what they produce is valuable. Proper research linkages with external funding agencies and government departments should be pursued more actively, as few higher education institutions in the country currently have access to sufficient research funding. Moreover, the NRF should develop strategies that seek to offer research financial assistance or grants for individual and institutional research activities or projects.

Well-defined policies for research benefits and incentives also concern both the higher education institution and the NRF. The low salaries that are generally offered to active researchers in the majority of HEIs in the country necessitate the need to provide adequate incentives to enhance the research capacity of staff members and retain exceptional scholars with research potential. Institutions should strengthen research benefits and incentives to support and incentivise the development of research throughout the institution and to serve as motivational factors for engagement in research. Furthermore, a well-defined body of policies that demonstrates the relevance of research to professional advancement and growth is needed. Universities should align their graduate programmes with the thrust of developing research institutions and producing capable research graduates. Thus, early exposure to research, such as publishing academic works and presenting papers at conferences, must be provided.

VI. Research Design

The study adopted a qualitative case study design in which

10 cases were drawn upon to explore the challenges of establishing a strong research culture at the CUT, and to determine the extent to which the current research interventions have addressed the perceivably "missing research culture." The cases comprised 4 heads of departments, 3 prolific established researchers and 3 emerging researchers in the FEIT at this university. The data collection process involved an exploration of the existing research culture at the institution, and of how established and emerging researchers contribute to the development of such a culture in the FEIT at CUT.

The established researchers were selected on the basis of the institutional and demographic data which revealed that many awards and research recognitions had been bestowed to these participants. The emerging researchers were mostly staff members who had either finished their postgraduate studies recently, had just started their academic research career, or had not published much in their field of expertise. Purposive sampling was employed for the data collection processes, as the researcher targeted academics with the aforementioned qualities. It should be underscored that the established and emerging researchers were asked specific questions to gather data regarding their activities and the general research culture of the institution.

VII. Data Collection Process

A. Interviews

In depth semi-structured interviews were conducted face-to-face with each of the 10 participants. The scheduled interviews, which lasted an hour on average, were conducted in the offices of the individual researchers and heads of departments. One of the most challenging aspects of the data collection process was the delay in securing appointments for the interviews, due to the busy schedules of the participants. Nonetheless, conducting the interviews at the research participants' institutions assisted in creating a context for observing the hectic research schedules of these participants.

The main author audio recorded all interviews, using a digital audio recorder while, simultaneously making extensive handwritten notes. An interview schedule, containing a broad list of questions, was used to guide the researcher in her exploration of the role of knowledge management in promoting the research culture in the FEIT. The interview participants were asked to respond to questions regarding their perceptions of the existing research culture at CUT and their contribution to the development of such a culture in their faculty.

VIII. Data Analysis

All data were transcribed verbatim by the main author in Microsoft Word, and were sorted and scripted to identify main themes and patterns, using thematic content analysis. Thematic content analysis enables the construction of meaning from data. Reference [33] affirms that the meaning-making process involves the identification of themes/patterns, organising them into coherent categories, and identifying other themes that serve as sub-categories. Hence, four categories emerged from both the Trifocal Function and Individual Attributes and Output themes, while two categories emerged from the Institutional Attributes and Policies theme (see Table I). The broad categories included background details related to research policy interventions; views about research support and opportunities for both established and emerging researchers; opinions and experiences on research challenges; and mentoring, building capacity and research productivity.

Each interview was assigned codes, and the line-by-line coding enabled the main author to have a close study of the data and to lay the foundation for its synthesis. The completion of the coding was followed by a clustering of the codes into meaningful groups to generate themes. In some cases, overlapping groups were collapsed in order to allow for more synthesis and rigor.

IX. Ethical Consideration

Reference [34, p. 16] establishes that it is necessary for researchers to take into consideration the ethical implications of their research to mitigate negative risks, prejudices, and undesirable consequences for subjects that may arise from the conduct of their research. Therefore, researchers must do everything possible to avoid harming the research subjects. Thus, in this study the following ethical standards were adhered to:

- Participants were informed of the purpose of the study and that no financial benefit would accrue from their active participation.
- Participants were also informed of their voluntary participation in interviews and of their right to withdraw from the study without any prejudice or harm. They were also assured of their anonymity and the reporting of their views in aggregate form to protect their identities.
- Pseudonyms were used in situations where it was necessary to identify participants in relation to their utterances.
- Participants were also informed that their privacy would be guaranteed and that all gathered information would be treated as confidential.

X. Findings and Discussion

Globally, universities have three defined mission statements: *Research* (generation of new knowledge), *Teaching and Learning* (dissemination of knowledge and transfer of existing knowledge), and *Community Engagement* (application of new and existing knowledge). Although these functions are all directly related to knowledge management, for the purpose of this study the researchers focused on findings related to research as a means of generating new knowledge.

TABLE I
RESEARCH CULTURE IN THE FEIT

Themes	Categories	Transcript Data	Researchers Comments
Domain 1 **Trifocal Function of University Faculty** *Research Support and Opportunities*	Promotions	Evidence of recent academic promotions of staff members from Senior Lecturer to Associate Professor in the Department of Civil and also Electrical Engineering is a sign to show that hard work is recognised. Also the Vice-Chancellor's Academic Excellence Awards at CUT for the recognition of excellence in research, innovation, teaching and learning activities, and in curriculum development (Vincent, 10/02/2017).	Staff advancement through recognition of hard work and promotion prepares academics for the complexities of educating a new generation with advanced skills and knowledge they will need for their unknown future.
	Study support	There is a study support system at CUT for all permanent and fixed term staff to cover for tuition fee for the improvement of a qualification (Walter, 10/02/2017).	Furthering education and qualifications is critical to consolidating the research culture at CUT.
	Establishment of new research centres, units and groups	This exercise [creating research centres, units and groups] is the most important process which has been undertaken by the institution in the grouping and identification of research niche areas (Edward, 14/02/2017).	The establishment of new research centres, units and groups is directed at building a critical mass in research and optimising opportunities to grow research outputs in the FEIT.
	Cross-cutting research activities	The Dean introduced cross-cutting research that is aimed at the initiation of a research flagship for the faculty which is aimed at identifying one target with several objectives considering the current and proposed future research capacity (Alex, 9/02/2017).	Recognition of cross-cutting research activities is crucial and should be to the advantage of the researchers.
Domain 2 **Individual Attributes and Output** *Research Challenges*	Teaching workload	Too much teaching workload, so the proposal is to reduce teaching workload of an academic provided the person is active in research. (Steve, 8/02/2017).	Reducing teaching load avails additional time for academic staff to do research which will directly lead to them having a passion for research.
	Incentive Funding	This [incentive funding] is meant to be used by researchers in support of their research activities however the revised policy on pay-out for personal incentive has demoralised staff as they were used to R30 000 instead of the current R15 000 which must still be channelled to Dean's research budget (Daniel, 14/02/2017).	A small part of research incentives is now channelled to the Dean's fund. That will be used to broaden the participation base in research – especially in the Research Units. However, staff members seem to be dissatisfied with the revised policy on the paying out of incentives.
	Limited funding	Postgraduates are expected to pay tuition fee, and most of them are not working. CUT should introduce a plan of waiving the tuition fee for all full-time postgraduate students (Mandisa, 14/02/2017, and general consensus from the majority of interviewees).	Limited funding for staff and students (because of limited internal resources and low participation in external research grant applications) is a barrier.
	Recruitment	1. Work out the old buddies system by appointing research-oriented/interested individuals with research profiles who would be able to mentor the emerging researchers (Grow your own timber). Excellent recruitment, remuneration and retention strategies (Steve, 8/02/2017). 2. Recruitment of more full-time post-graduate students and post-docs, accelerate the completion of staff qualifications and appoint more senior staff (Vincent, 10/02/2017). Communications and Marketing need to drive hard for postgraduate marketing (Moses, 16/02/2017).	1. Excellent recruitment of faculty staff with a passion for research is necessary, remunerate them accordingly and put retention strategies in place to retain knowledge. 2. Recruit more full-time postgraduate students and post-doctoral fellows who are research active. The marketing of CUT postgraduate qualifications is very low. If it was properly done, this would be a good platform to recruit BTech / Hons students to enrol for Masters Degrees.
Domain 3 **Institutional Attributes and Policies** *Research Policy Interventions*	Research Policies	Research and Development Plan (2014-2020) - promoting a culture of research within the University where there is a need for CUT to be defined as a niche university – "*what the university is known for*" (Nigel, 16/02/2017).	This approach requires a vibrant research culture supported by a clear research agenda, and a balanced ratio or proportion of teaching versus research involvement.
	Financial support to do research	There are some inconsistencies regarding the provision of funding for conference attendance, DHET Grant, UFS/CUT Joint Grant Programme, NRF Block Grant, etc. (Kennedy, 14/02/2017).	Departments could be encouraged to hold an internal seminar on a quarterly basis on research proposal writing for funding purposes.

Domain 1: Trifocal Function of a University

Research is part of the trifocal function of a university. This section discusses the research domain and its emphasis on the provision of research support. Although research had not been a key priority for Technikons, UoTs have been improving their profile in the South African research and innovation landscape. A research culture forms the basis of university education. It is also the intellectual lifeblood of staff, and should offer fundamental support for teaching and a basis of support for the community [35].

A. Research Support and Opportunities

Research support and opportunities discussed in the interviews included the recognition of excellence in research and teaching through promotion, the provision of study support, the establishment of research structures, and the institution of cross-cutting research structures. The academic staff was of the view that there was a steady improvement in the provision of research support. It was also observed that, although academic staff encountered pressure, owing to the increase in the teaching loads and financial constraints, they held a positive attitude towards conducting research. These issues are elaborated in sections below.

1. Recognition of Excellence in Research and Opportunities for Promotion

Excellence in teaching and research is recognised annually through the CUT's Vice-Chancellor's Academic Excellence Awards. One interviewee, an established researcher, explained as follows: "The prizes are awarded to academics displaying

best practices in research, innovation, teaching and learning activities, and in curriculum development. A system for awarding excellent learning also exists at CUT." The CUT has also established faculty excellence awards in recognition of achievements in teaching and learning and research at the faculty level. Annually high-performing students, referred to as A-students for extraordinary performance and the achievement of distinctions in all their courses, are recognised and awarded bursaries by the Vice-Chancellor. These students are exempted from paying university fees the following year. This strategy motivates other learners to strive for excellence in their studies (interview with Vincent, 10/02/2017). The interviewee further highlighted that staff are normally recognised for excellence in research during the annual faculty prize giving ceremony, rather than for teaching. The interviewee also mentioned staff resistance against the criteria of the Vice-Chancellors' excellence award for established researchers, especially the criterion that a nominee should be an NRF rated researcher. This demotivates staff in their strive for excellence in teaching activities. It was suggested that the established researcher award should rather require that a finalist for the Vice-Chancellor's Excellence Awards has demonstrated excellence in research and innovation based on evidence and rating by NRF.

2. Study Support

There was a consensus among study participants that the CUT provides a strong system for supporting the academic study of staff members. As one head of department noted: "There is a study support system at CUT for all permanent and fixed term staff to cover for tuition fee for the improvement of a qualification" (interview with Walter, 10/02/2017). More so, staff development was conceived to assist staff in the complexities of educating a new generation with the advanced skills and knowledge needed in the future.

3. Establishment of New Research Centres, Units and Groups

Participants viewed the CUT as being at the forefront of creating research support structures. As one emerging researcher put it: "This exercise [i.e. the establishment of new research centres, units and groups] is the most important process which has been undertaken by the institution in the grouping and identification of research niche areas." (interview with Edward, 14/02/2017). The establishment of new research centres, units and groups is an institutional intervention directed at building a critical mass in research, optimising opportunities to grow research outputs, and developing a publication research culture in the FEIT. However, the extent of the success of these initiatives is yet to be fully evaluated. In fact, what remains a grey area is where to profile and record such research outputs, especially whether to categorise it as an achievement of a specific faculty or to direct it to an individual research structure. In addition, there is an increasing realisation that some structures lead by more research proactive scholars and personalities are more research proactive than others that are dormant.

4. Cross-Cutting Research Activities

Evidently the academic staff was aware of some research activities that were built into faculties. As one emerging researcher revealed: "Dean introduced cross-cutting research that is aimed at the initiation of a research flagship for the FEIT which is able at identifying one target with several objectives considering the current and proposed future research capacity" (interview with Alex, 9/02/2017). These cross-cutting research activities include the scholarship of teaching and learning and the Stars of Academe and Research (SoAR), which is critical to the mentorship of novice researchers by senior academics and seasoned researchers.

Domain 2: Individual Attributes and Output

A. Research Challenges

While the CUT has made some strides in developing a culture of research, challenges continue to linger. A number of research-related challenges hinder the conducting of cutting-edge research among academics and researchers. These challenges include teaching staff workload, limited research funds, financial publication incentives, and lack of rigorous recruitment policies and marketing. These challenges are considered in the sections below.

1. Teaching Workload of Staff

A common view among academic staff was that the heavy teaching load was a main stumbling block in the way of world-class research. As one emerging researcher highlighted: "Majority of the junior academic staff spends most of their time in teaching and does not have adequate time to conduct research or involve themselves in research related activities. Being a junior faculty staff member, it is very difficult to do research along with teaching because I have to prepare and teach three subjects in a semester with a minimum of 230 students in one subject. Along with this heavy workload, we have to attend a lot of departmental meetings for setting the timetable, allocation of subjects, invigilation of assessments and other administrative issues (Steve, 8/02/2017)." This shows how the competing teaching and administrative responsibilities undermine the scholarly research productivity of junior staff.

The above finding supports [30] observation that although academics are motivated to engage in research when provided with proper facilities and motivation from leadership and senior colleagues, they are often burdened by a lack of administrative support, such as a research-friendly environment, time and funding constraints, and unattractive rewards for research. The research participants emphasised the need for the CUT to develop a time management framework and provide teaching support to emerging academic staff. The participants also noted the need for the provision of strong internet connections to support subjects taught online, especially for Information Technology (IT) students.

Training and development opportunities are also significant. Reference [17] argues that the nature and availability of training and development opportunities for academics facilitate the promotion of competitive research practices in

universities. For example, time management training may enable academics to maintain a balance between workload (either teaching or administrative) and research activities [18]. One established researcher suggested the appointment of teaching assistants as an effective strategy for managing time: "These [strategies for effective time management] included the consistent allocation of lecturing assistants who can assist with marking of class tests, practicals and assignments" (interview with Steve, 8/02/2017). This would provide academic staff with adequate time to conduct more cutting-edge research; thus improving the research culture in the faculty.

2. Limited Research Funds

There was a general concern among interviewees that the tuition fees that CUT requires of its full-time masters and doctoral students were high and could not be afforded by many students. As one head of department indicated: "One of the proposals given was the waiving of all tuition fees for postgraduate students" (interview with Mandisa, 14/02/2017, and supported by the majority of research participants). In future, the CUT would have to improve the process, allowing for more research projects to be completed and more students to graduate from the system, without having to worry about tuition fees. Students have to be encouraged to continue their studies at postgraduate level; thus, a conducive environment for research needs to be cultivated.

3. Financial Incentives for Research Publications

From the interviews it also emerged that, although the CUT has an established research incentive system, this system leaves much to be desired. The incentives for teaching, research and innovation was perceived as favouring the institution, as it offered a reduced financial benefit to the awardee. A recipient may take one-third of the financial incentive of R30 000 payable to each of the Vice-Chancellor's Academic Excellence Award recipients per category (Category A, teaching and curriculum innovation awards; Category B, research and innovation awards; and Category C, community engagement award) as a cash benefit which is fully taxable, while the remaining two thirds is set for use in enhancing teaching, research or community engagement activities. According to the CUT policy on publication incentives [36], the payout for the incentives of the 2014 accredited publications subsidies would be R 30 000 per credit unit, with the R 30 000 allocated as follows:

- R 15 000 – for the researcher to take as a personal incentive, subject to the payout conditions of personal incentives.
- R 12 000 – for the researcher to use in support of his or her research.
- R 3000 – to be channelled to the Dean's Research and Development Fund for the development and promotion of research in a faculty.

This new disbursement system emerged as a major source of staff disgruntlement. One head of department noted that: "This departure from the incentive system where the researcher would get the entire R 30 000 to getting R15 000 was reported to be demotivating and demoralising" (interview with Daniel, 14/02/2017). Reference [23] argues that this incentive system erroneously prices research productivity at the expense of publication quality and inadvertently discourages academics from publishing high-impact journals with more rigorous peer review systems and research quality considerations. The incentive system further undermines the culture of scholarly research in that it may compromise the intergenerational transfer of seasoned research expertise to emerging scholars as the previous system, the researcher would get the entire R30 000 as compared to the current system where the researcher would get only R15 000. Nevertheless, a research culture may develop at the individual level if due consideration is given to a number of factors. These factors include (a) improving research motivation and incentives, and (b) developing the institution's endowment of research skills through recruitment of world-class researchers and or quality education and training of junior research staff and academics.

4. Recruitment and Marketing

Various observations were made with regard to recruitment. One of the established researchers pointed out that: "The shortage of suitably qualified and experienced researchers, insufficient funding and the other factors such as not getting enough full-time postgraduate students constrained the implementation of plans and strategies aimed at establishing a research culture." (interview with Moses, 16/02/2017). It is clear that recruiting faculty staff with a passion for research and remunerating them accordingly, as well as putting retention strategies in place, is likely to enhance the institution's research culture, an excellent and retained staff would attract full-time postgraduate students and post-doctoral fellows and develop them into active researchers. To this end, the CUT needs to liaise with the Communications and Marketing Office to craft a rigorous marketing strategy that will attract more students who are qualified for the masters and doctorate programmes.

Domain 3: Institutional Attributes and Policies

A. Research Policy Interventions

1. Research Policies

There was a general agreement among interviewees that the university is paying an incentive to all researchers who published research outputs as per DHET categories. The payout is based on the submission of outputs (n) to the DHET (n+1) and the subsidy received (n+2). The objective is to incentivise researchers into producing more research outputs and for the researchers to use these funds to support further research [37].

At CUT more research-building policies are available focusing on research centres, units and clusters. Reference [38] suggests that, in addition to a centralised research unit, each discipline or unit should ideally have its own research centre, which directs resources for faculty research. In

addition, [15] argues that a specialised research centre or specific research unit may be best implemented to strengthen networks and research collaborations where a culture of research has already begun to take hold, as funding for research centre may be difficult to gain for units with unproven research success. These research approaches are evident at the institution under study. The Policy on Research Centres, Units and Groups at CUT is directed at building a critical mass in research and optimising opportunities to grow research outputs. The approved Research Clusters and Programmes are identified as a meaningful vehicle to meet the research outputs of the Research and Development Plan by 2020.

Research policies have also been developed to support scholarly research at the CUT. As one senior researcher pointed out: "According to the CUT Research and Development Plan (2014-2020) developed at the end of 2013 for the purpose of promoting a culture of research within the University where there is a need for CUT to be defined as a niche university – "*what the university is known for*" (interviews with Nigel, 16/02/2017). This approach requires a vibrant research culture, supported by clear research agenda, and a balanced ratio of teaching versus research involvement.

2. Financial Support to do Research

The research participants acknowledged the significance of the financial support offered by the NRF. Financial support, in the form of free-standing research grants, the master's and doctoral awards, the grant-holder linked bursaries, and other awards are indeed made available by the NRF. One emerging researcher indicated: "These were acknowledged as resources that CUT could use to implement its strategies and plans aimed at establishing and improving a research culture" (interview with Kennedy, 14/02/2017). More so, departments should be encouraged to hold a quarterly internal seminar on research proposal writing for funding purposes with the aim of promoting the core functions of higher education institutions, i.e. research, teaching and community engagement, and to facilitate timely completion of the postgraduate studies without any concerns regarding financial obligations to be met.

The semi-structured interview data revealed that faculty members did not consider any of the aspects of research culture in their institution as strong. They deemed the impact of research, inter-institutional collaboration, institutional research strategy, financial reward system, research infrastructure, the presence of ethical policies, and the availability of research funding as present only to a moderate extent. It must be noted that about 90% of the respondents concurred that institutional strategies and plans were in place for the management and development of research-related activities, as well as for improving prospects for inter-institutional collaboration. They were also cognisant of the existence of an institutional office that handles applications for and approves research ethics concerns.

The faculty members also identified specific facets of a research culture that were present but least evident among the indicators. These were faculty publications in national conference papers and international journals, faculty awareness of available funding for research, research workshops for faculty, and focus on the different types of research. Interestingly, at the Research Culture workshop that was held at the CUT in 2014, Prof. Habib delivered a presentation on how an institution can be successful in research. He mentioned that: "to be a great university, the institution needs to take account of the national context by acting locally while thinking globally. Prof. Habib also emphasised that South African universities need to compete as a system with other systems, rather than competing with one another at the expense of developing a synergy in the national system of higher education institutions. Hence, a university can build a research culture by following the three critical building blocks: recruit good academics, provide these academics with adequate funds to carry our research, and create an enabling environment. The first can indeed be achieved through working out an effective budgeting system with the aim of creating a sustainable academic pipeline that ensures entry of new generation academics to continue the work of retiring researchers."

XI. Implications for Future Research

In light of the findings and discussion above, the growth and creation of an excellent research culture is implicated and future research should focus on the following:

1. In view of the dominance of the research culture in the FEIT in comparison to other faculties, there is a need for the expansion of practices from here to other faculties to foster an active research culture at the institutional level [10]. Therefore, future research should examine the extent to which greater incentivisation of research across various faculties will enhance an institution-wide research culture.
2. Given the heavy teaching work-load of junior academic staff and the concomitant discrepancies in support mechanisms that are availed to junior staff, unlike to senior academics, future studies should examine the volume of research outputs of these different cohorts if academic work were to be more rationalised through the use of a work-load score board.
3. The apparent recognition of mediocrity, which manifests in the CUT paying the publication fee for manuscripts accepted in predatory journals listed on DHET, has implications on high-quality publications. Future research should underscore the overall impact (i.e. in terms of social impact, social innovations, products and services) arising from the publication of applied research in leading high-impact journals.

The aforementioned strategies will contribute to developing a framework that will embrace, encourage, enhance and build a sustained, relevant and responsive research culture at the CUT.

XII. Conclusion and Recommendations

Building and enhancement of a research culture at the CUT will remain a continuous process. However, findings revealed various individual and institutional factors which may affect the research practices of academics. It was also noted that the establishment of a research culture takes time, needs careful planning and resources, and is enabled by the existence of a conducive environment [39].

It is evident from the interviews conducted that time is a major constraint in conducting research activity. Academic staff is of the view that they can undertake more research if they had fewer teaching responsibilities. The CUT is striving to decrease the "juniorisation" of its institutional research system in favour of "seniorisation" through increased academic staff participation in research outputs (primarily through the award of research grants, publications, completed postgraduate studies, and rated researchers), encouraging studies towards higher qualifications among staff [10]. The University should look seriously into the heavy teaching work-loads of those at the Junior Lecturer and Lecturer categories, as compared to the Senior Lecturer and Associate Professor categories. The rationalisation of time allocated to teaching and research ensures a more balanced consumption of time for teaching and research activities. Student assistants and teaching or lecturing assistants may also be trained to deliver some courses, ensuring that senior academic staff and researchers are availed more time to conduct research and motivating emerging researchers to engage in a research culture. Again, it is evident from the interviews conducted that a culture of research is supported by faculty interaction, peer mentoring programmes and research collaboration established through institutional relationships with other universities, professional bodies, and government entities.

It is also evident from the interviews conducted that the lack of research skills is partially the result of the legacy of an education system that neither enhanced a strong research ethos nor championed the inculcation of research. Additional factors contributing to the lack of a strong research culture include the existence of a body of the CUT's long-serving academic staff who emerged from the former technikon tradition where teaching was prized over research; the inability to transform the "technikon mindset" through failure to establish strong research institutions (e.g. centres and units of excellence); the non-entrenchment of scholarly research ethos, values and tradition through elevating research into a central pillar of university businesses; and the non-inclusion, in some Engineering programmes at the CUT, of research as a subject in the undergraduate (BTech) curriculum. Hence, the need for the integration and teaching of research methodology and the conducting of research at all levels of the academic ladder to ensure that students assimilate and deepen the culture of research early in their academic careers is urgent. The practical application of research through student development of research projects, mini-theses, dissertations, posters, conference papers, and articles at all levels will entrench a research culture for both students and academics. Finally, the consistent enforcement of the CUT policy requiring masters and doctoral students to (co)-publish from their theses before their thesis examination, will also increase research outputs and strengthen the research culture at this institution.

The interview respondents further noted the prevalence of departmental silos where research continued to be discipline-based and opportunities for inter-, trans-, and cross-disciplinary research was neither tolerated nor exploited fully, thus leading the compromised development of a research culture. The development of inter-departmental knowledge sharing platforms at the CUT and facilitation of cross-faculty and inter-departmental research as the basis for funding research can contribute to the development of a research culture. In addition, the absence of well-equipped laboratories in some academic programmes, a high volume of part-time postgraduate students, and the existence of a small critical mass of academic staff, contribute to limited participation in research activities (workshops, seminars and conferences) that are aimed at sharing research experiences, best practices, innovations, models, theories and strategies that address issues and challenges related to research and guidelines for ethical and integrity challenges in faculties.

The findings from the interviews also suggest that the CUT should provide proper incentives to faculty members who engage in research activities. These incentives may include, but are not limited to financial monetary reward, and the provision of equipment, supplies and materials, as well as other research support with the aim of motivating researchers (both staff and postgraduate students). The CUT aspires to foster an institutional culture that focuses on the needs of South Africa and supports graduates with skills and competencies in appropriate technologies. However, the current situation, which is characterised by hinderences such as an extremely slow internet connectivity, will make the institutional objective impossible to achieve.

Other strategies to improve the research culture may involve exposing the staff and students to various publishing and research opportunities available in the field of Engineering and IT. Furthermore, the faculty could consider the establishment of postgraduate support groups and encourage staff to train postgraduate students on how to write proposals for funding. Moreover, the CUT needs to establish a postgraduate alumni system that contributes to substantial financial commitments, focusing on the enhancement of postgraduate studies. Such a system would decrease the institution's dependence on government funding.

A research culture may be fostered at the level of the institution through cohesive research actions and the implementation of institutional practices that make research more accessible (an "enabling" environment). This involves: (a) sharing expertise and knowledge, (b) having a research direction, niche or strategy, (c) creating institutional support, including commitment at the top level, and (d) the provision of research facilities and resources. The CUT Research and Development Office would need to liaise with the Communications and Marketing Unit to carry out high marketing of postgraduate programmes and attract high-quality students who can complete their studies within the

specified residency period of study. The provision of institutional repositories with the distinct areas of specialisation and knowledge differentiation of academic staff and supervisors will also make the CUT the university of choice for prospective students and will increase the visibility of research to local and international postgraduate students.

Reference [40] observes that there is a need for the CUT to be defined as a niche university – *What is the university known for?* The formation of research clusters and a multi-, inter- and trans-disciplinary approach to research is a sound strategy for defining the CUT research niche and programme mix. This will make it easier for the university to be competitive, obtain external funding and develop, attract and retain seasoned researchers. The approach to research requires collaboration and a vibrant research culture supported by clear research agenda, a balanced ratio of teaching versus research involvement, alignment with regional and continental strategic imperatives, an internationalisation of curriculum, building critical mass in research, and the financing of a research strategic plan.

Reference [28] maintains that successful researchers have a network of like-minded scholars with whom they discuss their projects. Departments must strive for quality through the establishment of such networks and affirming rules for conducting good research. Reference [28] again concludes that "when an individual faculty's research productivity is the goal, nothing substitutes for recruiting faculty staff with a passion for research and providing time for them to do research." At least one 'competent academic staff (member) in research' should be freed from invigilation duties during assessment and all departmental administration responsibilities to guide research students and conduct research activities at national and international level. Hence, [35] recommends the following to the Central University of Technology, for building a research culture: a) the continuous development of institutional research policies and agenda; b) improving Faculty/Departmental culture and working conditions; c) budgeting for research; d) supporting collaboration with and access to research professionals in other institutions; e) affirming policies and guidelines on research benefits and incentives; f) establishing research committees; and g) striving for publications that are of quality, high impact and bare relevance to the country and global standards and expectations. In fact, the evidence [10] suggests that the endowment of an ideal institutional research environment (comprising strong internet networks, persistent connectivity on and off campus), research peer mentorship, and growing publications should be matched by a consistent research incentive culture – a reality that the CUT should strive for.

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