The Potential use of an Online System to Support and Complement the Matching of Post Graduate Students to Supervisors within an Academic Institution in South Africa

Report to the
Water Research Commission

by

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EXECUTIVE SUMMARY

BACKGROUND

Postgraduate education and training post-1994 was seen as vital to close the skills gaps, a legacy of apartheid, and to produce knowledge workers that would contribute towards the building of South African society. Tertiary education was seen as the main driver of this education revolution and government set targets that talked to the number of PhD students and academic staff, more particularly from the Science, Engineering and Technology fields, that they felt could contribute positively towards bringing about the change needed.

Unfortunately, the target numbers set were not being achieved – and instead increasing high student dropouts at postgraduate level were in evidence. There were a variety of reasons posited for this, from a poor educational background through to funding challenges. In addition, it was discovered that a healthy supervisor/postgraduate relationship was central if students were to remain motivated to complete their studies and that a poor relationship contributed significantly towards student dropout.

This study explores the supervisor/postgraduate relationship, what factors need to be in place for this to be a successful relationship, and whether an Online Matching System could help improve the efficiency and effectiveness of the match thus leading to less dropout of Masters and PhD students.

AIMS

The project aims were to:

1. Determine the factors or variables that would make for an effective postgraduate/supervisor match that could lead to a sound relationship between the parties.
2. Explore the current process of matching postgraduates to supervisors, including the successes and challenges.
3. Interrogate whether an online matching system could improve the process – and contribute towards improved matching of postgraduates to supervisors.

METHODOLOGY

The research approach was qualitative with semi-structured interviews held with supervisors from one university. Focus Groups took place with nine students [at either Masters or PhD level] from a range of universities. The requirements for an effective supervisor relationship and the current challenges in the process were issues explored with both supervisors and students. Finally, IT technical and development staff were consulted to develop a model for a possible Online Matching System based on the factors and the process challenges raised. Interviews were also held with government officials to explore if any synergies existed with programmes that they are currently engaged with.

RESULTS AND DISCUSSION

THE VARIABLES

There was general agreement between supervisors and graduates on what factors were necessary for the successful matching of postgraduates to supervisors, although there was a difference of emphasis. Supervisor capacity [expertise as well as ability to provide feedback to students timeously] and interest in the research

topic were seen as key requirements for a successful relationship. While postgraduate students emphasized social support and supervisor personality as fundamental, supervisors also spoke to work experience and funding as factors requiring consideration. Ultimately, nine factors were identified: communication; supervisor skills and expertise; supervisor availability and feedback; funding; supervisor mentoring support; personality of the supervisor; working experience; demographics and qualifications. Ultimately, all these factors were considered except funding that was not be included as a criterion for funding as this would limit access.

THE PROCESS

For the university under review, while postgraduate students do register and provide all documentation online, the supervisor manually goes through all applications and makes decisions about which postgraduates to supervise. This is approved through faculty/departmental teams. Supervisors were happy with this process although they felt that this could be improved through the support of an Online System. The administrative burden of supervision as well as turnaround times were a particular bone of contention. For the postgraduate student, lack of access and information on supervisors to allow them to have greater choice over who they could work with was seen as the foremost problem they experienced.

THE ONLINE MATCHING SYSTEM MODEL

An Online Matching System Model based on the variables and addressing the challenges raised in the current matching process has been developed. The key suggestions include:

- Running an *automated match* around variables such as the number of graduates, qualifications, research interest, demographics and working experience. This would remove some of the administrative burden from supervisors and allow them to concentrate on core role and responsibility – selecting students based on research topics.
- Setting up a centralised Information Repository which contains all supervisor details and includes a Personality Matching form to address personality issues. The postgraduate student will therefore have better choice and control over the matching process. In addition, the postgraduate student will also be required to fill in the Personality Matching form of application.

CONCLUSIONS

An Online Matching System can complement the matching of postgraduate students with supervisors within an academic environment. The Online Matching System being proposed not only takes into consideration all variables for an effective match but addresses and resolves the key challenges experienced by supervisors/postgraduates who are engaging with the current system. This would allow for a more effective and efficient process, should result in more solid postgraduate/supervisory relationships, leading to fewer dropouts and more throughput of postgraduates in the system.

RECOMMENDATIONS

The proposed Online Matching System, like with all technology interventions, will need to be trialled and tested over a period to establish conclusive evidence as to whether this is an efficient and effective system. In addition, further research is needed to determine linkages and pathways between already existing systems and whether this platform could be monetized.

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ACRONYMS & ABBREVIATIONS

DHET	Department of Higher Education and Training
DSI	Department of Science
DWS	Department of Water and Sanitation
GEP	Water Graduate Employment Programme
HEIs	Higher Education Institutes
IT	Information Technology
NDP	National Development Plan
NRF	National Research Foundation
NW&SMP	National Water and Sanitation Master Plan
PhD	Doctor of Philosophy
UKZN	University of KwaZulu-Natal
UP	University of Pretoria
UNISA	University of South Africa
WEF	World Economic Forum
WRC	Water Research Commission
WSI	Working Solutions International

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1 BACKGROUND

The research issue to be explored in this study is whether an online system could be used to match potential postgraduate students with a supervisor at tertiary institutions in South Africa, and whether this platform could assist in improving efficiency and effectiveness of the postgraduate/supervisor match so as to limit dropout and non-completion of Master's and PhD students in postgraduate research studies.

Postgraduate education and training in South Africa has been considered vital in order to address the skills gaps in the country. The post-Apartheid government recognised that in order to address the country's development challenges, a new generation of knowledge workers would need to be created through a concerted focus on education and training programmes. Funding was made available for tertiary institutions in order to make this happen. However, high dropout rates and non-completion of qualifications has been seen, more particularly at postgraduate level, where research forms the core of the studies. One of the foremost reasons for why this has happened [and continues to happen] is because of the shortcomings in the postgraduate/supervisor relationship.

This study considers whether an Online Matching System could assist in improving efficiency and effectiveness of the postgraduate/supervisor match. As part of the WaterGEP, an online system was developed and used to match host/mentors to graduates seeking workplace exposure. The feasibility of using a similar tool for matching requirements for supervisors and potential postgraduate students in a South African academic environment could draw on some of the learnings from implementation of this matching system. However, factors and variables that are important for a host/mentor match for a graduate in the workplace would be different from those required for a postgraduate/supervisor match.

While Information Technology [IT] has value within any business or institution, as it can help to increase and improve system efficiency and processes, it needs to be responsive to the needs of the institution and the users of such a system. This therefore requires a thorough understanding of the variables or factors needed for the match; an understanding of how the current allocation of students to supervisors takes place, the advantages and limitations of the system, implications for the student/supervisor relationship – and finally whether an online system could improve, support or complement the current system.

This background is important as it will assist in determining whether an online system could more positively contribute to not only the process but lead to a more suitable student/supervisor match and relationship. This research study will conclude by suggesting how an Online Matching System could work in ways that could impact positively on the operational effectiveness of the student/supervisor relationship.

2 PROBLEM STATEMENT

Post-1994, tertiary education was seen as critically important in order to address and fill the skills gaps in the country. The Water and Sanitation sector was seen as no different. There was a recognition that competencies needed to be developed internal to government and throughout the sector to improve water management within South Africa – a water scarce country. The lack of water was identified in 2015 by the World Economic Forum (WEF) as being "the biggest societal and economic risk globally for the next ten years" (Cited in Water Research Commission (WRC) Report No. 2305/1/15). At this time, the WRC and other players in the Water and Sanitation sector had realised and were putting in place training and support programmes to improve the capacity in the sector. This included: supporting SMMEs in the Water R&D domain; and "capacity development to increase the use of treated effluent, decrease levels of salinity through desalination, increase rainwater harvesting and the use of groundwater" (WRC, 2015, 2).

The tertiary education sector was recognised as having an important role to play in fulfilling the skills gaps in the country. Tertiary education therefore became viewed as the main driver to meet the targets for the postgraduate educational environment, set by the National Research Foundation (NRF) namely:

- To increase the percentage of academic staff with PhDs from 43% to 75%.
- To produce more than 100 doctoral graduates per million by 2030 (current 36).
- To produce the more than 5 000 doctoral graduates per annum that SA needs (current 2 000).
- To produce an additional 100 000 PhDs.
- To aim for most of these doctorates being in Science, Engineering, and Technology (SET) – currently below 50%.
- To ensure that over 25% of university enrolments should be at postgraduate level (currently 16%).

(Department of Higher Education and Training, 2015).

However, high dropout rates and non-completion of postgraduate programmes has become common amongst South African students. This is often because students do not complete the research component of their studies (Sonn, 2016). This has an obvious impact on the number of graduates, more especially at postgraduate level that are exiting before having gained the necessary skills required by the sector.

Rosenberg et al. (2009), in their study on provision and access in relation to the environmental sector suggested a range of factors that impact participation *[and completion – my inclusion*] particularly of black students entering and exiting Master's and PHD programmes. While this study was concluded in 2009, many of the factors remain relevant today. These include:

- Poor educational background or schooling;
- Language proficiency;
- Cost of higher education and the lack of funding support;
- Little understanding of the range of courses on offer;
- Staff limitations in respect of Master's/PHD qualifications.

Nash (2021) suggests that another reason why postgraduate students do not complete their studies is because they are not adequately supported and sometimes clash with their supervisors (Nash, 2021). Many research studies have suggested that effective supervision is a key determining factor for the successful completion of a postgraduate programme and that the key to success lies in a positive relationship between the supervisor and student.

With academic staff increasingly under pressure to deliver greater numbers of graduates and postgraduate students and with this being linked to appraisal and reward systems (Stevens, 2021), a supervisor's ability to support their students adequately could be affected. The increased workload could have a negative impact on the quality of guidance and supervision. At times, there might also be a mismatch between the research interests and knowledge of the supervisor and the student, as well as their personal relationship.

The matching or allocation of supervisor to postgraduate students at programme outset therefore becomes important. Currently postgraduate students appear to be allocated to supervisors manually, sometimes through a centralised faculty, which is a time-consuming process. Sometimes matching can occur by means of interactions between students and supervisors. This can be problematic, as students are not always equipped with the necessary information on potential supervisors and vice versa. However, as Noel et al. (2021) point out, student involvement in the selection of supervisors is important to students and this needs to be considered. The value of introducing an Online Matching System to support the selection of supervisors either administratively or in facilitating the best match, bearing in mind all variables, needs to be researched.

The question that this study therefore seeks to answer is whether an Online Matching System to support student/supervisor matching is possible [or can complement the current process].

3 THE RESEARCH QUESTION AND SUB-QUESTIONS

This research will attempt to answer the following key question:

What possibilities exist for the use of an online system to support/complement the matching of potential postgraduate students with supervisors at academic institutions in South Africa?

To help answer this question, the following sub-questions will be investigated:

1. What would an effective online system need to incorporate for the effective matching of potential postgraduate students with supervisors?
2. What is the current process used to match potential postgraduate students with supervisors and what are the challenges and advantages of this process?

3. How suitable would the current online system (WaterGEP) be for matching potential postgraduate students with supervisors or providing insights into matching within an academic environment?
4. What are the best practice online IT matching models locally and internationally that support the allocation of postgraduate students to supervisors?
5. Can an online system be used to improve, support or complement the current system in order to improve efficiency and effectiveness

4 THE LITERATURE REVIEW

4.1 INTRODUCTION

In South Africa, postgraduate education has been seen as a potential catalyst for national development and poverty alleviation. The post-apartheid government recognised that in order to resolve South Africa's complex problems, education and training of South Africa's people would require a specific focus. The National Development Plan 2030 (National Planning Commission, n.d.). reflected on some of the Higher Education goals of the government, namely that with the economy becoming more knowledge intensive, people would need to be educated and trained in skills that would not only support the employment needs of the country but would create new knowledge to equip people to deal with the changing economy and to open up a range of opportunities. Post-1994, in response to government policy initiatives, universities saw not only the massification of students entering undergraduate degrees, but an increase in others pursuing postgraduate degrees. Government, in the National Development Plan 2030 (NDP 2030), emphasised the importance of education, including Higher Education.

The Water and Sanitation sector, a critical "at risk" sector, is no different. The National Water and Sanitation Master Plan [NW&SMP] acknowledges that capacity and knowledge transfer would need to be addressed in order for South Africa to secure its water future. In 2015, the Water Research Commission (WRC, 2015), after conducting a sector skills gap analysis, produced evidence of a significant skills shortage within the Department of Water and Sanitation (DWS), the Water Boards and municipalities throughout South Africa. While in the period 2010-2015, the number of Civil Engineering students had doubled [1000 to 2000], what was not clear was whether these graduates were in fact seeking job opportunities within the Water and Sanitation sector. Capacity issues broadly have remained a challenge.

The Water and Sanitation sector has also been hit with high turnover of staff resulting in a loss of skills and institutional memory over the years. The National Water and Sanitation Master Plan [NW&SMP] talks to ensuring that the right mix of skills and expertise are created so that planning, management and operational matters are developed and improved within the sector. In addition, the Master Plan recognises the need for experienced water managers to transfer their skills through mentoring young, new entrants into the field. A number of ways in which this could be done have been identified. Some of these include to:

- Define [and reinstate] career paths with defined training and on the job experience to build a knowledgeable sector of professionals.
- Develop and implement a mandatory, modular hands-on qualification for municipal water managers [technical managers] to be run over 18 months and to include aspects such as asset management, stakeholder engagement and customer relations.
- Initiate a focused research capability initiative in water sector economics to address the existing skills gaps.
- Continue to support programmes that enable the development of critical skills and exposure to emerging innovations.
- Develop high end [postgraduate] skills to ensure a future science, technology and innovation capability in South Africa.
  [Department of Water and Sanitation; National Water and Sanitation Master Plan, 2008: 46]

Governmental organisations working in the Water and Sanitation sector have been identified and have been working on addressing some of the human capacity challenges. For example, the WRC, in responding to the crisis has introduced programmes that link students to supervisors in order to gain practical experience. In addition, the Commission has worked to build the research capacity of students through funding allocations to research programmes often housed within the universities.

Universities have also become responsible for ensuring that they offer water, sanitation and related service degrees as a way to resolve some of the capacity challenges of the sectors. As outlined above, government has set broad targets for human capacity development at Master's and PHD levels – and has placed particular emphasis on ensuring throughput for Science, Engineering and Technology [SET] degrees. The challenge then becomes to ensure that students complete their undergraduate and postgraduate degrees so that they might begin to close the skills gaps in the sector. One of the key issues that prevents this happening is because of the poor matching of student and supervisor at the onset of the programme.

4.2 STUDENT/SUPERVISOR RATIOS

In the university environment, PhD student-supervisor ratios in South Africa increased from 1.3 students per supervisor to 1.9 between the years 2000 and 2007. With more funding being made available for postgraduate studies and universities being rewarded for producing doctoral graduates through the National Research Foundation (NRF) Funding Framework, there was a corresponding increase in doctoral graduates from 977 in 2004 to 1878 in 2012 (Mouton et al., 2015).

The Department of Higher Education and Training (DHET, 2018) reflected on the growth in numbers of Master's and Doctoral postgraduates from 1994-2016 across a range of fields. This study revealed that the output of Master's graduates trebled between 1994 and 2016, with the majority of graduates being in the SET fields, followed by the Humanities as reflected in Figure 1 below.

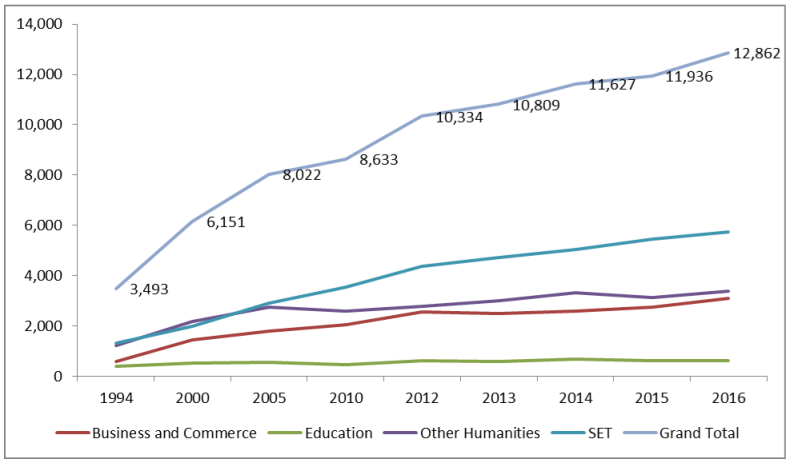


Figure 1: Source: DHET (2018, p.4). Number of Master's Graduates by field of study, 1994 to 2016

In much the same way, doctoral candidates increased from 738 in 1994 to 2797 in 2016.

Again, the highest number of these candidates were registered in the Science, Engineering and Technology field, and since 2003 through to 2016 this field has been made up 50% of doctoral candidates.

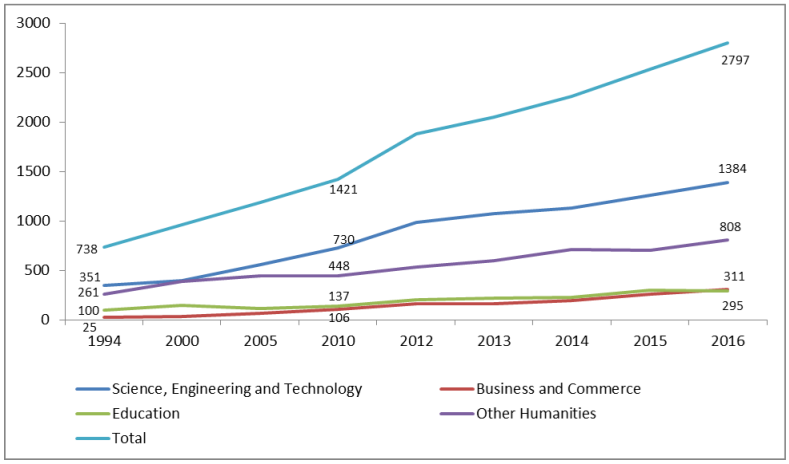


Figure 2: Source: DHET (2018, p.9). Number of Doctoral Graduates by field of study, 1994 to 2016

Despite the increases in Master's and Doctoral graduates, this has not come close to the NRF targets set to produce 5000 doctoral graduates per annum, or 100 000 PhDs.

Postgraduate academic staff numbers have also not increased at the same rate as that of students applying and entering the university system. This is evidenced in the table below which reflects the academic staff/student enrolments at the University of KwaZulu-Natal (UKZN) and the University of South Africa (Unisa). In UKZN, for example, for M-programmes, while the staff complement has dropped, student enrolments have increased by 66%. Unisa reflects a similar [although less intense] trend with the staff complement having increased by 63% and student enrolment by 85%.

Table 1: Source: Costa, K (2019; 30). Burden of supervision demonstration

INSTITUTION	QUAL/ENROL	2009	2010	2011	2012	2013	2014	2015	2016
UKZN	D-Staff	562	588	606	663	688	670	655	667
	Enrolments	1141	1173	1286	1626	2113	2453	2798	3044
	M-Staff	499	493	479	443	445	470	488	491
	Enrolments	3957	3932	4046	4418	5164	5448	5826	5991
UNISA	D-Staff	487	488	469	612	629/	690	732	834
	Enrolments	754	1024	1257	1173	1872	2100	2117	2179
	M-Staff	364	366	372	452	489	533	532	574
	Enrolments	4711	5459	5909	5254	6372	6072	5726	5500*

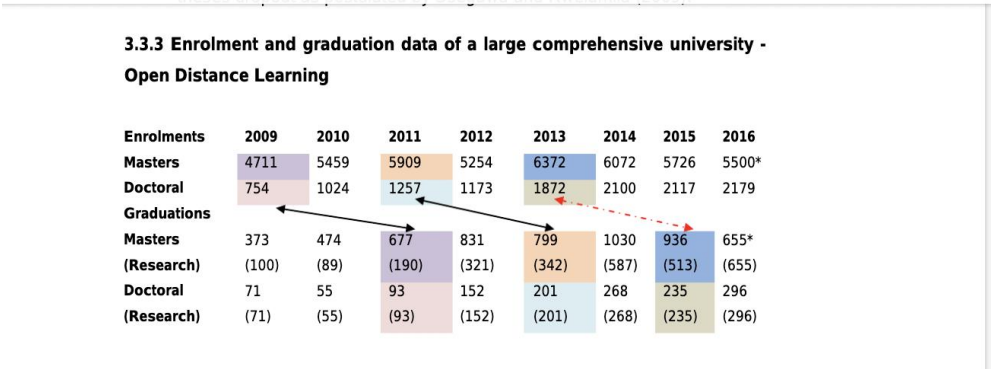
Academic staff are therefore increasingly under pressure as additional students apply and are accepted for postgraduate programmes while staffing complements do not increase at the same rate or sufficiently enough to cope with the increasing numbers. This situation is likely to be further exacerbated as the average age of an academic in 2015, was between 59 and 68 years, with many likely to retire by 2021 (NRF: 2015). Government pressure to reduce the amount of time students spend completing their university degrees has further added to the academics' burden (Manyike, 2017). The workload pressures – be this in the education, training, research or supervision of students – is therefore being felt across South African universities nationally. This will have an obvious impact on the ability or quality of delivery and needs to be carefully managed. With more experienced academic staff retiring and leaving the university, the problem is exacerbated. All these factors are important variables when considering allocation/matching of supervisor to student.

4.3 POSTGRADUATE STUDENT NEEDS FOR SUCCESSFUL COMPLETION OF DEGREE

There is a need to understand the role a supervisor plays in a postgraduate environment and what makes for an effective supervisory relationship if one is to determine what needs to be factored in when allocating/matching students to supervisors.

High dropout rates or non-completion of postgraduate programmes has become commonplace in South Africa. This is revealed in the tables below which reflect on the numbers of postgraduate students entering Master's and Doctoral research programmes at Unisa and Walter Sisulu University [WSU] versus those graduating and/or completing their programmes.

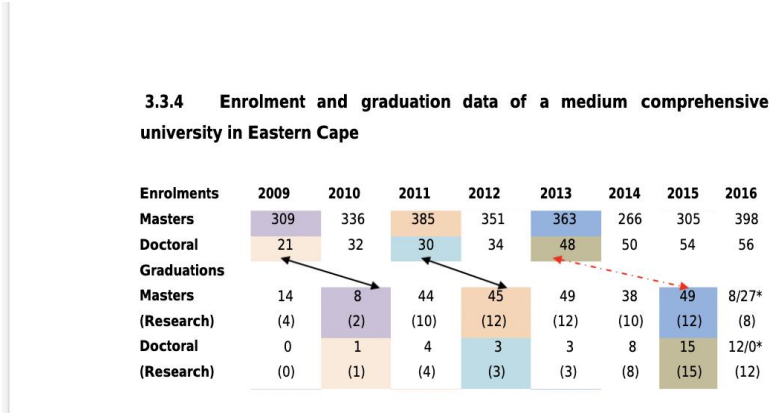
Table 2: UNISA Postgraduate Data [Date Source: CHET, compiled by King Costa]



3.3.3 Enrolment and graduation data of a large comprehensive university - Open Distance Learning

Enrolments	2009	2010	2011	2012	2013	2014	2015	2016
Masters	4711	5459	5909	5254	6372	6072	5726	5500*
Doctoral	754	1024	1257	1173	1872	2100	2117	2179
Graduations								
Masters	373	474	677	831	799	1030	936	655*
(Research)	(100)	(89)	(190)	(321)	(342)	(587)	(513)	(655)
Doctoral	71	55	93	152	201	268	235	296
(Research)	(71)	(55)	(93)	(152)	(201)	(268)	(235)	(296)

Table 3: WSU Postgraduate data [Data source; CHET, compiled by King Costa]



3.3.4 Enrolment and graduation data of a medium comprehensive university in Eastern Cape

Enrolments	2009	2010	2011	2012	2013	2014	2015	2016
Masters	309	336	385	351	363	266	305	398
Doctoral	21	32	30	34	48	50	54	56
Graduations								
Masters	14	8	44	45	49	38	49	8/27*
(Research)	(4)	(2)	(10)	(12)	(12)	(10)	(12)	(8)
Doctoral	0	1	4	3	3	8	15	12/0*
(Research)	(0)	(1)	(4)	(3)	(3)	(8)	(15)	(12)

Effective supervision has been shown to be a determining factor in the successful completion of a postgraduate programme. Many studies have suggested that the roles, abilities, personalities of the supervisors and students are key factors for determining whether a postgraduate programme is to result in a dropout or will be completed. The relationship between supervisor and student is seen as the key to this success. Sonn (2016) in a case study on Walter Sisulu University, found that while students were able to complete the coursework component of their studies, they did not have the same success when tackling the research aspect. He reasoned this was because of:

- A poor relationship between students and supervisors, including "inadequate, sporadic or unskilled supervision."
- Difficulties in formulating the problem statement, proposal writing and lack of professional writing skills.

Chireshe (2012) cited in Cekiso et al. (2019) reinforces the view that the student/supervisor relationship is central for the success of the postgraduate research programme. Chireshe suggests that due to the supervisor's workload and busy schedule, they are often not in a position to provide the support the student needs. His study revealed that in these instances students did not receive timeous feedback,

disagreements arose around what was expected from them in relation to the research project, and in some instances, supervisors seemed to have limited knowledge or expertise in their field.

As indicated in the introduction, in the past two decades, South African universities have seen an increase in the number of postgraduate students. The ratio between supervisor and the number of students requiring supervision has emerged as a problem as there has not necessarily been a corresponding increase in the number of supervisors (Mouton et al., 2015) show that *on average* a supervisor supervises four doctoral students, with some supervising more students than others. Mouton et al.' study [in Table 1 below] details the average number of PHD students that selected respondents currently supervise across a range of scientific fields. With Master's students also requiring supervision, the workload pressure increases exponentially.

Table 4: Source: Mouton et al. (2015, p. 9) Mean Number of PhD students per supervisor per field.

Field	Number of supervisors in sample	Mean number of students	Median number of students	Standard deviation	Minimum number	Maximum number
SSHA	108	4.6	4.0	3.6	0	20
EMS	18	4.3	3.5	3.6	1	16
EMICS	47	4.0	3.0	2.5	0	9
NAS	108	3.7	3.0	3.2	0	16
HS	46	3.5	2.0	3.9	0	20
Total	327	4.0	3.0	3.4	0	20

Abbreviations: ANS = Agricultural and Natural Sciences; EMICS = Engineering, Mathematical and Information and Computer Sciences; EMS = Economic and Management Sciences; HS = Health Sciences; and SSHA = Social Sciences, Humanities and Arts.

Generally speaking, supervisors in South Africa work under a great deal of pressure because of the increasing number of students they have to supervise. Ouma (2019), in exploring the challenges related to online/distance research supervision, found that supervisors are often overwhelmed by the number of students that need supervision – and as a result are unable to provide the support required. In addition, the pressure to produce more Master's and Doctoral students in a shorter space of time only compounds the pressures already faced.

Rashied & Inglesi-Lotz (2017) argue that postgraduate students research proficiency" …is not only dependent on their own knowledge and ability, but also on the knowledge, ability, and supervision capacity of their supervisors" (2017, p.1). Their study compared the ratio between supervisors and students; the age, marital status, race, and quintile level of the school graduates attended. Their study found that: 1) When considering the ratio of supervisors to students, those smaller ratios tend to have higher levels of success; 2) the level of experience of a supervisor plays a role in their ability to handle fewer or more students; and 3) supervision style is also important in determining success with some supervisors either encouraging self-directed study, while other are more hands-on in guiding their students through the research process.

Cohen, (2016) postulates that students do not complete their postgraduate studies due to: "prior academic record, the discipline (Sciences or Arts), gender, suitability of the research topic, intellectual environment of the department, and access to appropriate equipment and to computers". Within the South African context inconsistent access to computers and/or connectivity is one of the key factors

felt keenly by students that result in them feeling frustrated and in some instances, leading to them giving up on their studies. In addition, while it is obvious that academic record could impact on whether a student is able to complete their studies or not, this needs to be balanced against the suitability of the research topic for that graduate and whether the department and supervisor is able to give the student the support they need to complete their studies. A survey performed by Mouton, Boshoff & James (2015) with postgraduate supervisors in South Africa found that the chronic lack of sufficient supervisory support has also led to many PhD students entering their studies without being fully prepared academically for the type of research that they should undertake. They report that supervisors often complain that their doctoral students lack research skills, including analytical skills, and cannot write scientifically. In a context where the supervisor has limited time to coach and prepare students for the rigours of academic research, this can result in failure.

Cohen (2016) drawing on Edwards (2002) further suggests that there exist four significant problems in the postgraduate experience that might lead to dropout, namely:

- Clashes between the purposes of supervisors and students.
- Lack of support structures for students.
- Student isolation, and,
- Student confusion regarding the function of resources.

Nash (2021) picks up some of these themes and argues that graduate students might experience isolation, lack of support, and anxiety, due to inequities regarding access, which negates successful graduate studies. Nash argues that if graduate schools are serious about improving the experience of graduates, be it online or in person, they need to address issues of isolation, specifically experienced by graduates from marginalised or 'unrepresented' groups, it should "…focus on reducing the isolation of graduate students—creating a community of researchers who work together, rather than merely in competition with each other" (2021, p.3).

Cornér et al. (2018) refer to recent research findings that indicate that graduate students find it beneficial to access supervisory support from 'several and varying sources'; thus, not the traditional supervisor/graduate relationship, but instead, promoting belonging to a research community, as opposed to a singular learning relationship between supervisor and graduate. The objective, argue Cornér et al. (2018) is for the graduate to obtain 'matched support', which could be a matched supervisor, research support and social support.

Against this background, an emerging theme within the literature, is that the concept of supervision in postgraduate research could do with a re-imagining of a supervisory framework that addresses the *academic, social and mental health* needs of graduate students. Thus, the be-all and end-all of graduate support is not limited to being matched to a supervisor but understanding the "basket of needs" graduates have in relation to successfully completing their studies. This "basket of needs" would go beyond mere academic considerations and instead include a focus on resources and access to resources, support structures to assist the learning process, as well as ensuring a good fit between the supervisor/student.

This position is reinforced through students who argue that for them an effective supervisor should not only be an expert in their field but should be accessible, friendly and show empathy. Students are

looking for supervisors to be available, and to provide the moral support they need to get them through the Masters and PhD studies (Orellana, Perez & Salinas, 2016). While students recognise the importance of supervisors having competencies in research practices, processes and procedures, they present a strong argument for supervisors to also have soft-skills competencies – such as communication, active listening skills, empathy and support skills so as to offer help to students where this is required.

Students therefore generally seem to support a broad range of variables that they see would play a role in assisting them to complete their postgraduate studies. These variables range from academic considerations, through to access, social support as well as ensuring a good fit between supervisor/student. These variables would need to be considered in the matching/allocation of students to supervisors at the onset of the programme to increase the chances of successful completion. This will require an exploration of what variables could be incorporated in an online system that allows for allocation/matching of students to supervisor.

4.4 THE ROLE OF THE SUPERVISOR

The supervisor/student relationship has emerged as a key determinant as to whether there is likely to be large dropout and non-completion rates in postgraduate studies. In summary, the supervisor is expected to play several roles. Firstly, they must be able to: provide advice; enable the postgraduate student to plan, design research methods, collect data ethically, analyse this data through appropriate data analysis methods; and produce research findings (Manderson et al., 2017; Ul-Hadi & Muhammad, 2017). This view was originally suggested in a Brown and Atkins (1988) study where they suggested that supervisors need to not only be competent researchers but should also be able to analyse findings, suggest effective techniques and recommend methods when providing supervisory advice.

Since then many researchers have included additional skills requirements. Ungadi (2021), while reinforcing the advisory role, argues that supervisors need to cultivate professional relationships as well as be available to assist when students are faced with personal and general problems. This dual role is reinforced to some extent when referring to Cullen et al. [1994] as cited in Orellana et al. (2016). They suggested four indicators for effective supervision, namely:

1. Skill in direction and leadership, for example, arranging regular meetings; encouraging original ideas from students; and promoting social interaction and networking.
2. Scientific competence, or knowledge of and familiarity with the literature.
3. A positive attitude including being supportive, open and friendly.
4. The ability to be a creative, flexible thinker, who is publishing and working on their own research and who participates in searches for funding.

Generally speaking, for a mutually beneficial relationship between the supervisor and the student, the interaction needs to take into consideration not only the needs and the particular circumstances of the student, but also the skills, knowledge, role and availability of the supervisor. Not every relationship will be perfect though. There is a need therefore to be able to communicate, negotiate and compromise in order to build on the relationship.

4.5 EXTERNAL FACTORS AFFECTING POSTGRADUATE STUDY IN SOUTH AFRICA

Research conducted in Finland and Denmark by Cornér et al. (2015) shows that where postgraduate studies are free [e.g. Finland], the output of postgraduates particularly at PhD level is higher than the world average. Thus, socio-economic conditions within which online learning is executed, plays a determining role in how graduate students can indeed participate and complete their studies. Cornér et al. (2015) furthermore argue that equality of opportunity and social support are important determinants to successful graduate studies.

Over the years, South African universities have seen an an increase in the number of postgraduate students, more particularly from previously disadvantaged backgrounds, applying for Master's and PhD studies. This increase is linked to the post-apartheid dispensation where targets have been set to improve postgraduate student output – for example, the National Development Plan of South Africa has set targets for 70% for all academic staff to have obtained PhD qualifications compared to existing 40% by 2030. The Department of Higher Education (DHET, 2015) set as a target to produce 7000 PhD graduates by end of 2019.

With the increase in postgraduate students has come an increase in the availability of funding. Funding is now available from the South African National Student Assistance Fund, and the South African Research Funding. The National Research Fund has further set up grants worth R11 million to boost PhD production (Moodie, 2020). However, this funding is simply not enough to cater for all postgraduate students and their needs. For example, the National Research Foundation [NRF] that is mainly responsible for funding postgraduate students at Honours, Master's and PhD level report that in 2015-16 they provided R815 million in financial support. On average this would allow R6330 for the 128 747 full time students in South African universities studies – a huge shortfall (Phakeng, 2017).

The situation with regard to postgraduate funding has worsened over the past few years. Professor Nelwamondo, CEO of the National Research Foundation, has spoken of a dire funding shortage for postgraduate study in South Africa – and how budgets have been slashed – in this instance to R763 million in 2021. This has meant that of the 6524 Honours applications received, 2698 (41%) were funded. With regard to extensions for the completion of Master's degrees, of 1 555 applications, 848 (54%) were approved. At doctoral level, 239 (67%) of the 356 applications received were approved [https://www.usaf.ac.za/underfunding-is-a-threat-to-postgraduate-studies/].

The flip side of this problem is that even with limited funding, the increase of postgraduate students has led to a need for increased supervision. As indicated in section 4.2, many universities do not have enough supervisors available to match the supervisor-student ratio. This results in supervisors having too many postgraduate students to supervise, with too little time to provide timeous feedback, leading to delays in research implementation.

Within the South African context, the supervisor has a number of additional challenges that relate to the post-apartheid context in which the student/supervisor find themselves. These require addressing as a way to reduce the student dropout rates that remain extremely high. These include:

- Cultural issues [which can impact on different expectations and approaches]: There is unequal demographic representation of existing staff at universities in South Africa due to the apartheid

legacy. Cultural dissonance might arise in the supervisor/student relationship which will require a sensitivity in approach.

- Language: All universities use English as the medium of instruction. Many students still battle as English is not their home language. Students facing these difficulties require additional support to enable them to complete their postgraduate studies.
- Research skills: Due to in some instances poor academic rigour in undergraduate studies, students can enter postgraduate studies with limited or no research skills. Again, students facing these difficulties require additional support from supervisors to complete their postgraduate studies, particularly where research papers or theses are required.

4.6 CONCLUSION

The key to achieving a suitable student/supervisor matching is to assess certain key factors from both supervisors' and students' perspectives.

There have been a number of variables that have been identified from the literature, that if addressed and resolved will improve the supervisor/student experience of postgraduate studies which will hopefully translate into a decrease in the dropout rate. These variables consider the supervisor and students challenges and needs and include those indicated in Table 5 below:

Table 5: Variables to consider for both the supervisors' and students' challenges and needs.

Student	Supervisor
• Academic [Appropriate qualifications] and academic record	• Academic competency [Qualifications]
• Regular supervisory support and feedback	• Skills, knowledge and positive attitude
• Suitability and interest in the research topic	• Interest and good knowledge of the research topic
• Appropriate equipment and resources [computers, networks]	• Soft skills and empathetic training [Including communication; negotiation]
• Support structures [to overcome isolation]	• Manageable workload [includes no. of postgraduates allocated to supervisor]
• Funding	• Supervisory/mentoring experience/qualities [e.g. to provide timely and well thought through feedback]
• Language proficiency	• Knowledgeable of universities policies and procedures
• Cultural alignment	• Access to additional professional networks
• Research proficiency	• Supervisory experience

Based on this literature review, the following need to be investigated. Firstly, the successful matching or allocation of supervisors to students needs to take all of these variables into account. This research proposes an investigation into the possibilities of using an online system to match students to

supervisors. This will require an investigation into which variables an online platform could accommodate, and what others might need a more traditional approach for postgraduate placements. Local and international best practice models that currently exist will need to be considered. Finally, an analysis of the current WaterGEP online system will need to be carried out to ascertain whether this system could be replicated/extended to support student/supervisor matching, or what learnings there could be from development of this system.

5 MATCHING/ALLOCATION PROCESSES FOR STUDENTS AND SUPERVISORS

Traditional methods are still very much employed in supervisors/student allocation locally and internationally. These traditional methods see graduates approaching supervisors that they already have contact with [or vice versa].

The University of Pretoria (UP), in publishing guidelines for postgraduate studies, has introduced a series of steps that not only outline the process but drawing on James and Baldwin (1999), articulate the principles and requirements for effective supervisory practices.

These steps are reflected in the diagram below.

Source: https://www.up.ac.za/media/shared/Legacy/HS%20Res%20Office/guidelines_pg-students-supervision.zp37754.pdf

In the *Foundations Phase* students apply for the programme, select and get supervisors assigned to them, work on, and get approval for their research proposal. The UP guidelines suggest that this phase is important for:

- Ensuring the partnership is right for the project
- Getting to know students and carefully assessing their needs
- Establishing reasonable and agreed upon expectations
- Working with students to establish a strong conceptual structure and research plan.

It is in the *Foundations Phase* that student/supervisor matching takes place. The University of Pretoria requires that students are assigned a supervisor on enrolment. The student is able to either directly approach a supervisor and/or be assigned a supervisor. In fact, the university sees that it is important for the student to discuss supervision with the Head of Department and prospective supervisors before admission into the programme. The guidelines established in this *Foundations Phase* can also be viewed positively as they recognise the need for a strong relationship to be established between the supervisor and student that factors in the needs and expectation of the student – but also ensures both supervisor and student buy-in for the project.

A similar postgraduate application process is followed at Wits University. Postgraduate students are required to fill in an online application form. For postgraduate studies, there are a number of additional documents that are attached as part of this application [this does not necessarily apply across all faculties]. For the Wits School of Governance, these include:

- A brief letter of motivation
- A curriculum vitae, detailing the student's degrees, employment experience and any publications
- A 2000 word outline of the proposed research
- Official transcripts of qualifications showing degree, courses and results
- A students' graduation certificates;
- IELTS Language Proficiency scores (if required).

As part of the application process, students also need to be in touch with the School and Head of Department to determine which supervisors are available and to ensure that a match is made. Before admission has been finalised therefore, the student will already have secured a supervisor and have started working on their proposed research. While the traditional method of allocation is used, Wits has requested that in addition to the standard documentation, students motivate why they would like to be admitted for a postgraduate degree. Language proficiency is also considered. Both these factors are important when deciding and working on the allocation/matching of postgraduates with supervisors.

In both instances [UP and Wits University] students are allocated to supervisors for their projects by means of a centralized faculty or school head or by means of interactions between students and staff members. These processes are carried out manually. Those academic staff that are decision makers have to take into consideration the preferences of both students and supervisors with respect to the project, as well as consider the workload (in terms of supervision) for each supervisor. This situation can result in an extremely time consuming process.

When students are directly involved and approach supervisors seeking agreement for supervision, this can be positive in that both the supervisor and student might have a better sense of each other – their academic strengths and shared interests, whether they relate well to each other and other important factors. On the other hand this might lead to bias, not the correct fit and could result in the exclusion of other potential students from the experience.

At times, some students might also not be familiar with faculty lecturers and their area of expertise and might only be exposed to those who have taught them. This might affect who they select which could result in them being allocated projects that do not necessarily align with their interests. Students should have as much information on potential supervisors and their area of expertise if they are to make the correct choice. This then presents a strong case for investigating the use of an online system that makes that information accessible to students equally.

The massification of education is another reason why universities and other research institutions have explored the use of online platforms for supervisor/student matching. Allocating students to supervisors is a time-consuming and complex process. For example, in instances where 500 graduates would be applying for Master's/Postgraduate studies, there are many institutions who simply do not have the time or administrative capacity to be sifting, matching and placing students.

The University of Pretoria in outlining the *Momentum* and *Final Stages* that form part of its supervisory process, respond to some of the issues raised as reasons for dropout. This includes arguing for regular contact and feedback mechanisms as well as including students in departmental activities to avoid isolation and burn out. In the *Final Stages* of the process, this includes the careful monitoring, final production and presentation of the research. While this aspect of the process, does not necessarily refer directly to supervisor matching/allocation, failure to include these as part of the supervisory process impacts dropout. Manual handling of these aspects can be administratively intensive and time consuming and an Online Matching System that factors in and improves on this part of the process could add value within a university environment.

5.1 SUMMARY

Current supervisor matching with postgraduate students happens manually at most universities throughout South Africa. In addition, this matching is encouraged as part of the application process. While a range of factors are considered in the student/supervisory match, these do not necessarily encapsulate all the variables that were discussed when considering an effective and efficient supervisor/student relationship that would contribute to the reduction in student dropout.

6 CURRENT ONLINE MATCHING/ALLOCATION SYSTEMS

Universities/institutions have already begun exploring using Information Technology to aid supervisor/student matching. Sanchez-Anguix et al. (2019) have introduced a tool that works by matching the preferences of both students and supervisors with regards to research topics, while further ensuring that supervisors receive only the required quota of graduates so that their workload balance is maintained.

This tool is based on an algorithm with the following characteristics:

- It operates off a centralised decision making system where the users provide all the information that is needed to assist the process.
- Numerics are built into the system to ensure that supervisors are assigned students evenly so as to not overload supervisors.

- Student/Supervisor preferences are ranked against keywords from most to least preferred. These key words are selected from the body of knowledge.

Sanchez-Anguix et al. (2019) report that this tool has been used internationally [at Coventry University] with positive feedback [although this is not detailed in the research paper].

Hussain et al. (2019) reinforce the view that universities with a large number of students are most likely to use some form of computer algorithms for matching and allocating graduates to supervisors. These algorithms might differ between universities based on different inputs or constraints that each has. However, what is noted is that across these institutions, there is some commonality around project allocation methods which then informs the algorithms selected. For example, many international higher education institutions [HEIs] allocate projects based on selections by students around project titles. The Department of Civil Engineering at the National University of Singapore [NUS], for example, has proposed an algorithm that best matches the student preference for a project to not only their eligibility but subject to the constraints too, namely whether this be in student ranking of preference, and/or available project space. And for the Transnational Engineering Education project that runs as a joint programme between the Glasgow College and the University of Electronic Science and Technology of China, potential projects are uploaded to a specifically designed project database which students have access to and where they are called upon to rank their preferences. Once this is done, this "preference" list is used as an input into matching under a preference algorithm. This algorithm takes into account not only preferences but includes conditions around the number of projects a supervisor is able to take on, the number of students that are required to work on a project – and how a split is made between the workload of the different colleges or universities involved.

The Engineering Institute of Technology [EIT] in Perth Australia further explored and adopted an automated process for a supervisor/student match so as to assist the processing of a large number of students over a short timeframe. Supervisors' capacity, availability, experience and knowledge were factored into the system. This required the quantifying of the supervisor selection criteria and the translation of this into a decision tree which through developing a set of yes/no/possible responses in relation to the criteria would assist with the elimination of supervisor candidates until the most suitable match would be identified.

The SciPRO system [used at the Department of Computer and Systems Sciences[DSV] at Stockholm University [SU] helps match supervisors with students based on research proposals that reflect the student's interest. Supervisors pick a research idea from a student based on their interest. Similarly, a student can indicate an interest in a research topic proposed by a supervisor. This system was developed to support students, particularly in instances where they were struggling to find a supervisor which resulted in the delaying of the start of the research project.

The SciPRO system was built not only to support supervisory/matching processes but to assist and support the entire supervisory process from foundation through to completion of the final research report. This system was created to assist more particularly with streamlining administrative functions, for example, around arranging meetings with supervisors, engaging in ongoing communication, planning for a student's thesis defence, and addressing common issues to a number of students

simultaneously. In addition, the SciPRO system was seen as critical for information sharing around topics and papers that students might have difficulty getting access to.

6.1 CONCLUSION

Generally speaking, these online matching platforms seem to mainly factor in supervisor workload, capacity and availability as well as project titles and research interests as key variables. In one instance [EIT Australia], detailed guidance for less knowledgeable students was factored in – but this was quantified in terms of the experience of the supervisors with the belief being that the less experienced supervisor is likely to spend more time guiding the student.

Additional variables that have been highlighted as the basis for successful supervisor/student matching have not been incorporated. In addition to this, information technology is used to support the entire supervisory process – contributing to the reduction of the administrative burden – and assisting with the centralisation of documentation that supports the supervisory process.

7 THE WATER GRADUATE EMPLOYMENT PROGRAMME SYSTEM (WATERGEP)

The Water Graduate Employment Programme [WaterGEP] introduced an online matching service for graduates with project hosts. The Water GEP online system, with matching capabilities, was set up and tested as part of Phase 2 of the WaterGEP. The Water GEP System (The System) operates in the same way a recruitment system operates where jobseekers (The applicants) and the recruiters (The hosts) register themselves onto the system and upload the required documents. The host profiles the role they have available within their organisation and the system then uses analytics to match applicants to these roles and provides that list to the host to do final selection and onboarding.

The WaterGEP online system was conceptualised as a system that could improve the efficiency of the programme for three key reasons:

1. Matching could be done online by graduates/hosts allowing for limited intervention from a third party in terms of selection or choice based on qualifications and geographic location.
2. Project reporting in terms of who is in the system and their demographics would be accessible.
3. Monthly project reporting by graduates would be done online, eliminating the need for email processing that was often cumbersome and open to human error.

The WaterGEP online system has not been without its problems though – and over time glitches have been addressed so that developers could adjust the system to ensure the smooth running of the programme. With support from the WSI Technical Team, the system's efficiency has improved and the end-user adoption, although still low, has increased by 14% since inception. Those that are however, using the online system, have indicated that this has improved – or has the potential to improve – efficiency and efficacy for this project.

With the online system having been developed to support the matching and placement of hosts to graduates, consideration was given to whether this platform could be replicated or extended to support the matching of postgraduate students to supervisors. With variables differing between the

programmes, this is not possible. This study reflects on how the insights gained from the WaterGEP System can be used to determine the feasibility of a parallel platform that matches postgraduate students with a research supervisor in an academic environment. A research study such as this needs to consider the similarities and differences between what is required in terms of an online system that matches hosts with postgraduates within a workplace exposure context, and students with supervisors in an academic environment. Consideration needs to be given to what additional requirements need to be taken into account to ensure that this matching and allocation service is effective – and that all requirements are taken into account when determining a model so that the supervisor/student relationship results in the desired outcomes – with limited dropout from programmes.

8 THE RESEARCH METHODOLOGY

The research approach adopted for this study was qualitative to allow for full exploration of the topic under review. While initially there was consideration of a Case Study approach as there was a belief that supervisor/student allocations happen fairly uniformly across academic institutions and results could be extrapolated across a range of institutions, this was not possible due to time limitations. While supervisors who participated in this study all come from the same institution, students who agreed to be interviewed come from a range of institutions. Results have, however been fairly consistent.

All interviews and focus groups were conducted and recorded via Microsoft Teams. These interviews have since been transcribed.

8.1 DATA GATHERING TECHNIQUES

Semi structured interviews were conducted with:

8.1.1 Supervisors

Four supervisors from one academic institution were interviewed separately. This was to establish the requirements for an effective supervisor/student relationship, and to explore current allocation systems. Two of these supervisors had worked at a senior level within their departments, having served on committees or having decision-making power over students being accepted into postgraduate studies.

Supervisor 1	Lecturer [Supervising Masters students]
Supervisor 2	Associate Professor [Supervising PhD and Masters Students]
Supervisor 3	Lecturer [Supervising Masters students]
Supervisor 4	Professor [Supervising PhD and Masters Students]

8.1.2 Graduates – Focus Groups and interview

Nine graduates in total were interviewed to solicit the student's views on the requirements for an effective supervisor/student relationship and to explore current supervisor allocation systems. Six of these postgraduate students had either studied for were studying for their PhDs degrees, with three at Masters level. While one postgraduate was interviewed individually, the remainder of postgraduates were split into two focus groups.

8.1.2.1 Focus Group 1[FG1]

This Focus Group was made up of six graduates from a range of institutions that had either studied or were still studying towards their PhD or Master's degrees. Initially, a survey questionnaire (See Appendix A) was made available to the FG1 respondents to complete – and this was followed up with a focus group to probe responses. These six students were drawn from the following institutions and were studying at the following levels:

Graduate 1:	University of Johannesburg	Masters
Graduate 2:	University of Venda	Masters
Graduate 3:	University of Fort Hare	Masters
Graduate 4:	North West University	PhD
Graduate 5:	University of KZN	PhD
Graduate 6:	University of Limpopo	PhD

8.1.2.2 Focus Group 2 [FG2]

This Focus Group included two students that were currently studying at PhD level and were based at the same institution.

Graduate 7	UNISA	PhD
Graduate 8	UNISA	PhD

8.1.2.3 Interview

One postgraduate student was interviewed individually [Graduate 9].

8.1.3 Programmes support staff

Three respondents from two institutions were interviewed to explore the programmes that their organisations are currently engaged in, especially in respect of PhD and Masters students. In addition to providing an overview of these programmes, synergies in respect of IT and networking systems were to be explored with a view to establishing linkages and value-adds.

8.1.3.1 Water Research Commission [WRC 1] Programme Manager

The Water Research, Development and Innovation Roadmap Programme Co-ordinator was interviewed. This Manager has been responsible for co-ordination of the Water RDI Roadmap which is grounded on three pillars: Human Capital Development, Research and Development as well as

Innovation. The RDI Roadmap has a core focus on high end skills development particularly for PhD and Masters students in the water sector. Funding is made available to institutions that include Masters and PhD students as part of project teams. The RDI process has required extensive interaction with university institutions and potential supervisors, data that will be used to enrich this research report.

8.1.3.2 Two Department of Science and Innovation [DSI]staff members: High End Skills – 2 staff members [DSI 1, DSI 2]

The interview was to focus on research undertaken by the Department on postgraduate students [mainly tracer studies from education into employment] and funding support available for PhD and Masters students that are managed by agencies located within the Department. ICT systems were to be interrogated and explored for possible linkages.

8.1.4 IT Technical Support staff

8.1.4.1 An IT developer [WSI 1]:

WSI was tasked to develop a model for a possible Online Matching System based on consideration of the current processes and the key variables required to support effective matching and allocation of supervisor to student.

8.1.4.2 A WaterGEP technical staff member

WSi 2 was tasked to advise on advantages, limitations and learnings based on the current WaterGEP online system.

8.2 THEMATIC EVIDENCE

A thematic analysis was used to identify patterns emerging in the data. This was done after transcription of the interviews. These themes were congregated around the research questions that the study set out to investigate.

8.3 ETHICAL CONSIDERATIONS

All ethical matters were observed according to the Code of Ethics used by the Human Sciences Research Council (HSRC) and the South African Human Science Research Council (HSRC) (http://www.hsrc.ac.za/en/about/research-ethics/code-of-research-ethics.

The principles recorded within the ethics are:

1. The Principle of Respect and Protection.
2. The Principle of Transparency.
3. The Principle of Scientific and Academic Professionalism.
4. The Principle of Accountability

Throughout this research we complied with the Protection of Personal Information Act [POPI] of 2021 as enacted by the South African government.

All supervisors and graduates who were interviewed and participants in the focus groups were advised that their participation in the research study is voluntary, that the data gathered will be used for the purposes of this particular study, that no identifying details of participants will be published and that the results of this research will be made available to the Water Research Commission [WRC] who has contracted Working Solutions International [WSI] to conduct the study on their behalf. The results may be placed on the WRC's website [Knowledge Forum] or be presented at conferences or in academic journals. Participants were advised that they could withdraw their participation at any point.

Prior to all MS Teams meetings, participants' consent was solicited to record these interviews.

9 RESEARCH LIMITATIONS

This research has been limited by budgetary and time constraints. This has had a direct bearing on the number of South African universities we were able to engage with as well as the number of postgraduate students and supervisors we were able to interview. For this reason, we had hoped to use a Case Study approach where postgraduate/supervisor respondents would come from the same institution. However, while we were able to secure supervisors from the same institution, this was not the case with postgraduates. Postgraduate respondents hailed from seven different universities and while it is important to recognise the similarities experienced across institutions, this has limited the investigation in respect of the process due to our focus on one university. This research does, however provide a nuanced view from the perspective of students from a range of institutions, which might prove useful for this study.

10 FACTORS REQUIRED FOR EFFECTIVE SUPERVISOR/POSTGRADUATE RELATIONSHIPS

10.1 INTRODUCTION

The main aim of this study has been to explore whether an online system could be used to match and allocate postgraduate students to supervisors in an academic institution in a way that increases the efficiency and effectiveness of the allocation – with the final result being higher completion rates and fewer dropouts from PhD and Master's programmes.

In this summary of findings, we report on the factors that students and supervisors feel need to be in place for an effective student/supervisory relationship. This is important in that it provides us with a set of factors for a matching and allocation system – be this on or off-line. Once this had been established, the study examines the current processes for matching and allocation of students to supervisors and analyses the successes and limitations of these. Finally, consideration is given as to whether an online system could improve or complement these current processes – and what this would look like.

10.2 THE FACTORS – POSTGRADUATE RESPONDENT VIEWS

Focus Group 1 [FG1] respondents were initially asked to fill in an online questionnaire [Attached as Appendix A]. From this questionnaire it was established that four of the six student respondents felt that their relationship with their supervisor had been good and/or very good, all had received face-to-face or online supervision, with 57% receiving fewer than 10 hours per month, and the remaining 43% between 30-40 hours.

Of the remaining three postgraduate students [FG2, individual respondent], one reported that he was forced to change his supervisor due to a minor clash [Graduate 7], while the other two did not rate their experience [Graduate 8 and Graduate 9].

Collectively, the nine postgraduate respondents identified five key factors required for an effective match between themselves and their supervisors. These themes emerged from the postgraduate respondents themselves in response to a general question around variables they felt needed to be in place for effective supervisor/graduate relationships. Many of the factors identified reinforced what was found in studies that form part of the literature review although the emphasis might be different.

Unless, otherwise specifically referred to as emerging from a Focus Group discussion, the factors reflected on are in relation to feedback from all nine postgraduate student respondents.

10.2.1 Communication

Four of the nine postgraduate respondents felt that open communication with supervisors would make for a successful relationship. This was directly addressed by these postgraduates, with this quote from one respondent summing up this sentiment.

> *I think communication is very, very important because I believe that any relationship without communication, it can't be effective [Graduate 6]*

The remaining postgraduates alluded to this need when referring to feedback or the lack of feedback from supervisors. One student spoke of how some supervisors were also only prepared to provide one avenue for the student to use when communicating with them which further compromised their ability to get hold of them, which could result in delays and causing student motivation to drop.

> *I've had some students complaining that some of their supervisors, they can only communicate via e-mail with them. If they do not get a response, it's a problem because the phone will keep on ringing non-stop and then they don't even have their cell phone numbers. So that's what I wanted to point out that a good effective relationship [is what] makes your work so much effective, and it motivates you as a student to keep on going day by day. [Graduate 5]*

Another postgraduate respondent felt that this communication should go beyond merely reporting or feedback on the research study. In this instance, communication was linked to demonstrating support for the student.

> *…whenever a student has a personal issue, the mentor should try to understand that a student needs to balance between an academic and a personal life, so communication is just the key between two people. Yeah. For me, communication is important between two people. [Graduate 4]*

Without communication, academic guidance and support could be impeded as students spent valuable time pursuing supervisors for feedback or comment. This was not good for motivation or successful study output.

10.2.2 Supervisor skills and expertise in the topic

The need for the supervisor to have skills and expertise in relation to the research topic that a graduate would like to explore was rated highly.

> *As a student I would like to be able to know that if my area is sedimentology, my supervisor is an expert in sedimentology ….. Definitely I will go for that one. This information has to appear under each and every supervisor. In this case, they can even include an ID photo. Just a small photo for the supervisor and below they will write the areas of expertise, the skills whatsoever. [Graduate 9]*

This was reinforced by six out of the nine postgraduates, with one summing up this:

> *I feel like for academic reasons you need someone who is knowledgeable about the fields you are researching on. For academics, I think really, we should focus on someone having the knowledge in the field. [Graduate 3]*

One postgraduate respondent reiterated the implications of not getting a supervisor with the right credentials, emphasizing that this could result in his studies not being completed in time.

> *My main supervisor was not really an expert in the topic which I was pursuing. But however, I luckily managed to be united with someone who was an expert and I managed to learn a lot in a short period of time and submitted on time. [Graduate 4].*

One postgraduate student's experience had been different though. He reported that he had worked with a supervisor that had all the expert knowledge but that this relationship was not successful. He was simply not able to make any progress with this supervisor. It was only when he changed to another supervisor who had less expertise but was more available, that he felt that his studies progressed more smoothly.

> *I'm currently doing my PhD and the project I'm doing is not necessarily his [my supervisor's] field of expertise However, character wise he is someone that you can really work with and he's able to always make time and keep the communication flowing. [Graduate 6]*

He was challenged by the five other members of Focus Group 1 with a compromise being reached where it was suggested that both academic and social support were important for an effective relationship that will result in a good working relationship leading to successful conclusion of their studies. It appears that for students it is a combination of communication skills and expertise that matters.

10.2.3 Supervisor availability and feedback

Supervisor availability to guide and provide feedback on the postgraduate's research was considered core to the relationship. It is obvious that without this support, guidance and feedback, the student is left to work on their own – which limits their own learning and development process. Some students reported on the positive relationship they had with supervisors in respect of feedback – and revealed how potentially this could impact their studies.

> *I had a good relationship with both of these supervisors and they used to push me that I should make sure that I finish my studies in time…right away from the presentation of my proposal, they fully supported me. Each time I submitted the proposal draft copy, they would go through it and then they'll give me feedback, but at times, of course they could be some issues with it. [Graduate 8]*

Another postgraduate had not been so lucky.

> *When it comes to my work, maybe I'll send him a document or something that I wrote and then he won't respond. I'll be after him, asking him 'Did you read the document that I sent you? The he will say 'I will read it; reading is not a problem.' I will read it then come back to you. And then based to my lab work now, he doesn't know where I am right now. What am I doing? It's very difficult. [Graduate 1]*

This lack of feedback and the implications for the relationship were sketched out by this respondent who felt that it was difficult to challenge the supervisor on issues when feedback was not forthcoming. This could lead to a breakdown in the relationship. An important additional issue raised is that of concern over the number of students the supervisor is responsible for. Obviously with a high student: supervisor ratio, this would limit the amount of hours a supervisor could spend with each student.

> *I think the supervisor had lot of students under her that she is supervising that led to the issue whereby in terms of interactions, they wouldn't be there. There would be some sort of postponements when we have to discuss certain issues and then when you submit papers for a review they will take longer and when you try to interact and question certain things then you realize that probably you are seen as someone who is pressurizing. [Graduate 7]*

Most postgraduate respondents therefore reinforced the need for supervisor availability to support them towards completion of their studies.

> *So the level of interaction, I would actually rate it very high and also the availability of the supervisor when you need her. It is also one of the things that I'm commending. [Graduate 7]*

> *One other thing is the availability, especially when you need, especially when you do a project that involves experiments [Graduate 1]*

This postgraduate student sums up what the role of a supervisor should be and comments on issues that were raised repeatedly by students:

> *.. someone who gives you feedback on what you actually submitted, in time. And someone who responds to your queries and questions. Someone who can, sit you down if your research is like all over, because sometimes you get out of context. If you're not getting feedback from your supervisor, you are*

likely to just be all over because you don't know if you are on the right path, so I feel like a supervisor should be someone who responds to your queries, will give you feedback when you submit and give you feedback in time. And also, great communication. That's what is important mostly. [Graduate 2]

10.2.4 Supervisor' mentoring support

Over half the postgraduate respondents felt that the supervisor should play a supportive role not only in academia but also in social aspects of a student's life.

I think also you need someone like a life coach or mentor, if I would say. Someone who will help you with personal stuff – maybe advises on other aspects besides the academic part. [Graduate 3]

… the supervisor – I'm looking at someone who's educative ……. the person will be able to be a mentor and mentor me in every aspect of life.. I think that's what's important and apart from that we share the same sentiments. We share the same beliefs. I think these are the things that should be also looked into. I think what's important is someone who can be there emotionally in all ways actually because we all come in with different challenges, different backgrounds, stuff like that. [Graduate 6]

Someone who is going to have that extra interest in what is happening to ensure that you are in a good state of mind because at the same time, to push someone toward a certain goal [or] to set-up limits or deadlines that are not achievable based on certain circumstances can results in a student crashing . So, at times, someone who is at least is trained or understands the socio side or human side of it, then that person is always a bonus. [Graduate 7]

Relationships seemed to be negatively affected when issues arose:

My supervisor was very strict but an open person when coming to a student. Although we disagreed a lot because it's like our feelings did not matter much. [Anon – in questionnaire]

You know, so I think it was probably that that resulted in us not seeing eye to eye, and we ended up involving the university structures and changing the supervisor, then that's when I managed to finalize everything. [Graduate 7]

These incidences, and the accompanying feelings that are not addressed between supervisor and student can lead to unnecessary clashes. Changing supervisors has further implications for how long the project is going to take to finalise.

10.2.5 Personality of supervisor

Most postgraduate respondents felt that a supervisor's personality needs to be factored in if there is to be a successful match. This is summed up in a response from one postgraduate respondent who reinforced the need to include this kind of detail when uploading profile particulars.

… really the profile, it's just more of what he can do or what he has done in terms of academics, but you don't know his personality. I think maybe it should include like a CV. Include if you are able to communicate with people, you are maybe well spoken. Show other sides of the supervisor besides the

profile of saying this person has done this and done that and produced so many papers. I think it should also show other characters that I needed besides the academic part. [Graduate 3]

10.3 THE FACTORS – SUPERVISOR AND PROGRAMME RESPONSES

Respondents were all from the same university but demonstrated different levels of supervisory experience. All reiterated what the admission and registration process had outlined as criteria that would most likely contribute towards a successful match between students and supervisors. A successful match was seen as leading to the successful completion of Master's and PhD studies within the time allocated. When assessing student applications, supervisors considered the following:

10.3.1 Demographics [Age; race; gender; disability; country of origin]

Universities already have targets set as per the national demographics. Departments within universities will need to be sensitive to and ensure that student allocation is in line with the national targets. This was taken as a given by all the supervisor respondents as this was set at university-wide level.

One supervisor respondent was more particular and explained that she would like a postgraduate student to not have been out of an academic environment for too long.

I also look at your last year for registration. I wouldn't want someone who hasn't been studying for 10 years or so because it's going to be difficult for me to work with those students because they took a very long break and things have changed in between from their last registration until now. So, I normally prefer three, but yeah, I can also go to up to five years [out the system]. [Supervisor 1]

10.3.2 Qualifications [including academic transcripts]

Again, the university has set minimum targets for entry into Master's and PhD studies. These are university-wide criteria and therefore were taken as a given and accepted by all supervisor respondents. Academic transcripts are important for the supervisor to get clarity on student levels and the amount of support needed.

10.3.3 Working experience/References

All supervisor respondents mentioned working experience as being important in the choices that were made around potential postgraduate students.

….[Students] would need to have had at least about a couple of years of experience in that field because it's very abstract. If you have not worked with it, you will not be able to do it, even if they want to. [Supervisor 2]

Work experience was seen as particularly important within a funding context and also as a way for students to demonstrate their interest and competence in the field.

I would not really want to waste much of my time trying to train the people to also be experts in the field, while they haven't had any experience… So, I also look at the CVs – what they are doing, what they have

done, projects that they've been involved in because such students are likely to complete as compared to the ones where you are still going to start from scratch. [Supervisor 1]

Work experience – or even a working student – was viewed positively precisely because of their potential to request their employer to financially assist them with their studies. This was seen to be particularly favourable when employers were interested in the postgraduate's research topic. With students dropping out due to a funding crisis, this was one way that this problem could be circumvented.

So, we do look at funding and it's part of that application they put in. We like it very much if the employer funds cause often it's a study that the employer wants so they will fund it and the student will be able to work on it during office hours. It's very beneficial for the student to do that. So, in part of their questionnaire that we asked them to complete is, who will pay for it. So, they have to, but we do help a lot. [Supervisor 3]

10.3.4 Research Interests

As with students, supervisor respondents spoke of the need for there to be synchronicity between the student and supervisor in terms of the research topic that is to be undertaken. This would result in a higher level of interest from both parties. While in some instances students have chosen topics because of the potential to secure funding, "I mean students will jump at any opportunity they can" [WRC 1] this has not always resulted in good outputs. One respondent explained how he would match around topic.

…Because I've got a very specific research focus that I need to give feedback to the National Research Foundation [NRF] on, I can't just choose any ad hoc topics. I have a very specific environmental assessment follow up focus. Persons [chosen] need to want to study impact assessment follow up, which is management monitoring and auditing of environmental management. [Supervisor 2]]

Another respondent reinforced the idea of a topic of research match as the way to go. This has been supported by students and supervisors throughout.

"I think that the thing could be a much, much better match on subject area" [Supervisor 4]

10.3.5 Postgraduate access to funding/finances.

While funding does not determine whether a student is accepted into a Master's or PhD programme, this is one of the questions that has to be completed on their application form. One respondent suggested though that lack of funding might have some bearing on choice:

You are just a little more careful in terms of who you choose because you need these students not to halfway defer their studies they need to finish. [Supervisor 3]

The Water Research Commission respondent [WRC 1] expressed her view that from her experience in providing funding for research projects [albeit on a small scale], those supervisors who attach Masters and PhD students to these programmes have a good chance of success.

> *So there's a team of academic researchers who are contracted to do certain research but because they're also at universities, they need to continue to supervise students. So they are meeting their own career target, supervising those students. But they're also using the students as extra hands on these research projects to get stuff done. And I mean, those are the students that ultimately thrive the most. Obviously you know that that that's not the only way students thrive. But generally speaking, I think that's a really powerful model. [WRC 1]*

However, there is a downside to this approach:

> *…firstly these students, the types of teams that are doing this are largely at our previously advanced institutions. I think that it's not exclusively it but that is where the bulk of these students would be finding those types of projects. I mean I suppose there's a level of exclusivity at students who are well networked in that they have been in these institutions already so that they're able to approach these supervisors and know these supervisors already. Able to going to talk to them and say, hey, will you supervise me? [WRC 1]*

This upfront understanding of which students have funding or access to funding can help with department planning, for example, around what funding might need to be raised through the National Research Foundation (NRF) and/or if there are funded research projects that they can link students to. This will also give a sense of how many graduates might experience funding issues that could lead to dropout. This understanding will allow for planning at the onset of the programme rather than having to be dealt with in crisis mode.

10.3.6 Supervisory capacity and allocation

Supervisory capacity is viewed as critical if there is to be no overburdening of supervisors. Annually, supervisors review their capacity so as to avoid being overburdened. They are able to suggest how many postgraduates they would be able to supervise. As one respondents suggests:

> *So, you can't have an academic supervising 30 students that just won't work. So, part of planning that has been done now already is to say that for example, I've got eight students, I look as though I'm going to graduate two students this year. That means I've at least got that capacity for two or three more. [Supervisor 4]*

While in theory, all supervisors go through this process, what emerged in the research is that there has been little consideration given to how experienced the supervisor is nor the other duties that they might be required to perform. This tends to create imbalances in workload that lead to supervisors being overwhelmed. This supervisor respondent explained how this impacted her:

> *The workload becomes more for those who are studying and teaching modules with more students. You still have students to supervise both at honours and master's level so it's actually a lot of work. And of all those other students that I'm teaching for this specific module, they will then send emails and inquire about this and that.. ….. I find myself very much overwhelmed in that I will not return work that I have commented on, on time. I have to prioritise what has pressing deadlines and then attend to today's later and sometimes I feel that it is a bit unfair. [Supervisor 1]*

One respondent felt that capacity challenges needed to be addressed as a matter of urgency in order to improve the supervisory experience from both the student and supervisor perspectives.

I think maybe one of the biggest challenges in the South African system is that we sit with a huge lack of experienced supervisors which is quite, quite serious. We really need to be replacing old white males with all kinds of new young supervisors. We actually have got production targets in terms of PhD supervisors. But we actually do not have enough and then you end up with supervisors being overburdened.

I think we need to aggressively within the country, have massive supervisor training and a much broader group of potential supervisors. It's happening but, it's very, very slow …[We need] to have good support systems for the supervisors to be actually supervising larger cohorts of students, but also technical skills, supervisory skills research methodology skills to make sure that you can actually attain those targets that we set by the national development plan. [Supervisor 4]

10.3.7 Supervisory guidance and support

Two of the four supervisor respondents directly spoke of supervisory guidance and support going beyond support for academic studies only. This quote sums up their feelings around this:

"Also…I'm not sure if I need to call it social support or whatever – students go through quite a lot of things whether it be in their homes, at work and all that. That, as well, also affects their studies." [Supervisor 1]

While the other two respondents did not refer specifically to social support, what was clear was that they, as part of their responsibilities, had become involved in helping to secure funding opportunities for students.

10.3.8 Communication

One supervisor respondent stressed the need for open communication as the key for a healthy relationship, even if this might not be always positive.

I try very hard to communicate with my students because they might expect something from me of which I might not even be able to deliver at that time. That encourages them because they know that I'm not just taking them for granted. I also value that they send stuff on time, and I also need to keep the promise of filling the comments on time. In short, communication from my side, works for me. [Supervisor 1]

10.4 SUMMARY DISCUSSION

There was a great deal of overlap between what supervisors and postgraduate respondents identified as required in order for an effective and healthy match to be made between the parties. In some instances though, there was a difference in emphasis and/or approach. The following reflects the areas of overlap:

10.4.1 Communication

Four [4] out of the nine [9] postgraduate respondents mentioned upfront that open communication was key to a good relationship, while only one of the supervisor respondents reflected on this as being

important. Both groupings raised 'communication' specifically in relation to feedback that they were either giving or receiving around research drafts. In this instance, the supervisor felt that communication was important to maintain openness around deliverables, with postgraduate respondents expressing that often this is where the relationship with the supervisor broke down. The implications for both parties was clear – that without regular and systemic report backs, postgraduate studies could be delayed and the research quality impacted. In addition, limited communication and feedback can result in student demotivation and dropout.

10.4.2 Supervisory skills and expertise [research interests]

All postgraduates [bar one] felt that supervisors should have the skills and expertise to supervise the research topic as proposed. This would ensure that the postgraduates remained with the supervisor and there were no delays caused through students switching supervisors. Only one of the postgraduates reported that his experience had taught him that as long as the supervisor was skilled in research, expertise and skills around the specific topic were not necessarily required. Supervisor respondents reinforced the view that topics needed to be aligned to their expertise so as to maintain interest. Supervisor respondents also reported that they were responsible for particular projects and if graduates were not in tune with the topics, this could lead to poor research outputs. For some, both postgraduates and supervisors, this had been evidenced when topics were selected based on funding availability rather than interest.

10.4.3 Supervisor availability and feedback

All postgraduate respondents spoke of the need for supervisors to be available to provide feedback on their studies. This was not necessarily defined in terms of time. Postgraduate students reported differing experiences – some good which has led to improved motivation, and others poor – where students received no guidance leading to lack of direction, demotivation and poor quality research. Supervisor respondents were much more practical in determining capacity and availability speaking to how they would suggest the number of students they are able to take on. However, as one of the supervisor respondents indicated, what emerged is that there is a further need to factor in lecturing workload and supervisory experience before determining final student allocation numbers per supervisor. In addition, one supervisor respondent pointed to the need to secure additional supervisors to relieve the current burden of supervision.

10.4.4 Social support and personalities

Social support and the need for a supervisor to play a mentoring role beyond that of an academic was suggested by a majority [5 out of 9] of the postgraduate respondents. Further to this, two postgraduate respondents spoke of the need to match personalities where possible as well. Two of the supervisor respondents did talk to the social support that they offered, but this did not come across as strongly as with the postgraduates.

The postgraduates respondents felt that supervisors needed to demonstrate an interest or have an understanding of issues affecting postgraduate students beyond academia. Without this, there would likely be clashes around work schedules and deliverables, leading in some instances to students either

crashing out the system or putting their studies on hold. In instances where there are disputes between supervisors/postgraduates, this has led to a breakdown in the relationship. When this has happened, the postgraduate has been forced to change supervisors, which leads to further delays in getting the research studies completed on time.

10.4.5 Additional factors

Supervisor respondents spoke to a number of additional requirements or variables that are [or should be] taken into account in supervisor/graduate matching.

- Demographics and academic requirements: These factors are mainly used to establish quotas [demographics] or to eliminate students who are unlikely to be able to cope with the academic rigour required for postgraduate degrees. These are understood by supervisors and postgraduates.
- Work experience: Two supervisor respondents mentioned work experience as a key determining factor when selecting postgraduates. This is because without this experience, postgraduates will struggle with the academic research as this relies on the postgraduate having developed some practical knowledge of the work being undertaken. This will not be the case for all supervisors but will definitely be perceived as advantageous.
- Access to funding: This is an important issue as without funding, the postgraduate is bound to drop out of the programme. While this is not a criteria for entry into the programme, this is likely to be viewed as favourable if the postgraduate student has funding. Supervisor respondents indicated that they do try and support students to get funding or get allocated to funded projects so that this problem does not arise. However, this might require upfront planning interventions and supervisor support in order to ensure this does not result in large numbers of student dropout.

10.5 CONCLUSION

Both postgraduate and supervisory respondents seem to be in agreement in respect of the key variables that should be considered for an effective and efficient match. These are largely in line with what the literature review presented as important variables. Where there have been additional variables suggested, this is mainly related to the university wide requirements [demographics; academic performance] or where specific work experience is required. These factors all need to be included to support a match. Funding remains a consideration but as it is not a factor that can be used to exclude postgraduate students, this should be noted on the application but not be used to determine the match.

In going forward, it would be important to consider if and how these variables are currently being factored into the allocation process, if and how they could be included on an online system and finally whether this platform could support, complement or make for a better matching than the current system being used.

11 THE CURRENT MATCHING/ALLOCATION PROCESS – ADVANTAGES AND DISADVANTAGES

11.1 INTRODUCTION

Most South African universities follow a similar process for matching and allocation of postgraduate students to supervisors as outlined in the literature review section of this report (Section 4). Postgraduates when applying to a university, must select the degree they wish to study, fill in application forms and submit a range of documents, including a CV, qualifications and academic transcripts, employment history, etc. Master's and PhD students are, in addition, required to prepare a Research Proposal and motivation. If students have identified a supervisor, this should be noted on the application form. Some universities also compel postgraduates to secure a supervisor before they submit an application.

Supervisor respondents interviewed provided a more detailed description of the application, matching and allocation process that currently exists within their particular university. While application requirements are much the same across universities, respondents provided additional details on how the graduate/supervisor match takes place. This process is mainly followed in instances where postgraduates are not familiar with potential supervisors and have not been able to identify a supervisor to work with.

11.2 THE APPLICATION, MATCHING AND ALLOCATION PROCESS

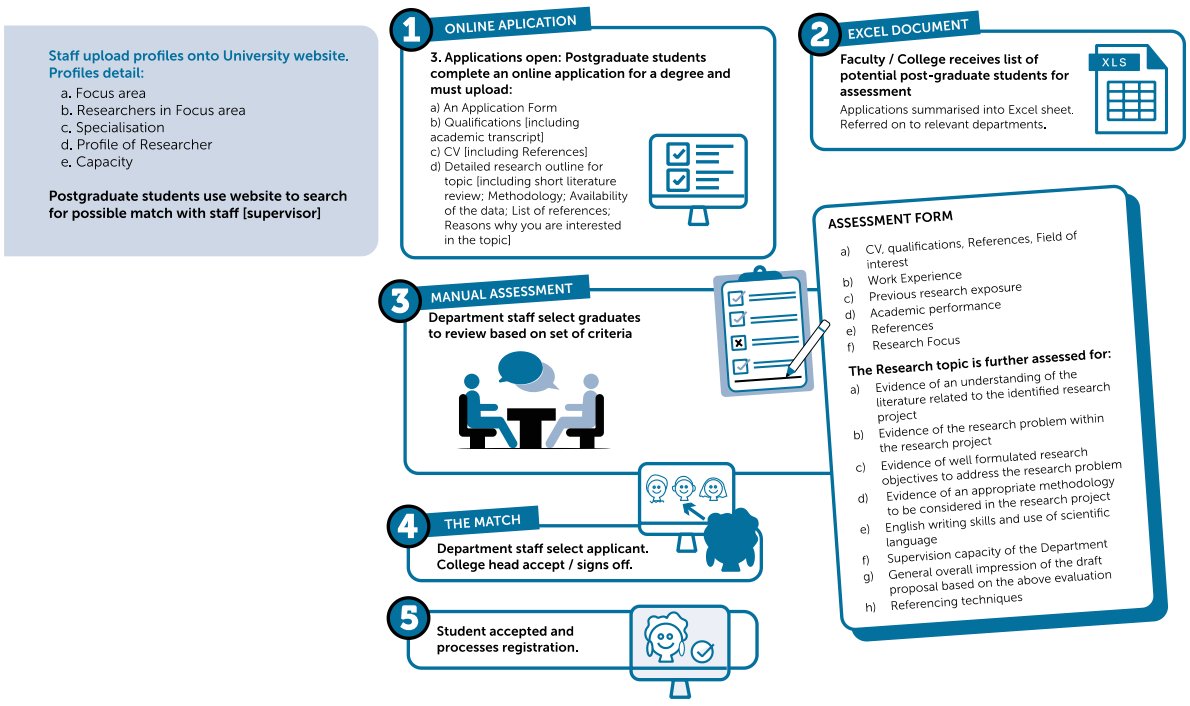


Figure 3: Current Supervisor Postgraduate Matching process at a South African university

This application process example from the university from which the supervisor participants were drawn, demonstrates that the allocations of postgraduate students to supervisors are largely done manually [See diagram above].

1. At the start of the process, supervisors upload their summary profiles [captured on a table] onto the university website. Here they outline their focus area, specialisation and detail how many PhD and/or Masters graduates they are able to supervise.

2. Graduates are asked to fill in an application form (or variation thereof) when applying for their studies [See Appendix 1, p59 for a copy of the Application form]. This Application Form requires the following information: Personal details, Employment details, References; Description of funding sources; Field of interest and Specialisation [Includes a list of possibilities]. In addition, postgraduates need to upload their CVs, qualifications, academic transcripts, and Concept Papers/Research Proposal notes.

3. Applications are submitted to the university administration who check and follow up on students whose documentation is missing. Once all uploads have been done, these student applications are made available [through the summary listing on an Excel document] to the Colleges [previously faculties] [and finally to the Departments] for assessment. Supervisors, through a Learner Management System [LMS] have access to all documentation on the students to assist them with the vetting process.

   > *That entire spreadsheet is then synced to every single academic in the department [through the College]. …you have a quota of what you need to do, but you can choose the students that you want to review or vet. And so, it goes through a vetting process. But you choose the students that you would want to supervise. [Supervisor 3]*

4. Supervisors assess postgraduate students using an Assessment Form template. They check student documentation, application forms as well as Concept Papers/Research Proposal [see Assessment form in Process Flowchart 1 above for detail]. The Concept Papers/Research Proposal is checked for understanding of research process and methodology, language, referencing capabilities.

5. Supervisors advise department of potential graduates for supervision. College head will sign off. The student will then be asked to process their registration.

11.3 THE MATCHING/ALLOCATION PROCESS – THE SUPERVISORS' EXPERIENCE

All supervisor respondents felt that they were managing with the current the supervisor/postgraduate allocation manual process, and none suggested that the system be scrapped. This was summed up by one respondent:

> *I do feel that the way we are doing it, the right student eventually gets the right supervisor, it works but technology will help.* [Supervisor 3]

Supervisors, however did raise some limitations and suggestions around how the process could be improved.

11.3.1 Turnaround time

One supervisor respondent felt that the application process needed to be tightened to improve on turnaround time. While calls for applications are open early, these are only processed by the administration two to three months down the line and sent in batches to the relevant Colleges and Departments to assess.

> *I think one of the biggest problems is with the amount of time it takes from a student applying and submitting documents, [through to] giving the document through to the department ….and for the final Dean's approval. It's too long. [Supervisor 4]*

The implication for these drawn out processes is that it impacts the throughput of graduates in studies. This supervisor respondent went on to explain that the only instance currently where an application can be fast tracked is when there has been an upfront agreement around allocation of the supervisor to the postgraduate – and this has been signed off on. This could be one way to address the issue of turnaround time.

> *So if I've got a student that's working on a specific project and we've been designing the project already before the registration, then that student would automatically indicate me as a supervisor …..[and] come straight to me because that student would have said they working with me on a research project related to one of our fields of expertise, so that's basically the process….I would already be able to approve certain students and fast track them.[*Supervisor 4]

While this would therefore definitely work for postgraduates students who are in the system and able to access supervisors, the downside would be for students still searching for supervisors.

11.3.2 Administration

Two out of the four supervisory respondents spoke about the amount of administration that lecturers and supervisory staff are faced with which tends to distract from their core function.

> *From where I am sitting it is too much admin for academics …I wish we could just highlight on that spreadsheet that accepted, accepted, accepted, and know that we have someone to complete all those forms on our behalf. [Supervisor 1]*

> *Currently now we've got so many applications that it's very difficult to go through everything. So what the system doesn't really do it – there's no real initial match between us so it's basically open to everyone and people choose whatever they want. And our heads of department definitely don't have time to go through all these applications and do their initial matching … so maybe a system like that [matching] can definitely improve the initial matching process. [Supervisor 2]*

One supervisor respondent blamed the inefficiencies within the student application system that has led to further administrative pressures at department level. She felt that these that could be improved by pre-vetting:

Basically when they [students] are applying, they are applying generally, and all their documents are submitted. I doubt they [admin] do any screening, what they will screen for is did they submit all the documents.. I'm sure they don't open them [the applications] because sometimes when you open the document, it's irrelevant. It's the wrong document. So that's a very good pre vetting that you can do. [Supervisor 3]

Supervisors, however, are particularly overwhelmed by the administrative burden placed on them. Selecting students for supervision increases this burden. This robs the supervisor of adequate time to consult, read and provide feedback to postgraduate students, one of the biggest issues raised by students.

11.3.3 Funding allocations

One supervisor respondent spoke extensively about the bureaucracy around funding allocations and the release of funding to graduates as part of their studies. He explained further about the misalignment in terms of time between the funding and student application processes resulting in additional administrative burdens being placed on supervisors.

….if you want to get students you have to on the NRF system when you get the money – usually in February – you have to allocate your students as quickly as possible to that money. You only get allocated to students with the right registration … at about end of March/April. …. So by then the NRF system has closed for allocation of students to the money, and then you have to go through additional process, which is very tedious. [Supervisor 2]

Funding allocations are therefore not simple and take up a great deal of time for the supervisor. While not strictly a process issue in terms of matching, this does have implications for student dropout and supervisor capacity. Even in instances where funding is available for postgraduate students, this is locked in university bureaucracy.

So it's not that easy. Because of, I think, bureaucracy and the way that our departments work with the clearance of money. It's not just one or two or three signatures; it is 5,6,7 signatures just to get your money approved and spend it. And then obviously I just need to write motivations and then just keep track on the system and write progress reports. [Supervisor 2]

11.3.4 Suggestions

With the amount of students applying and with pressures to increase this throughput and turnaround time on Master's and PhD degrees, all supervisors felt this system could benefit from automation. Different suggestions were made of how this could be done.

….the departments basically manually go through a process of linking a student to a supervisor. It could be very beneficial if there was some form of pre-linking already so that I don't have to go through 400 topics to see…I think we all do that. You kind of have keywords... So, you, you will have your favourites, and so you just go to see if these keywords pop up. [Supervisor 3]

I think with such systems the most important things will just be key words. For instance, if you're looking at recruiting air quality officers who have an honours degree in environmental sciences and then you

could just punch in "air quality and environmental sciences". I think that will work even better. I mean it would be much easier to match to candidates using such systems. [Supervisor 1]

Obviously an online system like that will give you closer answers [which] will be nice. [Supervisor 2]

I think it can be automated [application/assessment forms]. Because all you need to do is to complete the student's data, including their titles and then you just comment on the concept paper [Research Proposal] that they have received. You'll just say, "The objectives are not clear, and you don't think that this research will be doable", something like that. But I think that that can also be done on the system. It can be automated because believe me, it's just too much admin. [Supervisor 1]

11.4 THE MATCHING/ALLOCATION PROCESS: THE POSTGRADUATE EXPERIENCE

While three of the nine postgraduate respondents were from the same institution as the supervisor respondents, the six remaining studied at different universities throughout South Africa. All the graduates interviewed or who participated in the focus groups therefore did not necessarily interrogate processes within an institution but spoke broadly of how they have been matched to their supervisors – and what they thought of the system.

11.4.1 The matching process

Three out of nine were matched to a supervisor based on a prior relationship where they were either in the same institution, had worked on previous research projects together or had similar research interests.

I did everything from a junior degree until senior degree [at one university].....So, during our honour's degree, what they do in the department is that they just choose supervisors for us. You tell them your field of interest and then there's like a list of supervisors, but then randomly they just choose for you like the supervisor which they think will be fit enough to supervise you or rather guide you regarding the field of interest that you choose. This person has been with me from Master's through to PhD. [Graduate 4]

....when I was doing my Masters, she [my supervisor] was doing her PhD. We were doing more or less similar projects. So, because at one time we worked together it's when she had thought that maybe I would also be involved in the project and the specifically because we had done some studies together. [Graduate 8]

I got a call from my current supervisor and then he said, am I still interested in doing Masters? I said yes, I'm still interested. Then he said OK, it's fine. We will arrange… I have funding and a project for you. [Graduate 1]

"Word-of-mouth" seems also to play a big role in how postgraduates are matched with supervisors. One postgraduate respondent reported that often project leaders who were looking for Master's and PhD students that they had secured funding for, would approach potential graduates within their research field and ask them for help to find other postgraduates who might be interested.

> *Let's say we are in the lab. …. So, they come in and say," Is there anyone who knows someone who wants to do Master's or something. I do have funding. Then we will spread out to the information to the people … and we share on WhatsApp or Facebook you know. [Graduate 3]*

At other times, postgraduates would simply talk to each other to get recommendations on supervisors, as one respondent suggested:

> *…you'll be asking around ….Who are you doing your PhD with …Can you ask if that person can supervise me? So mostly this matching is through the word of mouth. So currently in most organisations, that is really what is happening.. I mean I've heard people saying, "ohh you are doing so and so, I want to do ABC and D? Do you know any supervisor there who can help me with this? [Graduate 7]*

All respondents at some point or the other have used university websites to look for supervisors who were specialists or experts in the research that they wish to pursue. This is usually in situations where postgraduates were wanting to switch institutions or they did not know potential supervisors from within that institution. Three respondents reported on the limitations of such a system – where either supervisor profiles are not captured fully or at all on the website, systems are difficult to navigate and it is might often be impossible to get a 'feel' for the supervisor.

> *… not all universities have got extensive profiles of their staff members. I must say some of the universities just list professor of ABC and D, the contact details and that's all. And you'll be expected to choose someone [who] you don't even know if he is very much interested in what you want to do. Yes, few universities, especially the so-called top universities, yes, they do have [supervisor profiles] but most of them still lack that particular information whereby it will allow you to make an informed decision of what you want to do.[Graduate 7]*

> *I was just trying to search on the website and apply for a certain university. The challenge was there are some courses or programs that are offered at the end they ask you to indicate the name of the supervisor which you want to supervise you. But in this case, somebody is just new within the institution website, you don't even know the supervisors, their names whatsoever. It becomes challenging to choose one. [Graduate 9]*

> *… not everyone can navigate through a university system…….. but I can do it because I'm from the academic environment [and] I've been university…but to a normal person, even if that person is a graduate, not everyone can navigate to get that particular information [Graduate 7}*

> *Then choosing the supervisor, especially when you are switching the institutions it's not so easy to find exactly the kind of a person that you might be looking for. Because now, for example, when I was looking for a PhD supervisor and I was coming from the other university, you are just looking for somebody who can just accommodate you and somebody within the field….. You only get to understand people once you are there. [Graduate 5]*

The lack of information and inability of postgraduates to access potential supervisors in order to make an informed choice on a match seems to be the biggest issue faced by postgraduates. One graduate explained how time consuming this process is while another suggested that this could result in

graduates not making an informed choice. One of the postgraduate respondents made this suggestion as a way to resolve the problem:

> *…if each and every university can have a system that is their main webpage where they have a section that talks to – student/supervision matching. Then under that have different schools to say if you want to do this, this is the list of supervisors [and] these are the areas of expertise. It would have made so many people's jobs very easy ….The project of match and place is really lacking….it's not there. [Graduate 7]*

While postgraduate students particularly focused on lack of access as a core limitation in matching with a supervisor, programme managers working in the field similarly believed that an online platform could improve issues of access.

> *I think what I'm saying is I see potential for an online system to kind of try and just open up the system more. And I mean definitely students who don't have that support network really struggle to know who to approach and they maybe don't necessarily look wide enough. They then just go to someone that they've met before.*
>
> *There is…..something quite exciting around a more virtual matchmaking thing because I think what we could do is start getting supervisors who are in institutions that don't have big research teams necessarily but are doing exciting stuff and looking for students, to start attracting students to themselves. If they could kind of start uploading their profiles and their vision onto a portal like this. [WRC 1]*

11.5 SUMMARY DISCUSSION

The matching and allocation process as outlined by supervisor respondents working in the university was mostly accepted by them. Supervisor respondents provided little to no criticism of the process besides commenting on the long turnaround time and additional administration burdens that were placed on them because of the process. Essentially, this administration could detract from the core supervisory function, namely to support the postgraduate through their research studies, providing direction on their research proposal and feedback as research drafts are presented.

While this was not raised by supervisors, a manual supervisor allocation process in which supervisors review from a list of potential postgraduates can have its limitations. Yuanyuan [2021] details how:

> The course coordinator looks at the first thesis topic and selects a supervisor from the potential supervisor list for the student, but later notices that the already selected supervisor is more suitable to supervise another thesis student down the student list. Then, the course coordinator has to go back to reallocate a different supervisor for the first thesis student. Eventually, when all the 20 thesis students have been allocated supervisors by the course coordinator checking back and forth, there could have been tens of times of reallocating. Even with all the time and effort spent, there is still no guarantee that all the 20 thesis students would end up with the best matching supervisors.
>
> Source: Yuanyuan, F [2021) http://www.wiete.com.au/journals/GJEE/Publish/vol23no1/03-Evangelista-A.pdf

Supervisor respondents felt that through automation and management of the pre-vetting and pre-selection processes some of the challenges raised could be resolved. Further more specific suggestions

were made on how this could be done. Speaking generally though, it is often difficult for non-IT persons to define how to improve on systems so that functionality is enhanced. Rather problems are identified and IT solutions sought to resolve these.

Postgraduate respondents seemed to have relied more on word-of-mouth or on a prior relationship, and less on the institutional system, when selecting a supervisor. This usually happened when they were already in the institution and/or had access to student and academic networks. However, not mentioned by these postgraduate respondents is that at times a supervisor might not be available and will not agree to supervise the postgraduate student. These students will definitely need to be able to access supervisors that they might not have any details about or have selected initially.

University websites were the go-to for the postgraduate respondents who are not within the institution and/or do not know any supervisors with their particular specialisation. These websites should provide the necessary details of the supervisor, including but not limited to their profile, specialisation, areas of interest, research capabilities, etc. This is where problems arose as profiles either did not exist or were inadequate for students to make real informed choices. In addition, these websites were often difficult to navigate and the information was not found easily. Suggestions were made about how this situation could be changed to accommodate these concerns. If resolved, this would have an important knock-on effect with the opening of greater access by postgraduates to supervisors nationally.

Of interest is that most variables identified by both groups of respondents as needing to be in place to ensure effective and efficient matching have been catered for through the current system, although the match is not automated. These variables have included: Demographics [with an additional suggestion]; Employment; References; Funding; Field of interest; Field of Specialisation; Research Title and "Indicate Supervisor". Those variables that are excluded are those that are difficult to measure, including levels of social support, communication, and personality measures. In addition it appears that within this current process, the supervisor has a greater say over the match than the postgraduate unless the postgraduate pre-selects the supervisor and engages upfront with them – and it would be important to attempt to balance this in some way.

11.6 CONCLUSION

There are points of weakness in the current matching/allocation process that if fixed could result in improvements that could satisfy both parties and lead to a more efficient and effective system. The next section will explore how an online system could be used to plug the gaps in the current system in a way that the areas of weakness raised by the postgraduate students as well as the supervisors respondents are resolved. Factors seen as critical for an effective match are also taken into consideration.

12 INFORMATION TECHNOLOGY FOR THE MATCHING/ALLOCATION PROCESS

12.1 INTRODUCTION

Information Technology [IT] plays an important and central role in any organisation – more so in this digital age. IT's role is to support the key functions of the organisation, to optimise business performance, improve and enhance user experience, provide access to information and support decision-making.

Technical staff were consulted to provide expert advice on how IT could play a role in matching postgraduate students to supervisors. This was done through a number of discussions held with key respondents WSI 1 [as IT developer] and WSI 2 [as technical support on WaterGEP online system]. In this section, we present a possible model for the matching process arising from these discussions that factors in not only the key variables but could contribute to improving efficiency and effectiveness in respect of the process. This, it is hoped, will ultimately result in higher completion rates and fewer dropouts from PhD and Master's programmes.

12.2 BACKGROUND AND CONTEXT

Currently the postgraduate/supervisor matching process within the university that supervisor respondents are from is largely manual. Collectively postgraduate and supervisor respondents identified limitations to the system and felt that if an Online Matching System could assist with addressing a number of core issues, that this could contribute towards efficiency and effectiveness, with the knock-on potential effect of improved supervisor/postgraduate relationships. These issues were:

1. Lessening of the administrative burden amongst university officials and academics to allow for more time to concentrate on core work [lecturing; supervision, etc.].
2. Shorter turnaround time in matching of postgraduate students to supervisors [this assists with throughput]
3. The increase of visibility of the supervisor allowing for postgraduate students to explore an appropriate match.
4. The increase of visibility of the postgraduate student allowing for the supervisor to explore an appropriate match.
5. Misalignment of funding and student registration processes.
6. Open access to supervisors allowing for more appropriate matches across institutions.

All respondents were unable to confidently talk of how an online system could resolve some of the challenges in matching and allocation of postgraduate students to supervisors. This is not surprising as the architecture of such as system requires specialist expertise. In this section, we will begin by looking at potential local and international matching models that might inform a postgraduate/supervisor match; will make some suggestions about how an Online Matching System could possibly assist to resolve the challenges with the current system – and how, through this process, the factors required for an effective postgraduate/supervisor match might be resolved.

12.3 LOCAL AND INTERNATIONAL SUPERVISORY/POSTGRADUATE MATCHING MODELS

12.3.1 Introduction

Models of how to match postgraduate students to supervisors in a way that potentially can improve the efficiency and effectiveness of the allocation are constantly being explored locally and internationally, more especially within this digital age. A distinction needs to be made between those models who include *automated matching based* on a feeding in a range of criteria to support the match and those where databases are collated and access granted to users to find suitable matches.

12.3.2 International models

Internationally supervisory/postgraduate matching models have been developed, often to tackle the issue of massification where large numbers of postgraduates apply for research programmes – and might have little or no knowledge of supervisors that are available to provide support.

The models explored in the literature review included automatic matching based on algorithms as a key feature and mostly included these key factors in making the match:

- Supervisor capacity and availability. In some models, supervisor experience and knowledge of the research topic were factored in.
- Availability in terms of project space and no. of students required per project.
- Ranking of research topics against keywords: In this instance, this was mainly from the postgraduate side, listing particular research preferences against key words.
- Project titles: Supervisors pick a research idea from a student based on their own interests. Similarly, a student can indicate an interest in a research topic proposed by a supervisor.

Due to time and resource constraints, it was impossible to source and interview university staff internationally who might have been able to provide more detail of this postgraduate/supervisor matching system they are currently using. This could be part of further research and investigation, building on this study.

12.3.3 Local models

Locally, no evidence came to light of postgraduate/supervisor *automated matching* happening through an online system. The closest to this was the Department of Science and Innovation [DSI] who in working with Universities South Africa [USAF][1] had come up with a recommendation to "establish a virtual online platform to facilitate mentoring between established researchers, newcomers or emerging researchers on the one hand but also, to link postgraduate students with potential supervisors."[DSI].

[1] USAF was formerly known as Higher Education South Africa (HESA). It is a membership organisation representing all 26 of South Africa's public universities.

> *So, it is more of a virtual marketplace or market space. When you are an established researcher, you put your profile, you put your research area, your interest in terms of what you do, and then Mary Soap or Joe Soap somewhere in the hinterland of the country will go in and say I just graduated with my PhD in this area and I'm looking for a mentor or maybe if he or she doesn't have a PhD, I'm looking for a PhD supervisor in this area. We were busy with the establishment of that platform. [DSI 1]*

Motivation for this platform has been a recognition of the need to create shared services to widen access and narrow the gaps between historically disadvantaged and advantaged universities. However, on further investigation, this system is still in its infancy with the focus of USAF at this time being on the exchange of good practices on postgraduate education and training.

Other local matching systems within the education and training space seem to mainly relate to the matching of graduates to workplace opportunities/internships and/or operate within the employment recruitment space. For example, the Human Sciences Research Council [HSRC] has been working on the development of an online platforms for matching graduates to employers for internship opportunities [http://interns.hsrc.ac.za/]

> *Basically, what happens is there is a database of host institutions that the program has. The host institutions are then requested to communicate their needs in terms of the research areas that they want the interns from, and the level of qualification.*
>
> *So perhaps a host institution in KZN wants an honours student with biotechnology, …..that is when the advert comes out. Then the students would apply. By the time they apply, they would already be in the system and the host institution would already be in the system. Then the advert comes out and the graduates apply. They are then shortlisted, and the host institutions would be the ones that would then interview the potential intern. [DSI 2]*

The Water Graduate Employability Programme [WaterGEP] online system is an example of an *automated allocation system* that matches graduates to hosts for workplace experiential learning [www.watergep.co.za].

This Online Matching System was developed to match water, sanitation and related service graduates to employees for workplace experience. Employers and graduates are required to register on the system. The variables are simple: Employees need to list the number of workplace opportunities available, where these occur geographically, and the qualifications that are suited for the job. Graduates are required to submit their demographic details, including their location and qualifications – and upload supporting evidence. The match is made around the number of job opportunities available, qualifications required and location. Employers and graduates are able to accept or reject the placement. Employers are also given full access to graduate documentation to check CVs, qualifications and can set up interviews if they want. Once accepted, all contracting and reporting on the graduate is managed through the system.

This system falls short in terms of the suitability for matching supervisors to postgraduates though. This is largely because the variables [factors] required for a postgraduate/supervisory match are different [and more extensive] and the application and registration processes within academic institutions are fairly well established. However, there are important learnings in terms of the impact and implementation of the system.

In terms of impact, with the matching taking place online, a lot of unnecessary administration is removed. Done manually, the match is either made by a third party investigating employer requirements and matching a graduate to these. In other instances, the employer would need to login and search a database of potential graduates – and make the selection from there [as with SA Mobi portal mobi-site, SAYouth.mobi.]. Automatic matches remove these steps, and present a number of options for the employer to select from. Both employer and graduate are also able to reject or accept the offerings allowing for selection control by both parties.

Consideration of the Water Graduate Employability Programme [WaterGEP] online system provides some useful insights for the creation of a similar platform for the matching of postgraduate students to supervisors. What follows is a discussion of a possible way of organising the proposed online system for the matching of postgraduates and supervisors. In terms of implementation, what is clear is that from the outset project scoping around functionality and requirements must be as near complete as possible. This essentially means that there needs to be absolute clarity on what is required from the system in terms of functionality; what current difficulties and problems it is possible for the proposed system to resolve and what objectives it is required of the system to achieve. Further to this, there needs to be enough time to test (pilot) and remove any glitches that occur during the development process. This is important as it can result in system rejection, even though many of the problems that are being presented could easily be resolved. They system also needs to be user-friendly, with users easily able to see how this will benefit them. Once, users are able to recognise how this system works, how it can improve operations and be of benefit, the adoption of this system is made easier.

12.4 POSTGRADUATE/SUPERVISOR MATCHING – AN IT MODEL

An Online Matching System will only be effective in instances where it supports or enhances operations within an organisation, solves/resolves problems that have been identified, and realises a set of objectives as set out.

The following schematic arose from discussions with the IT developer [WSI 1] and introduces a possible way of organising a postgraduate/supervisor matching system that suggests how the current matching process can be improved and/or enhanced through automation. This will require an online system that not only solves/resolves the issues that have emerged through the research process, but also ensures that the factors that make for a successful supervisor/postgraduate relationship are also addressed.

Figure 4 outlines the proposed Online Matching System with the detail of the process flow described in the steps below.

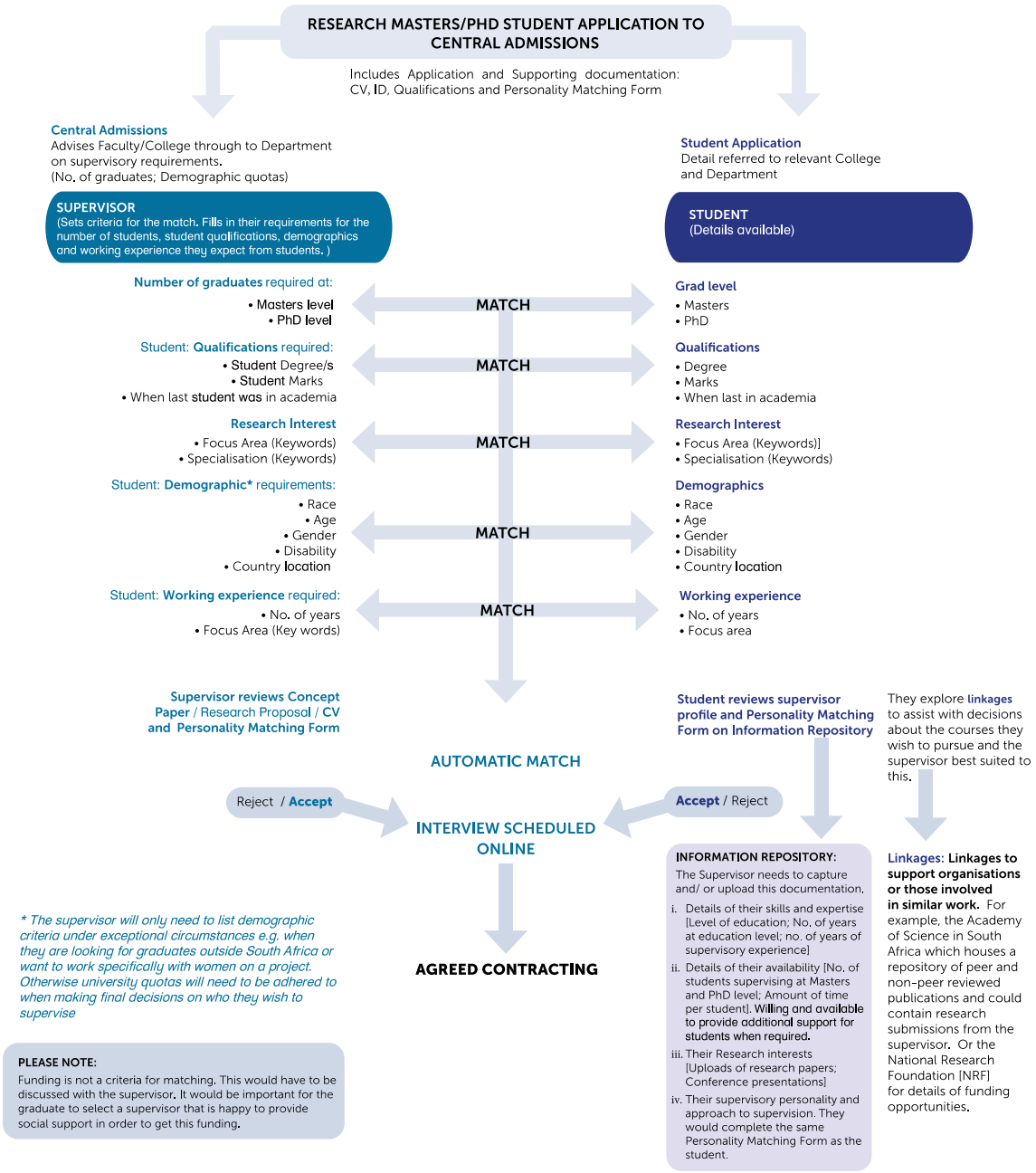


Figure 4: Proposed postgraduate/supervisor IT matching model

The Online Matching System process flow:

1) Step 1: Postgraduate registration
   A *postgraduate student* submits an application on a Central Admissions system. They register for a degree within a specific College/Faculty. All information and documentation that was requested as part of the applications procedure in terms of the current process is relevant. The only difference would be:
   a. The application will not be captured on a form, but directly into the system via a series of drop downs. This would include: Demographics; Qualifications [Degree; Results]; Research Interest]; Working Experience [Field; No. of years].

b. A Personality Matching Form will also need to be completed. This form will be used in an attempt to match supervisor/postgraduate personalities. The form will include a ranking scale around the following themes: Co-operation (Supportive); Dependability (diligent; punctual; organised); Tolerance of stress; and open minded and flexible.

All supporting documentation should be uploaded.

2) Step 2: Postgraduate details referred to Department
This *postgraduate student's details* become available to the Department only once all fields have been populated and documentation uploaded. This is done through an automatic share.

3) Step 3: Supervisor: Setting criteria for a match
A *potential supervisor* registers on the system. The supervisor must feed in details of what they are looking for in someone they wish to supervise. They essentially set the criteria for the match. In other words, once logged in to the system, the supervisor will indicate:
   a) The no. of graduates they require and at what level [PhD; Masters];
   b) The qualifications these graduates should have [Degree; Marks]. Some supervisors raised that they would also prefer graduates who have not been out of academia for too long. They would indicate this preference in what they would be prepared to accept in terms of years out of academia.
   c) Research interests [Focus area; Specialisation listed as key words]; and,
   d) Working Experience. How many years of working experience they would like the graduates to have so that they will be able to do the job.
   e) Demographics should be entered in only under exceptional circumstances. For example, where supervisors are looking for graduates outside South Africa and country location becomes important or where supervisors would particularly like to work with women because of the nature of the project. Otherwise university-wide quotas have been set that would need to be adhered to and factored in to when choices are being made.

4) Step 4: An *automated match* takes place.
This occurs mainly around the no. of graduates, qualifications, research interests, demographics [only when absolutely necessary] and working experience.[2] At this time, matching cannot take place around funding as this is not a requirement for supervisor/graduate matching. Social support and the matching of personalities will take place through an online form that both the postgraduate/supervisor will need to complete.

[2] Numerics would need to be built into the system to ensure that the supervisor is not overwhelmed by the number of matches but instead can regulated this – perhaps to double their requirements to enable choice.

5) Step 5: The postgraduate and supervisor are informed of the match.
    a. The supervisor can either accept or reject the match. They are given full access to the postgraduate student's documentation in order to decide this. If accepted, they can schedule an interview with the graduate.
    b. The postgraduate student can either accept or reject the match. They will be sent a link to an Information Repository that includes full supervisor profiles. This will appear in a template with supporting documentation. The template should include supervisory:
        i. Skills and expertise {Level of education; No. of years at education level; no. of years of supervisory experience]
        ii. Availability [No. of students supervising at Masters and PhD level; Amount of time per student; Willingness and availability to provide additional support to graduates]
        iii. Research interests [Uploads of research papers; Conference presentations]
        iv. Supervisory personality and approach to supervision. They would complete the same Personality Matching Form as the student.

a) If both parties accept the match, the interviews will be scheduled to interrogate the Concept Paper/Research Proposal. From the supervisor's perspective, the CV and Personality Matching form will be seen as supporting evidence in taking final decisions around the match. From the graduates perspective, the supervisor's profile [including the Personality Matching Form] will determine whether they accept the interview. Post the interview the student will be informed whether they have been accepted or rejected through an *automated* response that will be generated from the system.

12.5 DISCUSSION

Postgraduate and supervisor respondents raised core issues with the current matching process that they felt could be enhanced through an online system. They included a number of key factors [variables] that need to be in place. It is important to explore whether the suggested online system or platform could address the problems while at the same time ensuring that the factors/variables making for an effective and efficient process and a beneficial supervisory/postgraduate relationship are in place.

12.5.1 Addressing the administrative burden

All supervisor respondents drawn from the one institution spoke of the administrative burden they face not only in the allocation/matching process but throughout their interaction with research Master's and PhD students. As part of this institution's current matching process, supervisors select postgraduates off an Excel listing of potential postgraduates for review. Once selected, they are able to tap into the Central Admissions System which provides full access to the postgraduates' applications, their supporting documentation [CVs, ID, Academic Record] as well their Concept Paper/Research Proposal explaining what their proposed study will be about, why they want to carry it out and how they intend conducting the research.

The postgraduate/supervisor matching system attempts to circumvent some of the bureaucracy and administration that has been built into the current process. Essentially, what model proposes is that the initial match is automated, with potential postgraduates being identified for supervision against a set of established criteria. If the graduate is accepted for interview [or accepts to be interviewed after reviewing the supervisor's profile], there will only be two documents that the supervisor will have to interrogate – their CV and Concept Paper/Research Proposal. Interview scheduling can be done through the system, where the potential postgraduate will be asked to choose from a number of available slots should they be accepted for the interview.

This proposed online system removes some of the administrative burden on the supervisor who will no longer be required to sift through a large number of applications to identify who could be suitable candidates. Instead, the automated match will throw up a limited list of potential for review based on the numbers the supervisor has suggested they have the capacity to mentor. The supervisor will then become responsible for their core function – selection of appropriate candidates based on their research interests and field experience. Once the interview process is complete, the supervisor would need merely to indicate whether they accept or reject the application and an email will be sent advising the postgraduate of this.

There are a number of duties that the supervisor becomes responsible for once matched with the postgraduate students. These include: Event scheduling for feedback on drafts; feedback on drafts; submission of funding proposals; and, report backs on student progress [internal to the university; external to funders]. Any of the *administrative* duties that are not strictly the remit of supervisors and which could be supported by IT should be factored into the system for example, in event scheduling of appointments and feedback sessions, uploading of student reports, etc. This can be automated – and is already been managed through Learner Management Systems [LMS] within some universities. This circumvents the back-and-forth on emails that is time consuming and can leave supervisors enough time to work on reading drafts, providing input – and even supporting students who might be experiencing funding challenges.

12.5.2 Shorter turnaround time

With matching managed online, it is possible that the turnaround time could be shortened. However, this is largely dependent on staff being responsive timeously at different stages in the matching process. The university in this instance would need to manage timelines around this process.

12.5.3 Misalignment and bureaucracy around funding

Funding for studies is an area of concern for supervisor and graduates alike as it can result in student dropout from the programme. Funding has not been established as a criteria for matching although it needs to be addressed once the student is in the programme. The misalignment of dates between funding and registration applications as well as the bureaucracy around receiving payments has huge implications for the postgraduate and supervisor and needs to be resolved. This cannot be addressed within the parameters of this research paper – but consideration of an online system to at least resolve the bureaucracy in terms of release of funds could be helpful.

12.5.4 The increase of visibility of the supervisor

The proposed supervisor/postgraduate Online Matching System begins with a supervisor request for a postgraduate based on a firm set of criteria. Built into this system is the ability of the postgraduate to reject the supervisor if they are not happy with their credentials. While these credentials are not included in the initial match, they are to be made available in an Information repository that is linked to the Online Matching System.

With postgraduate respondents arguing that the university system is not easily penetrable and that supervisors often do not provide full profiles or relevant information to make an informed choice, two suggestions are made:

a) An information repository of supervisors is created. In much the same way that graduate applicants are required to upload key information and documentation, supervisors should be required to do the same. A template outlining what information and documentation is required by supervisors will be made available by the university or the agency managing this repository. The information that supervisors will have to include:
    a. Supervisor skills and expertise: Education level; No. of years at the education level; No. of years supervising Masters and PhD students
    b. Supervisor research interest: Focus Area; area of specialisation; research papers; conference presentations (with links to them)
    c. Supervisory availability/capacity: No. of students supervising [Masters/PhD level[; amount of time committed per month, per graduate; additional workload
    d. Social profile: Supervisor's approach to supervision; personality type. This would include the Personality Matching from.
b) When postgraduates are matched on the system, they will receive a link to the Information repository. This will provide them with an opportunity to interrogate whether they think the supervisor is an appropriate match for them before agreeing to an interview.

An Information repository would resolve two problems raised by participants in this study:

I. Supervisor visibility would be raised significantly. Postgraduates would be able to get a better sense of their supervisor before finally approaching them to supervise their research project. This would allow them to make a more informed choice. It would also not be difficult to access the supervisor through the system as a link would be provided once the match had been made.
II. The variables identified as important to secure a good match [supervisor skills and expertise; research interests; capacity and availability] will largely be addressed. The inclusion of a "social" profile is there to attempt to address more soft skills issues.

While initially all information for the system would require upfront time and effort for the supervisor to collate, once completed annual updates would require minimal effort.

There has been a further suggestion that in order to get a better social/personality profile of a supervisor, postgraduates should be asked annually to assess supervisors. This is done anonymously and the rating recorded on the Information Repository against the supervisor's name. The ratings

would be against the criteria included in the Personality Matching form. Each item would need to be unpacked further, with ratings between 1 and 5 given. This rating would help to a certain extent with determining personality type.

Generally speaking however, nothing will replace face-to-face interactions and interviews between supervisors and students in order to establish the terms of the relationship. Most supervisors even put in place a contract between the student/supervisor at the start of the degree process that will set the parameters of the relationship from the outset. These include commitments around: timeframes for completion of the research thesis (graduate) and feedback (supervisor), frequency of meetings; language standards; research ethics; administrative requirements being met, etc.

12.5.5 The increase of visibility of the postgraduate student

The postgraduate student when applying to the university is required to submit a full application with supporting documentation. The supervisor has from the start access to this documentation. The suggestion is that in addition to this the postgraduate student will complete the Personality Matching form which will give the supervisor a holistic view of the postgraduate. With the system having taken away the initial administrative burden, this allows time for the supervisor to interrogate the Concept Paper/Research Proposal, the CV and personality profile, interview the postgraduate – and make an informed decision on whether they are suitable to tackle a Masters/PhD degree and are a suitable match personality wise.

12.5.6 Access to supervisors allowing for more appropriate matches

Postgraduate respondents spoke of the difficulty that they and many of their peers experience in accessing supervisors. This is especially the case in instances where they are have been in the workplace for a while, are not based in an academic environment or want to change to from one institution to the other. While some universities might have more up-to-date websites detailing supervisor profiles, this was not always the case. At times, these were also difficult to navigate.

This proposed system would help with access. Firstly, should a postgraduate not be able to select a supervisor, the system would throw up a supervisor if a match is made. The graduate would then be sent a link to the supervisor's profile for review – and to accept/reject based on this. This not only provides postgraduates with greater access but also gives them more control over their choice.

This system does not stop a postgraduate from identifying a supervisor that they would like to work with and seeking sign-off from that supervisor prior to the matching process. However, in order to assist with easier access and allow for fair process, we would suggest that quotas be established in relation to how much matching happens in this way. In other words, if a supervisor is, for example, required to supervisor eight Masters students, the university and/or the Faculty/College could suggest that 50% of these come from an automated match.

Should the postgraduate wish to make the selection upfront though, this needs to be signed off by the supervisor [it cannot merely be a suggestion]. In this instance, the Repository of supervisors will be

very useful in helping postgraduates to make their choice. This repository should be placed in a prominent position on the university website – thus allowing for easy referencing.

In order to truly address the issue of access of supervisors to postgraduate students, consideration should be given to centralising these repositories. This could be done, for example, through the Universities South Africa website, with plugs-ins from all universities linking with this site. In order to make an informed choice, an investigation into the most appropriate institutions to house this repository will need to be conducted. This question could be addressed as part of a further research study.

13 CONCLUSION

An Online Matching System that matches postgraduates to supervisors can help to resolve the major challenge raised by supervisors – namely, the administrative burden they face in the matching process. Initial selection of suitable candidates can be done through an IT matching platform. Supervisors will then be freed up to interview graduates around issues emerging from their CVs and Concept Papers/Research Proposals, which is an effective use of their skills and will allow time for more informed decision making around postgraduate allocations. In addition, the supervisor will have a better sense of the postgraduate based on their personality profile which should result in them selecting students better aligned with their personality.

An information repository of supervisors has also been suggested as an adjunct to the Online Matching System. This repository will include a profile of each available supervisor – and will include the majority of variables that were identified in this study as key for an effective and efficient postgraduate/supervisory relationship. This repository will also satisfy an additional requirement from postgraduates, namely, easier access to information and more control over choice of supervisor.

Based on this, it can be concluded that an Online Matching System can complement the matching of postgraduate students with supervisors at an academic environment. The Online Matching System being proposed not only takes into consideration all variables for an effective match but addresses and resolves the key challenges experienced by supervisors/postgraduates who are engaging with the current system. Based on the literature review, this system should therefore be more effective and efficient, should result in more solid postgraduate/supervisory relationships, leading to fewer dropouts and more throughput of postgraduates in the system. However, this online system, like with all technology interventions, will need to be trialled and tested over a period of time in order to establish conclusive evidence.

14 RECOMMENDATIONS

14.1 DESIGN AND BUY-IN FOR MIGRATION TO AN ONLINE SYSTEM

Any online system that is developed needs to demonstrate how it will improve the current experience of users. In designing the online system, the following should be considered: requirements for functionality; challenges that need to be addressed by the system, objectives of the system. There should be a pilot test to check on user-friendliness and any other challenges that arise. There needs to be a presentation to universities on the possible benefits of incorporating such a system. If this does not happen, the system will be rejected and become obsolete. This require regular and open communication with users to secure buy-in.

14.2 CENTRALISING ONLINE SYSTEMS

A central body would be better placed to host, for example, an information repository or a portal of potential supervisors from different disciplines and universities. The IT model that has been proposed could seek collaboration with organisations such as DSI and USAF who are working in Masters/PhD education and training interventions – and build on what has already started.

The Water Research Commission [WRC] could also be considered to set up a similar portal that connects a national network of supervisors within water, waste and related services, thus providing a service to the sector.

14.3 LINKAGES AND PATHWAYS

Linkages across online systems are possible but would need to be explored in more detail.

a) The National Research Foundation [NRF] and the Council for Scientific and Industrial Research [CSIR] provide funding for postgraduate Master's and PhD students, more particularly for science, engineering and technology degrees. This can be done through individual applications or through the submission of proposals by university departments. Selections are made post-submission of applications and through review by a committee.

   An initial IT matching system, based on the model for postgraduate/supervisor matching, might support this process and make it more efficient.

   > *Now, what usually happens is that the NRF will usually issue a call during the course of the year, and they would then manage the shortlisting and the selection of who then gets bursaries. The NRF gets panels in place. The panels consist of experts in the research area. The panels would be able to assess who gets the bursaries and who doesn't get the bursaries. [DSI 1]*

   However, it would be important to explore in more detail the possibility of online linkages between students applying to study at particular universities, and potential funding systems and allocations.

b) Employment pathways: South Africa has a number of programmes addressing youth unemployment that include getting students to register their needs online and employers to do the same. Most operate essentially as searchable databases – and could benefit from a matching platform – something similar to what has been suggested as the IT model. However, what would be of particular use to explore is how a linkage between university graduates exiting studies and these employment databases could be built so as to allow for seamless pathways between graduation and the world of work.

14.4 OWNERSHIP AND MONETISING OF THE ONLINE SYSTEM

Companies have increasingly started to recognize that they are able to create value through commercializing and monetizing online systems, as well as the data stored and the data analytics that is based on this. Monetizing strategies have become second nature to these companies, but this is still something that is being considered within universities and government institutions.

There are several common ways in which to generate revenue from IT. These include but are not limited to:

i. Selling IP: This is an upfront payment for the online system or application.
ii. Free/Premium services: Initially offered for free, this service will include only limited features and basic functions. Additional premium services will be offered for revenue.
iii. Advertising: Brands participate in paying for adverts on the online system.
iv. Subscriptions: User often start off by getting access for free but post this will need to pay a monthly subscription for use of the service.

WSI can recommend several ways in which ownership and monetizing around an online system that matches supervisors to postgraduates and graduates to host employers might be able to create value for an organization. Differences arise around ownership and monetization in the public and private sector – and different strategies will need to be considered for each. This is particularly the case when users in the public sector are for example, students, government employees or university staff members. In instances such as these, it would be difficult to charge for use of the Online Matching System. However, this problem does not necessarily arise for the private sector which is generally more profit driven and is not necessarily providing a service.

Here are two examples of how to potentially generate revenue around differing online systems.

14.4.1 Postgraduate to supervisor IT Matching platform [Based on the current Online Matching System Model].

This Online Matching System IP could be “owned” by either an individual university and/or centralized through the university coordinating body, Universities South Africa [USAF]. The platform could be monetized through:

1. Selling the IP to private education and training companies who are involved in similar matching work.
2. Advertising on the platform: This is the most common monetization strategy that is used. This allows for the display of adverts to all users on the platform. This will be of particular

interest to a range of private companies wishing to target an entire university community. Examples include Cell phone operators [data]; Computer companies [laptops], clothing brands, etc. These companies could be charged for placement of an advert or "pay-per click".

3. Data: Data is an extremely important asset. The suggestion here would be for the university/institution to sell on data that is generated when users register or provide information on the system. While ensuring that anonymity is maintained, the platform is likely to contain datasets which when analysed will provide useful information that could be sold on to companies/institutions.
4. The Online Matching System and/or Information Repository linked to this will include Research Papers uploaded from the supervisor and/or graduate. This could also include technology innovation projects that form part of the research initiatives. Those users outside the university environments could be asked to pay for downloading research papers and could be asked to invest in technology innovations that might be of interest to them.

14.4.2 Graduate to employer IT matching platform [Based on the WaterGEP online system]

This online system is different in that a private company – the employer will be engaged as part of the match. While pts 1.1-1.3 above could easily be used to generate funding for running of the online system, in this instance employers could be charged to register on the system and/or when potential graduates are made available for their companies/institutions. This is particularly the case when operating an open platform as the system will be required to be maintained if it is to work effectively.

14.4.3 The Information Repository

An Information Repository which includes Research Papers or Technology innovations developed by academic staff or postgraduates is seen as highly valuable as this can be used to benefit society. This too can be monetized through users paying to access research and innovation. In addition, this could open access – and draw in investors who might be willing to put in funding to support innovation, for example, at a particular university or institution.

14.4.4 Recommendation

Further research is needed to come up with a Business Feasibility Model to monetize and commercialise the current [or a similar] IT Matching Platform

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16 APPENDICES

16.1 APPENDIX 1: THE CURRENT MATCHING SYSTEM

Please complete the information required in this Application form and submit a CV, Academic Transcripts as well as Concept Note of your proposed research				
Degree you wish to apply for	Masters in		PhD	
Personal Details and Contact Information				
Title		Qualifications		
Surname		1.		
First Names		2.		
Maiden Name		3.		
ID/Passport No		Gender	Male	Female
Email address		Nationality		
City		Ethnic Group		
Postal code		Contact number		
Country of residence		number		
Employment Details				
Job Title				
Company				
Department				
Documents				
CV		Academic transcripts	Concept Note	
Did you consult the Concept Note which is available on the college website under Open Resources?			Yes	No
References: Please provide the following information from 2 References				
Reference 1		**Reference 2**		
Title		Title		
Surname		Surname		
First Names		First Names		
Email address		Email address		
Cellphone number		Cellphone number		
Daytime phone number		Daytime phone no.		
Source of funding for research project				
Do you have funding for your studies?			Yes	No
If yes, which of the following apply?		Bursary	Personal Funds	Both
Field of interest (choose only 1 as this should relate to your specialisation field as per your qualification)				
Field of specialisation (choose only 1 as this should relate to your specialisation field as per your qualification)				
Proposed title of Research				
Indicate Supervisor				

16.2 APPENDIX 2 – GRADUATE QUESTIONNAIRE

1. THE ROLE OF A SUPERVISOR WITHIN AN ACADEMIC INSTITUTION

1.1. Describe the kind of relationship you had/have with your academic supervisor when studying for your PhD or Masters degrees?

1.1.1. Was this face-to-face supervision?
1.1.2. How much time does/did your supervisor spend with you on average in a month?
1.1.3. Were and/or are you happy with the supervision that you are receiving/received?
1.1.4. What has worked/not worked?

_____
_____
_____
_____
_____
_____

1.2. What do you think should be the role of a supervisor within an academic institution?

_____
_____
_____
_____
_____
_____

1.3. What do you think makes for a successful relationship between you as a post-graduate and your supervisors?

_____
_____
_____
_____
_____

1.4. What factors do you feel need to be in place for an effective post-graduate student/supervisor relationship?

_____
_____
_____
_____

a) What factors that are beyond your control could impact on this relationship? What are the implications of this?

_____
_____
_____

2. THE SUPERVISOR/GRADUATE MATCHING PROCESS

2.1. What institution/s did you apply to for your PhD/Masters programme and why did you select this institution/s?

_____
_____
_____
_____

2.2. Describe the application process for your PhD/Masters programme?

_____
_____
_____
_____
_____
_____

2.3. How are you and/or were you matched to your academic supervisor to your Masters/PhD? Outline the process you followed to secure your supervisor and the role you played, if any, in deciding on the supervisor?

_____
_____
_____
_____

2.4. If you played a role in choosing your supervisor, what key factors did you consider when deciding on the supervisor?

_____
_____
_____
_____
_____

2.5. How do you/did you find the application and allocation process for your Masters and/or PhD programme? Was it efficient and effective? What are/were the challenges you experienced?

_____
_____
_____
_____

2.6. What suggestions would you have to improve the current system?

_____
_____
_____
_____

3. AN ONLINE SYSTEM

3.1. The WRC/WSI has developed an online matching system that matches graduates to host for workplace experience.

3.1.1 Do you think that an online to match students to supervisors in an academic environment could work? Why? Why not?

_____
_____
_____
_____

3.1.2 What would the advantages be for you as a post-graduate student?

_____
_____
_____
_____

3.1.3 What could be the disadvantages to you as a post-graduate student?

_____
_____
_____
_____

3.2 Has the department/university ever thought about, automated or provided an online matching service for supervisors/post-graduate students? If yes, what was the system that they used?

_____
_____
_____
_____

3.3 Do you think the current WaterGEP online system [matching graduates to hosts] could in any way complement the current system that matches supervisors to students? If yes, how could this be done?

_____
_____
_____
_____

3.4 What do you think would need to be done in a university environment for supervisors to make the change to an online system?

_____
_____
_____
_____