

**Research Report on Programme desirability, impact or relevance (through employer studies and student demand studies) for the following programmes:**

Diploma: Mech Eng, Civil Eng, & Elec Eng

Advanced Diploma: Mech Eng, Civil Eng, & Elec Eng

BEng Tech: Mech, Civil & Elec Eng

BEng Tech (Hons): Mech, Civil & Elec Eng

MTech/MSc Eng/MEng: Mech, Civil & Elec Eng

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**merSETA**  
MANUFACTURING, ENGINEERING  
AND RELATED SERVICES SETA

## **Executive Summary**

This report describes the results of employer and student demand studies that were undertaken to assess the desirability for Walter Sisulu University (WSU) to offer a selected range of HEQSF-aligned engineering programmes. The focus of this study covered qualifications at the Diploma, Advanced Diploma, Bachelors, Honours and Masters level within the disciplines of Civil, Electrical and Mechanical Engineering.

Civil, Electrical and Mechanical Engineering employer representatives were asked as to:

- the need within their organisation for graduates with the type of HEQSF-aligned engineering qualifications that WSU are consider offering;
- indicate whether there are any other related engineering qualification(s) which WSU should consider offering;
- rate the competencies of WSU engineering graduates;
- indicate what criteria their organisation view as being the most important when recruiting engineering graduates;
- indicate whether there are competency areas (needed in employment) that should be expanded on, or more comprehensively covered in the curriculum.

In addition the views of prospective Civil, Electrical and Mechanical Engineering students were obtained to determine:

- whether they are interested in enrolling for the new HEQSF-aligned qualifications that WSU plans to offer;
- if interested, when are they likely to enrol for these qualifications;
- their preferred campus to study at;
- their preferred mode of study;
- whether there are any other engineering qualifications that they would like to see that WSU consider.

The population sample for the employer study was derived through a process of stratified sampling to ensure employer representation from persons with the relevant experience, professional profile and who has, or may in the future interact with civil engineering students and graduates from WSU. The population sample for the student demand study were predominantly drawn from WSU engineering alumni who had graduated with a Diploma or BTech qualification from any of the WSU campuses in the last 6 years. A descriptive and evaluative questionnaire, utilising the software package Survey Monkey was used to develop the data collection instrument. Both closed and open-ended questions were incorporated in the surveys. The questionnaires were distributed to the target population by means of a web-based approach. A total of 697 questionnaires were distributed to employer representatives, while a separate questionnaire was sent to 749 prospective students. The employer survey yielded an overall response rate of 18%. The overall response rate for the student demand survey was 35%. Use was made of the statistical software packages SPSS and Microsoft Excel for analysing the data for the surveys.

### Employer study results:

The responses from employers to the question: "what HEQSF-aligned engineering qualifications are required by industry?", indicate that employers across all disciplines consider the engineering qualifications on offer at NQF levels 6 and 7, i.e. the range comprising the Diploma, Advanced Diploma and BEng Tech qualifications, as being important and needed. Civil Engineering employers in particular expressed a strong interest for graduates with the BEng Tech qualification. Demand for the Advanced Diploma, which has the same Exit Level Outcomes as that of the BEng Tech degree, yielded a lower demand value. This can probably be attributed to employers being less familiar with the Advanced Diploma, given that it is a

new qualification type within the engineering sector. Demand for graduates with post grad qualifications, i.e. with Honours and Masters Degrees, was significantly higher among Civil Engineering employers, in comparison with their counterparts in the Electrical and Mechanical sectors.

Responses to the question posed to the type and stream of engineering qualification(s) which WSU should consider offering, indicate an interest among some employers for a few specialised engineering qualifications, beyond the generic programmes in Civil, Electrical and Mechanical Engineering that WSU is consider offering. The additional qualification and specialisation needs, as expressed by employers, are listed in the text. These “additional” qualifications are all closely aligned to the generic engineering qualifications that WSU plans to offer, and it is likely that such “additional” qualifications can be nested within the generic and core discipline qualifications.

Responses to the question on the level of competencies that Engineering graduates display in the workplace indicate that Electrical and Mechanical Engineering employers are slightly more satisfied with the competencies of WSU graduates, than their counterparts in the Civil Engineering sector. Employers in all three engineering disciplines rated the collective competencies of WSU Engineering graduates as slightly above the scale point of ‘neither high nor low’.

Of the individual competencies that were assessed, employers across all disciplines rated graduates’ competency for ‘individual and teamwork ability’ the highest. The graduate competency ‘independent learning ability’ also received high rankings from all sectors. Employers within the Civil Engineering cohort rated graduate competencies for “engineering design ability” the lowest, while employers within the Electrical and Mechanical Engineering cohort rated graduate competencies for “professional and technical communications skills” the lowest.

Results to the question: “what criteria are the most important when recruiting engineering graduates?”, indicate that employers rate “Engineering-specific/Technical skills” and “Academic results” as being the most important. Graduate competencies in “soft skills”, such as “Inter-personal skills”, “Personal skills” and “Communication skills” also ranked high as employment criteria. It points to importance of ensuring that the curriculum values the development of “soft skills” in addition to emphasising the technical and engineering specific skills.

The results to the question posed to employers as to what competency areas should be more comprehensively covered in the curriculum closely mirrored the views of employers on areas where graduates competencies are below expectations.

The views of employers, as was collected in the survey, can be used to inform and strengthen specific parts of the engineering curriculum. It also provides useful pointers, and baseline data to explore and conduct further research within the specific areas of concerns that the employers have raised.

#### Student demand study results:

The results of the question posed to prospective engineering students as to whether they are interested in enrolling for the new HEQSF-aligned qualifications that WSU plans to offer indicate that there is a definitive demand among students, across all disciplines, for qualifications to be offered at Bachelors, Honours and Masters degree level. Based on a 95% Confidence Interval the interest from students resided predominantly within the “definitely

need” to “probably need” range. It also became clear during the survey that prospective students are mostly unfamiliar with the context and structure of the new type of engineering qualifications such as the Advanced Diploma, as provided for within the HEQSF (even though the purpose and structure of these qualifications were well explained and referenced in the survey instrument). Prospective students, like employers, appear to have difficulty in comprehending that the Advanced Diploma for engineering have the same Exit Level Outcomes as that of the BEng Tech degree. Prospective engineering students across all disciplines expressed limited interest for qualifications at the Diploma and, Advanced Diploma level but this should be read in the context that the survey sample were mostly alumni, who have already obtained these, or equivalent qualifications at these levels. It is therefore understandable that the survey cohort targeted had no specific need to enrol for these qualifications. As such, the views of employers, who expressed a high need for graduates with Diploma and Advanced Diploma qualifications are deemed a more reliable demand measure for these two qualifications.

The results to the question posed to prospective engineering students as to when they are likely to enrol for the respective qualifications reflect that there is an immediate interest to enrol for the range of qualifications that WSU consider offering. The results also show that the interest to enrol for post grad qualifications in engineering is not necessarily a short term goal, with prospective students showing strong immediate interest, continuing up to the year 2022 and beyond.

The results to the question posed to prospective engineering students as to what their preferred campus is to attend classes show that Buffalo City is the preferred campus for the majority of students. This can possibly be attributed to the urban setting of the Buffalo City campus, and the fact that many of the prospective students reside within the metropolitan area, and that most of the work opportunities are located within the metro.

Prospective engineering students, across all Engineering disciplines, expressed a preference for Part Time (block sessions) as their preferred mode of tuition. The interest among students for tuition to be through full time and distance learning modes was almost equal, but was well below preference for students to study through Part Time (block sessions). The limited interest for full time studies can possibly be attributed to many of the prospective students being in employment, which makes it difficult for them to be absent from the workplace for extended periods.

The results to the question posed to prospective engineering students as to whether there are any other engineering qualifications that WSU should consider offering shows that the needs of students are broadly aligned with the additional qualification requirements expressed by employers. As was explained earlier, the additional qualifications that students have expressed an interest in can be developed as parallel qualifications, or as specialist streams, nested within the generic qualifications that WSU plans to offer in the disciplines of Civil, Electrical and Mechanical Engineering.

Seeking the views of employers and graduates, remains an important part of the quality assurance process and is embedded in programme accreditation criteria. Not only does it promote engagement between academic institutions and external stakeholders but it also provide evidence of the efforts made by an institution to actively assess the responsiveness and relevance of its academic programmes. Employer and Students Demand Studies, as contained in this report, contains baseline information that is both useful and informative and serves to improve programme design and delivery.

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## **1. INTRODUCTION AND BACKGROUND TO THE STUDY**

Both universities and employers have a desire to develop graduates possessing the competencies required by employers for a competitive and technology-driven global environment (Klein-Gardner & Walker 2011; Singer, Nielsen & Schweingruber 2012; Besterfield-Sacre et al. 2014). Government values the role of engineering professionals to contribute to the social, economic and human upliftment of South Africa (The Presidency 2010; Taylor 2015). A study by the Engineering Council of South Africa (ECSA 2010) indicates that there is a severe shortage of engineering professionals (e.g. engineers, technologists and technicians) per capita of the population in South Africa, in comparison with other developed countries (Lawless 2005). There are approximately 1.4 technicians for every engineer in South Africa (Du Toit & Roodt 2008; Wolff 2017). Du Toit, and Roodt (2008) go on to state that, for developed countries, the ideal ratio would be four technicians to two technologists for every one engineer and that both ECSA and the Engineering Association of South Africa (EASA) deem this ratio to be four technicians per one technologist and one engineer. A lack of civil engineering graduates and diplomates has been equated as a contributing reason for ongoing poor service delivery at municipal level (Lawless 2005; Du Toit, & Roodt 2008; Lawless 2011; Watermeyer & Pillay 2012). It is, therefore, not surprising to find that the civil engineering technician is amongst the occupations highest in demand in South Africa (Department of Higher Education and Training 2016).

Increasing the output of engineering graduates who possess the contemporary sets of knowledge, skills and attitudes to respond to the modern-day workplace and a competitive economic environment is therefore an important educational objective in South Africa (Lawless 2005; Lawless 2011; Watermeyer & Pillay 2012; Taylor 2015, Naicker, 2016). Engineering faculties in South Africa, while striving to increase their output, are being placed under increased scrutiny from industry to determine whether their graduates and diplomates have the range and level of competencies required in the workplace. Examples of recent studies that highlights the importance of the curriculum and training of engineering graduates towards ensuring that they are competent in meeting the needs of industry, include: study by the Council for the Built Environment (CBE 2014) that ask "is there a gap between graduate competencies and expectations?"; the online survey launched by the South African Institution of Civil Engineering (SAICE) in 2016 to establish "how industry perceives and rates the various tertiary institutions"; and the investigation by the engineering faculty at Stellenbosch University (Basson, 2017) as to "what should engineers be trained for in South Africa?"

These studies acknowledge that engineering graduates, particularly those in South Africa often have to fulfill many different roles in practice. This makes it very difficult to tailor an engineering curriculum for all the possible job types, given the wide scope of the profession and the limited time available to cover all specialisation areas to the same depth as part of the graduate training at university. Competency levels that graduates need to demonstrate in achieving the various engineering qualifications are made explicit in the qualification standards but it should be noted that ECSA does not give any detailed requirements for the curriculum content. The ECSA standards only states that the engineering fundamentals and specialist engineering science content must be consistent with the designation of the qualification (ECSA, 2016).

The scope of work that engineering qualifications have to cover are often so wide that the design of the curriculum inevitably entails many compromises insofar as what should be included and what should be left out of the curriculum. The luxury of offering a wide variety of electives and specialised streams are constrained by limited funding sources and the associated on-going pressure faced by academic departments to achieve financial break-

even. These constraints necessitate compromises in the context and focus of the curriculum. By developing an understanding as to what the most likely roles are that graduates will fulfill in the workplace can help to guide the curriculum design by informing the context within which the stipulated graduate attributes of the respective qualifications are to be achieved. This approach relates to the notion of constructive alignment as developed by Biggs (2014) and depicts learning as a process of constructivism, insofar that individuals make sense of or construe meaning from the learning events that they are given the opportunity to interact with. A constructive alignment approach therefore seeks to align the learning outcomes, learning activities, as well as the assessment. The data obtained from graduates and employer studies therefore helps to strategically focus the curriculum design and ensure that there is greater alignment between the competencies that engineering qualifications seek to achieve and the expectations that employers have from newly qualified graduates.

### **South African Regulatory Framework and its implications for Engineering Education**

The Higher Education Act of 1997 assigns overall responsibility for quality assurance in higher education to the Council on Higher Education (CHE), through its permanent sub-committee Higher Education Quality Committee (HEQC). Criteria 18 and 19 of the HEQC's Handbook on Programme Accreditation Criteria specifies, amongst others, that surveys, reviews and impact studies on the effectiveness of all programmes need to be conducted and that the results be used to improve the programme's design and delivery (CHE 2012). In 2006, CHE and HEQC entered into a Memorandum of Understanding (MoU) with ECSA, whereby ECSA was delegated to undertake the quality assurance functions of HEQC with regard to the undergraduate engineering programmes. ECSA, therefore, has the statutory responsibility of accrediting the engineering programmes offered at undergraduate level and they conduct regular accreditation evaluation visits to institutions that offer engineering programmes. One of the reasons for this, as cited in the ECSA policy on accreditation inspections, is to establish "...whether the Diplomates and Graduates from the respective programmes are ready for employment ..." (ECSA 2013: 5).

Accreditation criteria consider the structure, learning outcomes, educational process, resourcing and sustainability of the programme to determine if the quality of the programme is adequate. This means, inter alia, that both the programme and the work performed by the students must meet the specified ECSA Exit Level Outcomes (ELOs) applicable for that programme. ECSA has developed quality assurance documents that contain standards, criteria, policies and procedures that the education provider must comply with, in order to secure accreditation (ECSA 2013). These quality assurance documents include a Higher Education Qualifications Sub-Framework (HEQSF)-compliant Diploma qualification in engineering (ECSA 2016). It is, therefore, clear that the HEQC and ECSA, in fulfilling their functions as accreditation bodies, require the curriculum and outcomes of engineering undergraduate programmes to be suitably aligned to the competency requirements and expectations of employers. The importance of accreditation, as an independent quality assurance process, cannot be underestimated. It is, after all, there to assure the public of the quality of these programmes (ECSA 2013: 5); even though some of the engineering programmes only achieve full accreditation after multiple ECSA visits, this being as a result of deficiencies not being addressed adequately. In some instances programme deficiencies are only resolved once the professional body notifies the institution of its intention to withdraw programme accreditation. It is, therefore, questionable whether the award of accreditation for a programme is, indeed, sufficient for employers to be assured that graduates and diplomates are both ready for the workplace and sufficiently equipped to continue with their learning within the profession. Ballim, Mabizela & Mubangizi (2014) point out that both the curriculum



and the teaching and learning process at a university could be compromised if meeting the requirements of an external instrument, such as accreditation, become the primary focus of teaching. ECSA's accreditation policy states that universities have an obligation to "assess the impact of the programme and to show how the results are used to improve the programme" (ECSA 2014: 8). There is, however, no stipulation in the ECSA document as to how the impact of the programme must be assessed. Whilst employer representatives give direct input on the programme during the accreditation process, universities often fail to provide evidence on the impact of their programmes, despite this being ECSA and HEQC requirements (CHE 2012; ECSA 2014). Providing information on the impact of these programmes is particularly important to historically disadvantaged institutions, as it is mostly programmes from these institutions that are criticised for the poor quality of tuition (Cape Higher Education Consortium [CHEC] 2013), resulting in the perception that graduates and diplomates from these institutions are the least preferred candidates when seeking employment in industry (Naicker 2016).

The aim of this study was to gather the views of civil, electrical and mechanical engineering employer representatives as to: the extent to which their organisation need graduates with the HEQSF-aligned engineering qualifications that are on offer; whether there are any other engineering qualification(s) which WSU should consider offering; how industry rate the competency of graduates from WSU; what the five most important criteria are for the recruitment of newly qualified engineering graduates; whether there are competency areas (needed in employment) that should be expanded on, or more comprehensively covered in the curriculum.

Furthermore the study aimed to gather the views from prospective civil, electrical and mechanical engineering students as to: whether they are interested in enrolling for the new HEQSF-aligned qualifications that WSU plans to offer; when they are likely to enrol for these qualifications; their preferred mode of study; their preferred campus; whether there are any other engineering qualifications that they would like to see WSU offer.

Employer studies are useful instruments that can contribute to understanding the links between learning, competences and job requirements and this research report provides relevant empirical data to base engineering education to address the dearth of South African employers' views on the readiness of engineering diplomates entering the workplace. The data and results will assist both universities and employers to develop graduates possessing the competencies required by employers for a competitive and technology-driven global environment. The results will enhance universities' awareness of the public expectations for higher education graduates to be more directly prepared for the world of work.

## **2. THEORY AND LITERATURE**

Employer surveys have been widely used as part of the quality assurance processes universities to identify and address possible deficits with its educational programmes (Allahverdi & Aldowaisan 2015; Elrod et al. 2015; Gwyn & Gupta 2015). Other international studies that explored how well graduate competencies and industry needs were aligned included that, as reported by Neilsen (2000) in Australia, Besterfield-Sacre et al. (2014) in the United States, Ridgman and Liu in the United Kingdom and China, Peng, Zhang and Gu (2016) in China and Vadivu, Bala and Sumathi (2016) in India.

Walther and Radcliffe (2007: 42) state that competence can be conceptualised as an iceberg where the skill and knowledge domain form the tip, visible above the waterline, and traits, self-conception and motives make up the base. They argue that universities concentrate on

the parts of the competency iceberg that are above the waterline while companies tend to focus on the parts of the competency iceberg below the waterline. Expert panels tend to define graduates' attributes for engineering programmes as broad aspirational goals that only point in a general direction while industry, in contrast, have a much more detailed competency profile for each particular position in the organisation. This study draws from Holland's theory of vocational behaviour, which suggests that each environment, whether it is a work environment or an academic discipline, has a distinctive pattern of competencies, values, attitudes, interests, and self-perceptions. This approach in understanding how competencies are valued in the workplace is corroborated by Passow (2012).

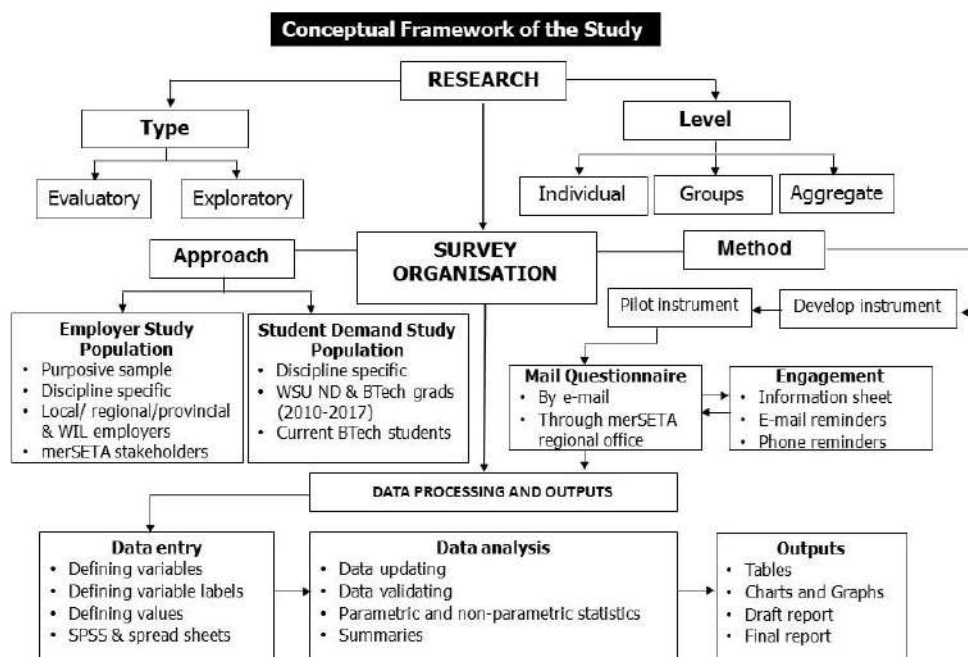
Research conducted in a South African context that overlaps with this study includes that of Griesel and Parker (2009) who did a baseline study on South African graduates from the perspective of employers. Their findings indicated, among other things, that there was a real need to address gaps between employer expectations and higher education outcomes. Ngetich and Moll (2013) research focussed on the relationship between industry and newly graduated engineers and the effectiveness and efficiency of graduates in the workplace. Hauschildt and Brown (2013) described a competence diagnostics project that focused on assessing the competence of students with completed engineering qualifications. Kraak and du Toit conducted a study on behalf of the Cape Higher Education Consortium in order to determine levels of 'graduate employment and unemployment' and to identify the different pathways from higher education into the world of work (CHEC 2013).

All of these studies point to increased public expectations for higher education graduates to be more directly prepared for the world of work. Employer studies are therefore useful instruments that can contribute to understanding the links between learning, competences and job requirements (Teichler 2013). This study was initiated in an attempt to explore these links. In summary, employer surveys have been widely used as part of the quality assurance processes in universities to identify and address possible deficits with its educational programmes and how well graduate competencies and industry needs were aligned. In terms of competences, universities concentrate on the skill and knowledge domain while companies tend to focus on traits, self-conception and motives. South African studies on of employers' perspectives indicated, among other things, that there was a real need to address gaps between employer expectations and higher education outcomes, especially of newly graduated engineers and the effectiveness and efficiency of graduates in the workplace.

### **3. METHODOLOGY**

#### **3.1 Conceptual Framework of the Study**

The Conceptual Framework of the Study and the associated organisation of the survey are depicted in Figure 1 below. It indicates that the study consisted of two parts, i.e. an Employer Study and Student Demand Study, It indicates that the opinions of employers and prospective students were obtained through a web-based survey and that the views of respondents were evaluated in terms of various cohorts, e.g. at individual, group and aggregate level.



**FIGURE 1: Conceptual Framework of the Study**

### 3.2 Population sampling

This section explains the methods and techniques used to collect and analyse the data for the study. The sample population, data-collection procedures and data analyses instruments are discussed in more detail in the sections below.

#### 3.2.1 Employer Study

##### Civil Engineering employer cohort

The target population was employer representatives with the relevant experience, professional profile and who has, or may, in the future, interact with civil engineering students and graduates from WSU. A purposive sampling method was adopted and contact details of employer representatives were extracted from the WSU Civil Engineering department's database of Advisory Board members and Work Integrated Learning (WIL) mentors. The sample was expanded to include industry and vocational society members of the Eastern Cape branches of the South African Civil Engineering Institution (SAICE) and Institute of Municipal Engineering of Southern Africa (IMESA). A total of 613 employer representatives were identified through this process and constituted the purposive Civil Engineering employer cohort sample.

##### Electrical and Mechanical Engineering employer cohorts

As was the case for civil engineering, employer representatives were targeted who had the relevant experience, professional profile and who has, or may, in the future, interact with electrical and mechanical engineering students and graduates from WSU. The reason for combining the employer cohorts for these two disciplines was to prevent employer representatives having to complete two questionnaires, as companies in these two sectors often employ both electrical and mechanical graduates. Contact details of employer representatives were extracted from the WSU Electrical and Mechanical Engineering departments' Advisory Board member databases and the departmental records of persons who served as mentors as part of the Work Integrated Learning (WIL) training of students. A total of 84 electrical and mechanical employer representatives were identified through this

process. The targeted employer cohorts were expanded with the inclusion of the merSETA database of its Employer Stakeholders within the Eastern Cape. Due to need for adherence to privacy legislation and related merSETA policies the names and number of merSETA Employer Stakeholders targeted could not be made available to WSU.

### **3.2.2 Student Demand Study**

The target population for the demand study was drawn from recent WSU engineering alumni, i.e. those who graduated with a National Diploma (ND) or BTech engineering qualification from any of the WSU campuses in period 2010 to 2017. Where records were available, senior (S4) ND students and BTech students, who did not complete their ND qualification at WSU were added to the targeted population. Contact details of prospective students were extracted from WSU's graduation and ITS databases, which was supplemented with departmental records, where these existed.

### **3.3 Instruments**

The instruments used in the study are discussed in more detail in the sections below.

#### **3.3.1 Employer Study**

A descriptive and evaluative questionnaire, utilising the software package Survey Monkey was used to develop the data collection instrument. The instrument for the Civil Engineering employer cohort had a total of 14 questions, while the instrument for the Electrical and Mechanical Engineering employer cohorts had a total of 15 questions. The reason for adding an additional question to the Electrical and Mechanical Engineering employer questionnaire was to allow for a separation of responses in analysing Electrical and Mechanical qualifications needs.

The questionnaire was distributed to the sample through email messages with a web-based link to the questionnaire. The email message also contained a detailed information sheet that explained the purpose of the survey, ethical considerations and a request for consent to willingly participate in the survey. The respondents were provided with the opportunity to opt out of the survey, either at the start or during the survey.

The survey instrument consisted of a combination of multiple choice, Likert scale and open-ended questions. Employer representatives were asked specific questions relating to:

- the type and size of their organisation,
- their academic qualifications and professional status,
- field(s) of specialisation,
- job designation,
- gender,
- age and
- years of experience.

In addition respondents were asked to:

- indicate the extent to which their organisation need graduates with each of the engineering qualifications that are on offer,
- indicate whether there any other engineering qualification(s) needed in industry and which WSU should consider offering,
- indicate how many graduates from the WSU their company has employed within the last five years,
- rate the competency of graduates from WSU in terms of an abbreviated version of the exit level outcomes and graduates attributes, as contained in the new ECSA qualifications standards,

- indicate the five most important criteria used in the recruitment of newly qualified engineering graduates within their organisation,
- indicate whether there is a need for any competency areas (needed in employment) that should be expanded on, or more comprehensively covered in the curriculum.

### **3.3.2 Student Demand Study**

A descriptive and evaluative questionnaire, utilising the software package Survey Monkey was used to develop the data collection instrument. The instrument for the targeted groups of the three engineering disciplines were generic with the exception that each of the discipline instruments were aligned with the respective qualifications that are on offer in that specific field. Each student demand study instrument had a total of 16 questions and comprised of multiple choice, Likert scale and open-ended questions. Prospective students were asked to answer questions as to their:

- gender,
- age,
- academic career path and qualifications,
- year in which completed their highest engineering qualification,
- which university/campus they graduated from,
- whether they are currently employed,
- what the focus area are of their organisation.

In addition respondents were asked to:

- indicate whether they would be interested in enrolling for qualifications that WSU consider offering,
- indicate when they are likely to enrol for these qualifications,
- indicate their preferred mode of study,
- indicate their preferred campus for attending,
- indicate if there are any other engineering qualifications that they would like to see WSU offer,
- comment on any aspect of the survey,
- indicate if they would be willing to participate in follow up group discussions.

### **3.4 Piloting**

The content, structure and applicability of the questionnaires compiled for the Employer and Student Demand Study were discussed with engineering HoD's and with the Senior Manager: Strategy & Research at merSETA. As a result of the discussions aspects of the questionnaires were changed which included; standardisation of company size classification, providing a choice for some questions of "not able to respond", application of logic features in questionnaire that respondents skip to a specific question on a later page, based on their answer to a previous closed-ended question. The measures so adopted was aimed at improving the face and construct validity of the questionnaires.

### **3.5 Data collection**

#### **3.5.1 Employer Study**

##### Overall

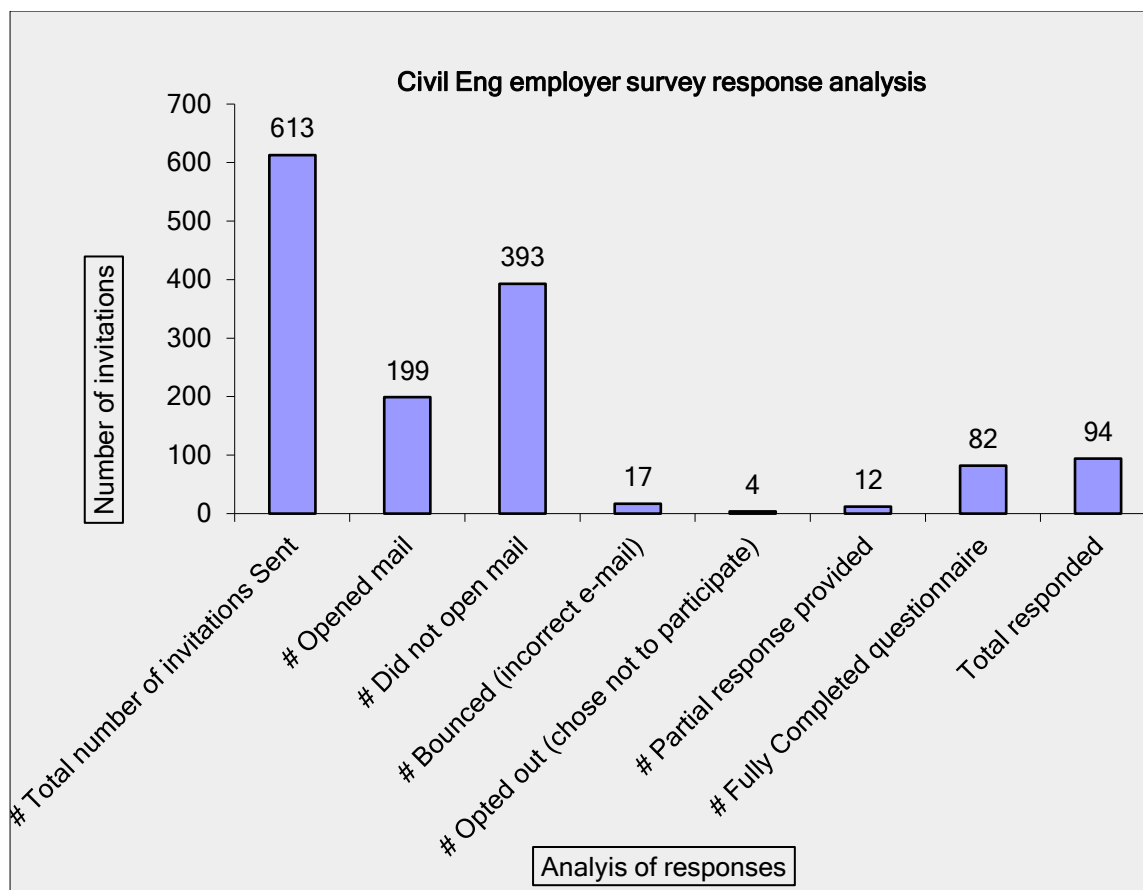
A total of 697 invitations were sent out to employer representatives across the three engineering disciplines. This number excludes invitations sent to the merSETA Employer Stakeholder group, as these numbers are not known (the reasons as was explained earlier). The distribution of data collected from the respective engineering employer representative cohorts are as indicated in Table 1 and Figures 2 & 3.

**TABLE 1: Summary of invitations & responses: Employer survey**

Cohort	# Total number of invitations Sent	# Opened mail	As percentage of invitation sent (%)	# Did not open mail	As percentage of invitation sent (%)	# Bounced (incorrect e-mail)	As percentage of invitation sent (%)	# Opted out (chose not to participate)	As percentage of invitation sent (%)	# Partial response provided	As percentage of invitation sent (%)	# Fully Completed questionnaire	As percentage of invitation sent (%)	Total responded	As percentage of invitation sent (%)	As percentage of opened (%)
Civil	613	199	32%	393	64%	17	3%	4	1%	12	2%	82	13%	94	15%	47%
Electrical	31	13	42%	14	45%	4	13%	0	0%	1	3%	10	32%	11	35%	85%
Mechanical	53	23	43%	26	49%	4	8%	0	0%	2	4%	16	30%	18	34%	78%
<b>Total</b>	<b>697</b>	<b>235</b>	<b>34%</b>	<b>433</b>	<b>62%</b>	<b>25</b>	<b>4%</b>	<b>4</b>	<b>1%</b>	<b>15</b>	<b>2%</b>	<b>108</b>	<b>15%</b>	<b>123</b>	<b>18%</b>	<b>52%</b>

Civil Engineering employer cohort

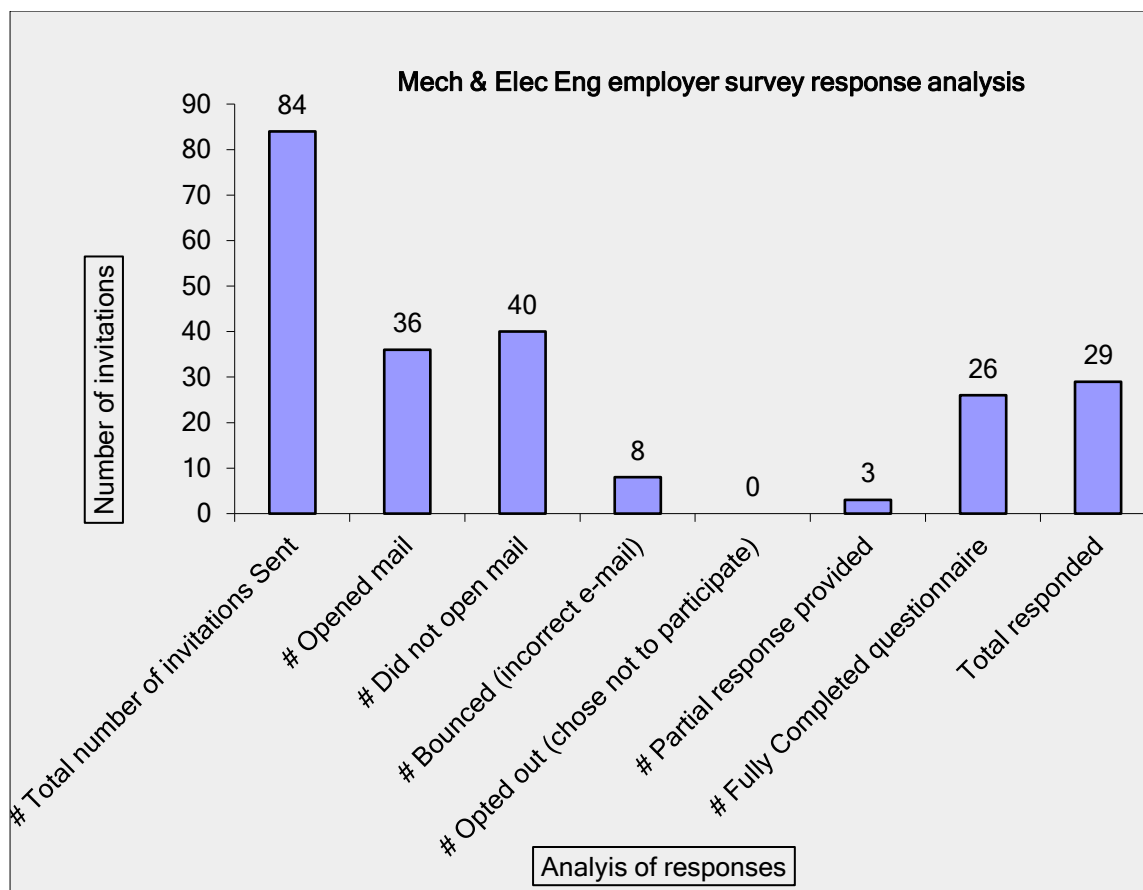
The survey questionnaire was sent to 613 civil engineering employer representatives. The distribution of the survey was web-based through use of an e-mail collector type. An email collector type enables individual responses to be tracked, reminder messages to be send out (to those who have not completed the questionnaire) and thank you messages to be send out (to those who have completed it). Each person targeted in the survey therefore receives a personalised email message. The email message contains detailed information as to the purpose and objectives of the survey, a hyperlink to the ECSA website that provided detailed information of the new engineering qualification standards, approximate time requirements to complete the survey and a hyperlink (in the form of a button) at the end of the message which enabled the employer representatives to commence with the survey. The contact details of the WSU researcher was also provided to assist respondents who had a need to obtain further information or wished to ask follow up questions.



**FIGURE 2: Civil Engineering employers’ response analysis**

#### Electrical and Mechanical Engineering employer cohort

A single, combined cohort of Employer representatives was created for the Electrical and Mechanical Engineering disciplines. This cohort comprised of two groups, drawn from different sources. The first group of 84 electrical and mechanical Employer representatives were selected from the WSU departmental employer databases. The second group consisted of merSETA Employer Stakeholders in the Eastern Cape. The way in which the survey was distributed to the two groups differed, insofar the collector type that was used. An e-mail collector type was used for the distribution of the survey to the group drawn from the WSU databases. The distribution of the survey to the second group (drawn from merSETA database) was distributed by merSETA’s regional office through use of an URL collector type. The difference between an e-mail collector type and URL collector type is that a URL collector type does not allow for individual responses to be tracked. It is therefore not possible to send selective reminder and thank you messages to individuals when using this type of collector. Except for the collector type, the targeted population for both groups received exactly the information, which included an explanation as to the objectives of the survey, a hyperlink to the ECSA website where more detailed information as to the new engineering qualification standards could be accessed, approximate time requirements to complete the survey and a hyperlink (in the form of a button) at the end of the message which enabled the prospective student to commence with the survey.



**FIGURE 3: Mech and Elec Engineering employers' response analysis**

### 3.4.2 Student Demand Study

Invitations to participate in the survey questionnaire were sent out to a total of 749 prospective students. The distribution of data collected from the prospective engineering student cohorts are as indicated in Table 2.

**TABLE 2: Summary of invitations & responses: Student demand study**

Cohort	# Total number of invitations Sent	# Opened mail	As percentage of invitation sent (%)	# Did not open mail	As percentage of invitation sent (%)	# Bounced (incorrect e-mail)	As percentage of invitation sent (%)	# Opted out (chose not to participate)	As percentage of invitation sent (%)	# Partial response provided	As percentage of invitation sent (%)	# Fully Completed questionnaire	As percentage of invitation sent (%)	Total responded	As percentage of invitation sent (%)	As percentage of opened (%)
Civil	332	194	58%	107	32%	29	9%	2	1%	15	5%	92	28%	107	32%	55%
Electrical	135	78	58%	46	34%	11	8%	0	0%	4	3%	51	38%	55	41%	71%
Mechanical	282	164	58%	84	30%	34	12%	0	0%	12	4%	90	32%	102	36%	62%
<b>Total</b>	<b>749</b>	<b>436</b>	<b>58%</b>	<b>237</b>	<b>32%</b>	<b>74</b>	<b>10%</b>	<b>2</b>	<b>0%</b>	<b>31</b>	<b>4%</b>	<b>233</b>	<b>31%</b>	<b>264</b>	<b>35%</b>	<b>61%</b>



Of the invitations sent, 332 went to prospective Civil Engineering students, 135 to prospective Electrical Engineering students and 282 to prospective Mechanical Engineering students. In all cases an e-mail collector type was used for the distribution of the survey. Each prospective student therefore received a personalised email message that provided detailed information of the survey. This included an explanation as to the objectives of the survey, a hyperlink to the ECSA website where more detailed information as to the new engineering qualification standards could be accessed, approximate time requirements to complete the survey and a hyperlink (in the form of a button) at the end of the message which enabled the prospective student to commence with the survey.

### **3.6 Response rate**

#### **3.6.1 Employer Study**

##### Overall

235 (34%) of the total of 697 mail messages, inviting employer representatives to participate in the survey were opened. The balance consisted of 433 (62%) employer representatives who did not open the mail message at all, with a further 25 (4%) of the targeted population whose e-mail messages bounced, i.e. the addresses were invalid. The high number of unopened e-mails can possibly be attributed to a combination of factors such as: the mail message not reaching the targeted audience due to firewalls and filters that exist within many organisations; work pressure constraints, resulting in a reluctance to spend time on non-work matters; fear that participation in a survey may expose the participant to internet viruses. Bundled messages, such as that used as part of the survey's email collector method, are also prone to being classified as spam mail by firewalls. Tracking does not provide information as to whether a message was delivered to a recipient's mail or spam mail, box. The only way to overcome this is to phone the non-respondent and ask whether they had received the message. This approach does however takes time and is not always practical as resources are required to do follow ups. It was therefore not possible to do extensive follow ups, with follow ups being limited to group cohorts, where the number of responses were low. As pointed out by one of the targeted population, spam mail is often not seen by recipients, as they are unaware of the request to participate in the survey, given that they do not tend to be aware what is in their spam mail box.

123 (52%) of the 235 employer representatives who opened their mail messages completed the survey, either in partial or in full. The overall response rate is therefore 18%, if measured on invitations sent and 52%, based on invitations opened. The acquired response rates are deemed satisfactory, given that a response rate of between 10% and 20% of the population in descriptive research is viewed to be reasonable (Gay, Mills and Airasian 2011). Archer (2008) pointed out that if the primary goal of the survey was to measure quality, then low response rates may yield just as meaningful results if a reasonable breadth and range of the population sample was reached, as was the case in this study.

##### Civil Engineering employers

199 (32%) of the total of 613 mail messages, inviting Civil Engineering employer representatives to participate in the survey were opened. 393 (64%) of the employer representatives did not open their mail messages, while 17 (3%) of the targeted population e-mail messages bounced, and 4 (1%) opted out of the survey. 94 (47%) of the 199 Civil Engineering employer representatives who opened their mail messages completed the survey, either in partial or in full.

#### Electrical Engineering employers

13 (42%) of the total of 31 mail messages, inviting Electrical Engineering employer representatives to participate in the survey were opened. 14 (45%) of the employer representatives did not open their mail messages, while 4 (13%) of the targeted population e-mail messages bounced. 11 (85%) of the 13 Electrical Engineering employer representatives who opened their mail messages completed the survey, either in partial or in full.

#### Mechanical Engineering employers

23 (43%) of the total of 53 mail messages, inviting Mechanical Engineering employer representatives to participate in the survey were opened. 26 (49%) of the employer representatives did not open their mail messages, while 4 (13%) of the targeted population e-mail messages bounced. 18 (78%) of the 23 Mechanical Engineering employer representatives who opened their mail messages completed the survey, either in partial or in full.

### **3.6.2 Student Demand Study**

#### Overall

436 (58%) of the total of 749 mail messages, inviting prospective students to participate in the survey were opened. 237 (32%) prospective students did not open their mail messages, 74 (18%) of the targeted student population's e-mail messages bounced, and 2 (0.6%) of prospective students opted out of the survey. 264 (61%) of the 436 prospective students who opened their mail messages completed the survey, either in partial or in full. The overall response rate is therefore 35%, if measured on invitations sent, while it is 61%, if the response rate is based on completed surveys based on respondents who opened the invitations. The acquired response rate are deemed adequate given the 7.2% response rate reported by Basson (2017) in a similar survey study among Stellenbosch University engineering graduates and the 22.5% response rate reported in the graduate tracer survey study conducted among graduates in the Western Cape (CHEC 2013).

#### Prospective Civil Engineering students

194 (58%) of the total of 332 mail messages, inviting prospective Civil Engineering students to participate in the survey were opened. 107 (32%) of the prospective students did not open their mail messages, while 29 (9%) of the targeted population e-mail messages bounced and 2 (0.3%) opted out of the survey. 107 (55%) of the 194 prospective Civil Engineering students who opened their mail messages completed the survey, either in partial or in full.

#### Prospective Electrical Engineering students

78 (58%) of the total of 135 mail messages, inviting prospective Electrical Engineering students to participate in the survey were opened. 46 (34%) of the prospective students did not open their mail messages, while 11 (8%) of the targeted population e-mail messages bounced. 55 (71%) of the 78 prospective Electrical Engineering students who opened their mail messages completed the survey, either in partial or in full.

#### Prospective Mechanical Engineering students

164 (58%) of the total of 282 mail messages, inviting prospective Mechanical Engineering students to participate in the survey were opened. 84 (30%) of the prospective students did not open their mail messages, while 34 (12%) of the targeted population e-mail messages bounced. 102 (62%) of the 164 prospective Mechanical Engineering students who opened their mail messages completed the survey, either in partial or in full.

### 3.7 Data analysis

Results of the closed-ended questions were presented as frequency tables and charts, which were plotted using SPSS version 20 and 24 software and Microsoft Excel spreadsheets. Cross tabulation and the chi-square tests were used to compare categorical data. Comparisons of Likert scale variables were done by the Kruskal-Wallis statistical test. Open-ended questions were reported in descriptive statements. A summary of selected results are given below.

## 4. RESULTS AND DISCUSSION

### 4.1 Employer Study

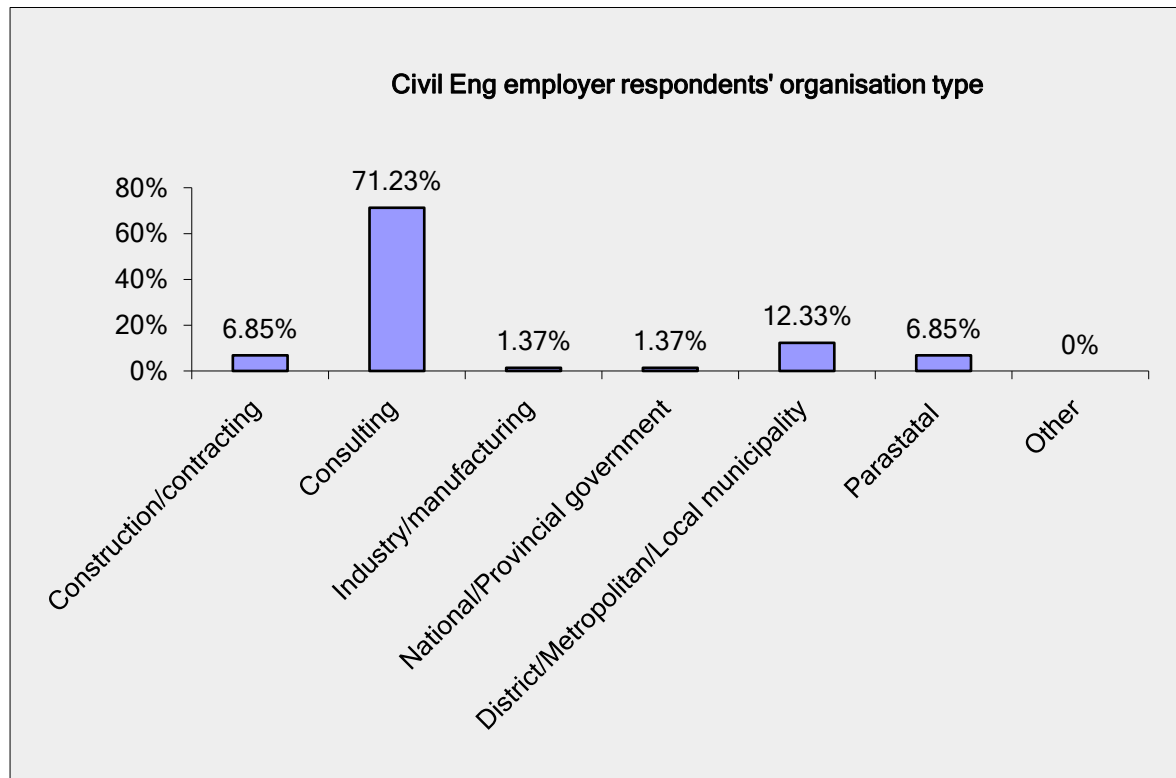
#### 4.1.1 Civil Engineering employer demographics

##### Distribution of respondents by organisation

Results of the type of organisation where employer representatives work are presented in Table 3 and Figure 4.

**TABLE 3: Civil Engineering employers' organisation categories (n=73)**

Type of organisation	Count	Percentage
Construction/contracting	5	6.85%
Consulting	52	71.23%
Industry/manufacturing	1	1.37%
National/Provincial government	1	1.37%
District/Metropolitan/Local municipality	9	12.33%
Parastatal (wholly, or partly owned government entity)	5	6.85%
Other	0	0%



**FIGURE 4: Civil Engineering employers' organisation categories (n=73)**

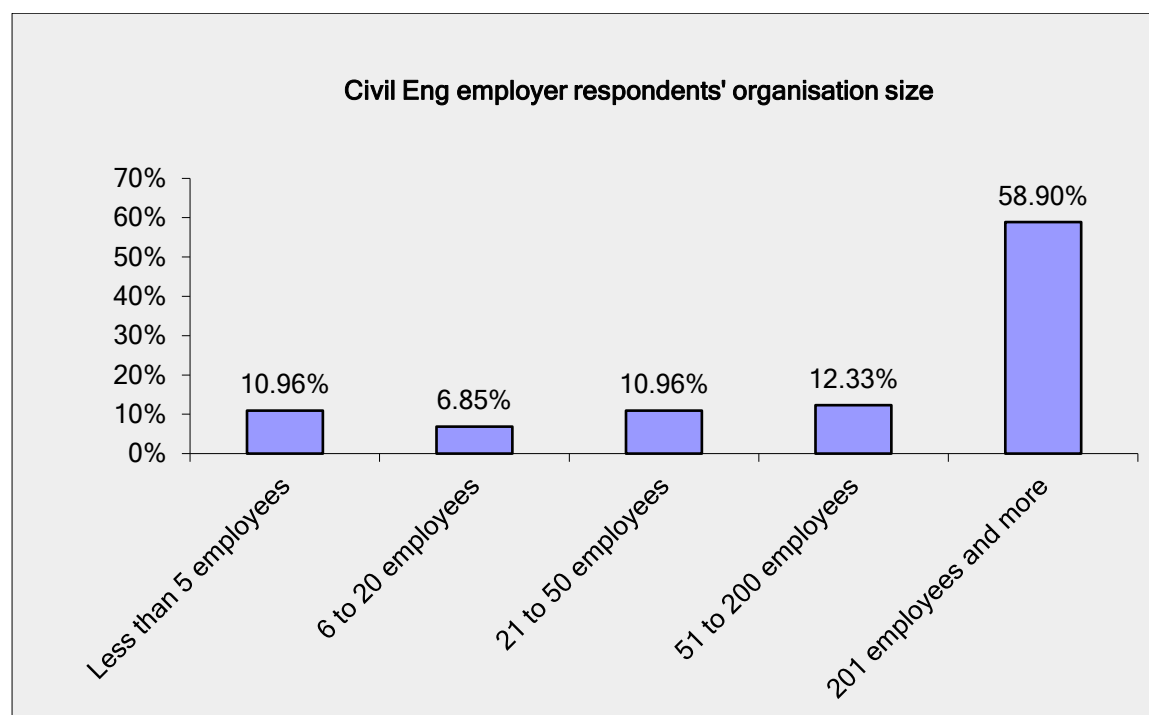
The results revealed that 71.23% of the civil engineering respondents represented consulting engineering firms while 13.70% of respondents representing public institutions such as government departments and municipalities. Construction companies and parastatals both have a 6.85% representation.

#### Size of organisation

Table 4 shows the size of companies, for whom employer representatives work. It was necessary to establish the distribution of respondents by size of the enterprise to determine the degree to which the views of employer representatives working for bigger and smaller companies vary.

**TABLE 4: Number of workers in the company (n=73)**

Number of workers	Count	Percentage
Less than 5 employees	8	10.96%
6 to 20 employees	5	6.85%
21 to 50 employees	8	10.96%
51 to 200 employees	9	12.33%
201 employees and more	43	58.90%



**FIGURE 5: Civil Engineering employers' organisation size (n=73)**

Table 4 and Figure 5 show that 58.90% of the respondents work within companies that employ between 201 workers or more, while respondents, who are employed in companies where there are less than 5 workers were in the minority at 10.96%.

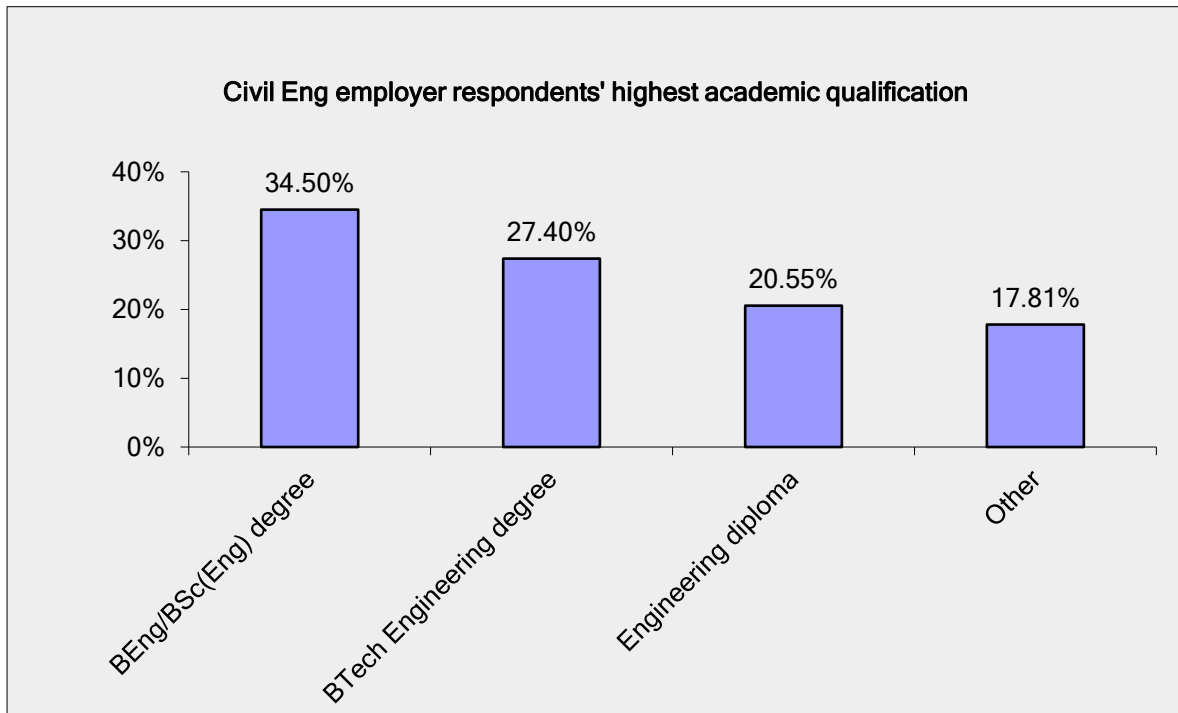
#### Academic qualifications of respondents

It was deemed useful to establish the academic qualifications of respondents to determine whether the views of employer representatives vary depending on their academic qualifications.

**TABLE 5: Academic qualification of Civil Engineering respondents (n=73)**

Academic qualification status of respondents	Count	Percentage
BEng/BSc(Eng) degree	25	34.50%
BTech Engineering degree	20	27.40%
Engineering diploma	15	20.55%
Other	13	17.81%

Table 5 and Figure 6 indicate that 61.9% of the respondents possessed an Engineering degree with 20.55% having an Engineering Diploma. 17.81% of the respondents had other qualifications.

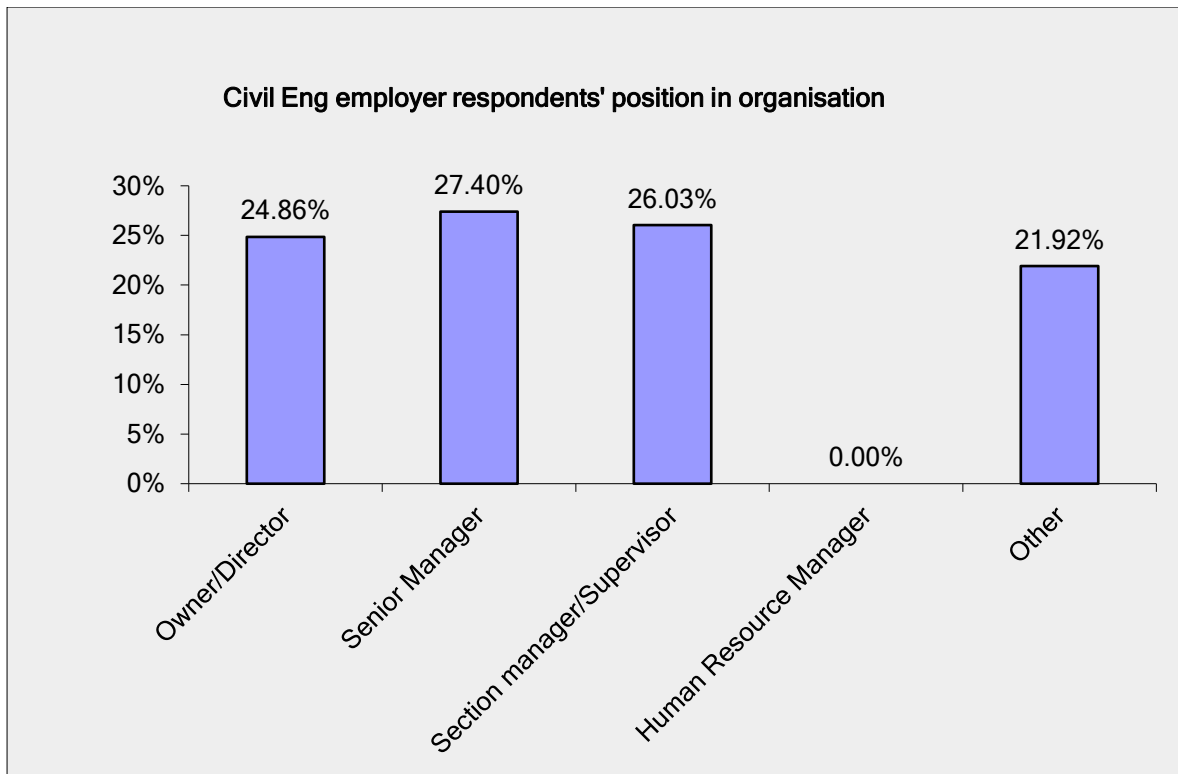
**FIGURE 6: Academic qualification of Civil Engineering respondents (n=73)**

#### Respondents' position in the organisation

Respondents were predominantly drawn from senior management and supervisor groups, with a near equal distribution among these two groups. Results on the full distribution of respondents by position are indicated in Table 6 and Figure 7.

**TABLE 6: Respondents' position in the organisation (n=73)**

Respondents' position in the organisation	Count	Percentage
Owner/Director	18	24.86%
Senior Manager	20	27.40%
Section manager/Supervisor	19	26.03%
Human Resource Manager	0	0.00%
Other	16	21.92%



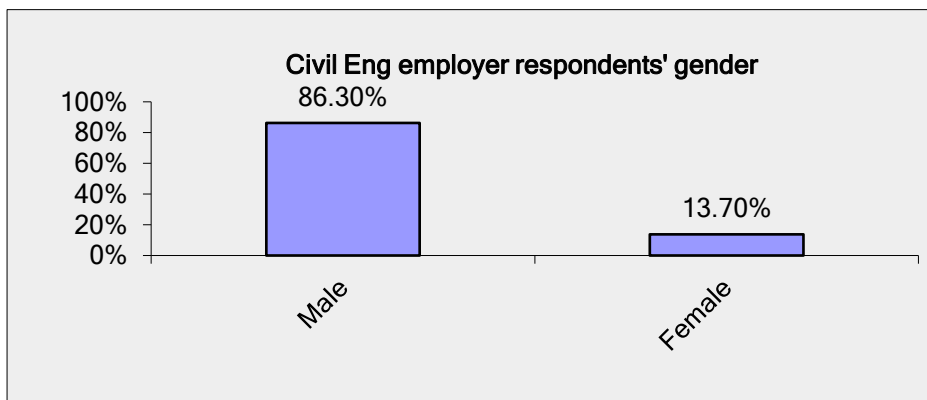
**FIGURE 7: Civil Engineering employers' position in organisation (n=73)**

Distribution of respondents by gender

Table 7 and Figure 8 show that male respondents were by far in the majority, representing 86.30% of the total, while the female respondents made up only 13.70% of the respondents.

**TABLE 7: Gender of Civil Engineering respondents (n=73)**

Gender of respondents	Count	Percentage
Male	63	86.30%
Female	10	13.70%



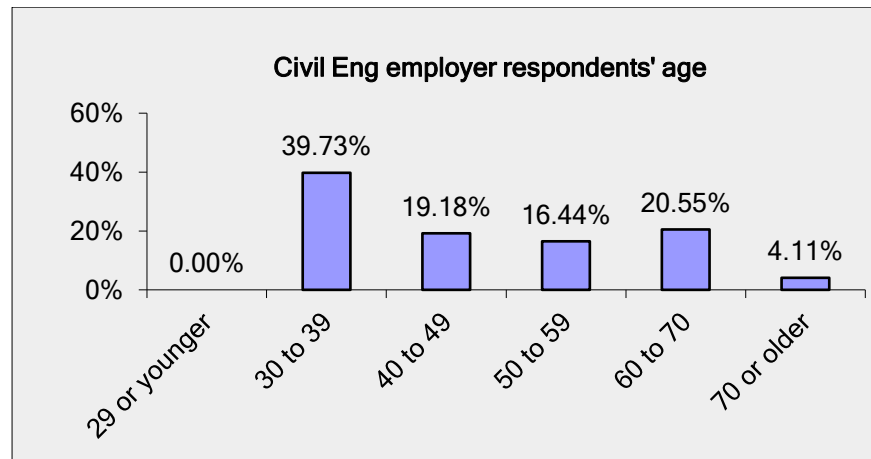
**FIGURE 8: Gender of Civil Engineering respondents (n=73)**

Distribution of respondents by age

Table 8 and Figure 9 show that respondents in the age group 30 to 39 were the group with largest distribution at 39.73%.

**TABLE 8: Age of Civil Engineering respondents (n=73)**

Age of respondents	Count	Percentage
29 or younger	0	0.00%
30 to 39	29	39.73%
40 to 49	14	19.18%
50 to 59	12	16.44%
60 to 70	15	20.55%
70 or older	3	4.11%

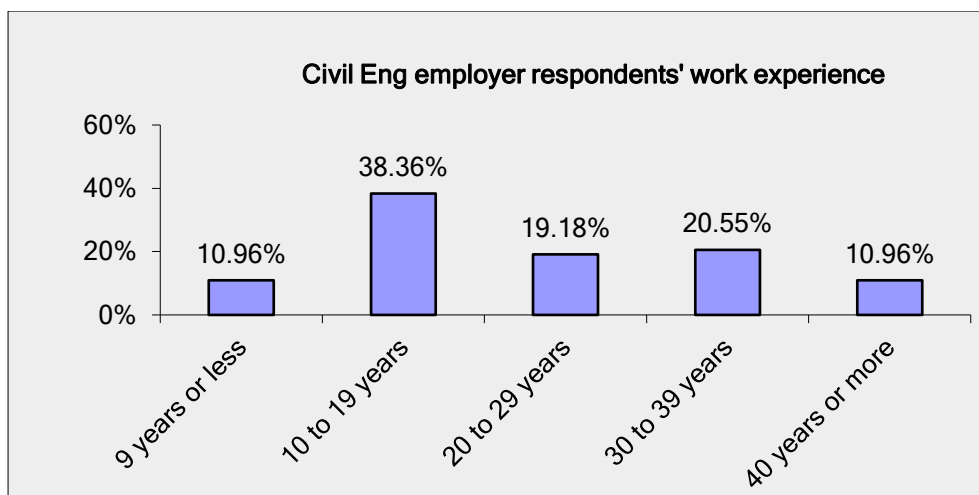
**FIGURE 9: Age of Civil Engineering respondents (n=73)**

#### Experience of respondents

Information on experience of respondents was obtained to establish the degree to which respondents with different years of experience agree/disagree on the competencies of graduates entering the workplace. The largest group (38.8%) were respondents who had between 10 to 19 years' experience. The distribution of groups by experience are shown in Table 9 and Figure 10.

**TABLE 9: Experience of respondents (n=73)**

Experience of respondents	Count	Percentage
9 years or less	8	10.96%
10 to 19 years	28	38.36%
20 to 29 years	14	19.18%
30 to 39 years	15	20.55%
40 years or more	8	10.96%



**FIGURE 10: Work experience of Civil Engineering respondents (n=73)**

#### 4.1.2 Employer views as to Civil Engineering qualifications needs

Employer representatives were asked to indicate the extent to which their organisation need graduates with HEQSF-aligned engineering qualifications at Diploma, Advanced Diploma, Bachelor's degree (BEng Tech), Honours and Masters level. Respondents were asked to rate their need on the following rating scale: "definitely don't need", "probably don't need", "undecided", "probably need", "definitely need". In order to assess the importance of the competencies (on the basis of the responses), the ratings were treated as a five-point ordinal Likert scale, with a linear allocation of values (1, 2, 3, 4, 5) given to the ratings increments from "definitely don't need" to "definitely need". It is acknowledged that it cannot be stated for certain that the interval between "definitely don't need" and "probably don't need" is equivalent to the interval between "probably don't need" and "undecided". The practice to treat ordinal data as though it were interval level data, and conduct statistical tests that are appropriate for interval level data are not uncommon in social sciences research, and may be permissible if the statistical analytic procedure you are considering, and the substantive meaning and the interpretability of the statistics you are computing are based on informed, sound judgment (Virginia Tech, n.d.; Griesel and Parker, 2009; Nic & Rarr, 2013).

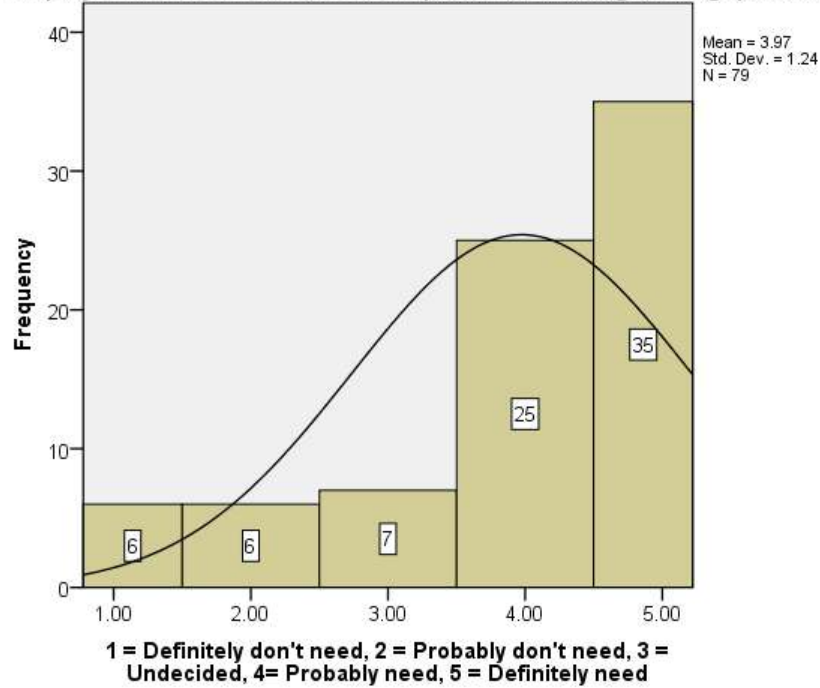
Tables 10-14 and Figures 11-15 below show employer responses as to the choice of Civil Engineering qualifications that WSU is consider offering.

**TABLE 10: Civil Eng employer views as to need for Diploma in Civil Engineering**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	6	6.4	7.6	7.6
	Probably don't need	6	6.4	7.6	15.2
	Undecided	7	7.4	8.9	24.1
	Probably need	25	26.6	31.6	55.7
	Definitely need	35	37.2	44.3	100.0
	Total	79	84.0	100.0	
Missing	System	15	16.0		
Total		94	100.0		



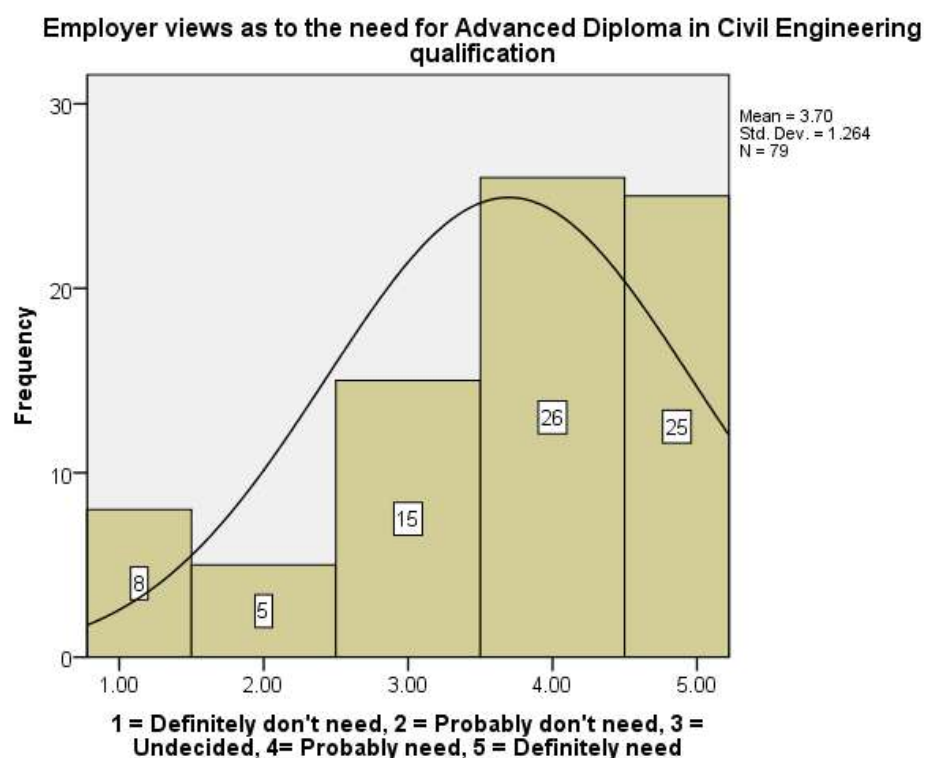
Employer views as to the need for Diploma in Civil Engineering qualification



**FIGURE 11: Civil Eng employer views: Diploma in Civil Engineering (n=79)**

**TABLE 11: Civil Eng employer views as to need for Advanced Diploma in Civil Engineering**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	8	8.5	10.1	10.1
	Probably don't need	5	5.3	6.3	16.5
	Undecided	15	16.0	19.0	35.4
	Probably need	26	27.7	32.9	68.4
	Definitely need	25	26.6	31.6	100.0
	Total	79	84.0	100.0	
Missing	System	15	16.0		
Total		94	100.0		

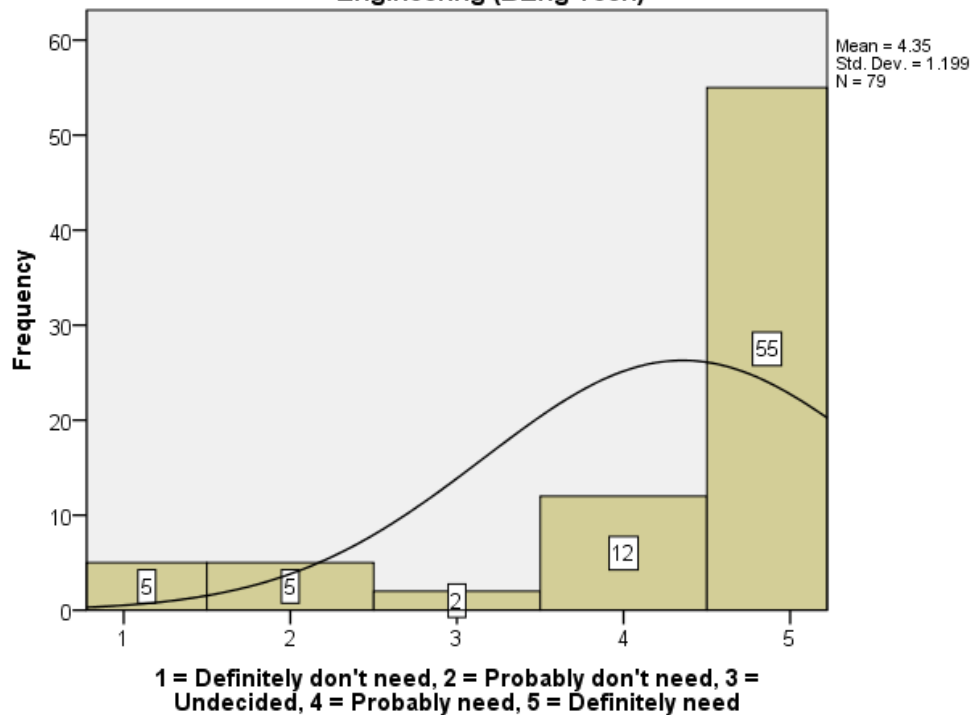


**FIGURE 12: Civil Eng employer views: Advanced Diploma in Civil Engineering (n=79)**

**TABLE 12: Civil Eng employer views as to need for Bachelor of Engineering Technology in Civil Engineering (BEng Tech)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	5	5.3	6.3	6.3
	Probably don't need	5	5.3	6.3	12.7
	Undecided	2	2.1	2.5	15.2
	Probably need	12	12.8	15.2	30.4
	Definitely need	55	58.5	69.6	100.0
Total		79	84.0	100.0	
Missing	System	15	16.0		
Total		94	100.0		

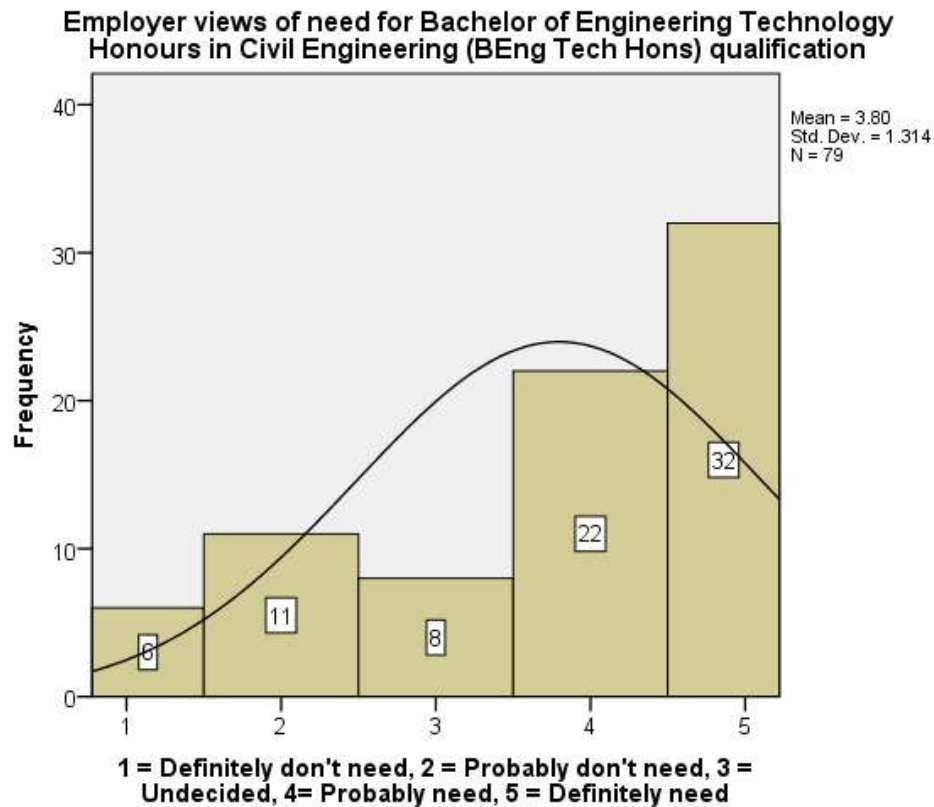
**Employer views as to the need for Bachelor of Engineering Technology in Civil Engineering (BEng Tech)**



**FIGURE 13: Civil Eng employer views: BEng Tech (n=79)**

**TABLE 13: Civil Eng employer views as to need for Bachelor of Engineering Technology Honours in Civil Engineering (BEng Tech Hons)**

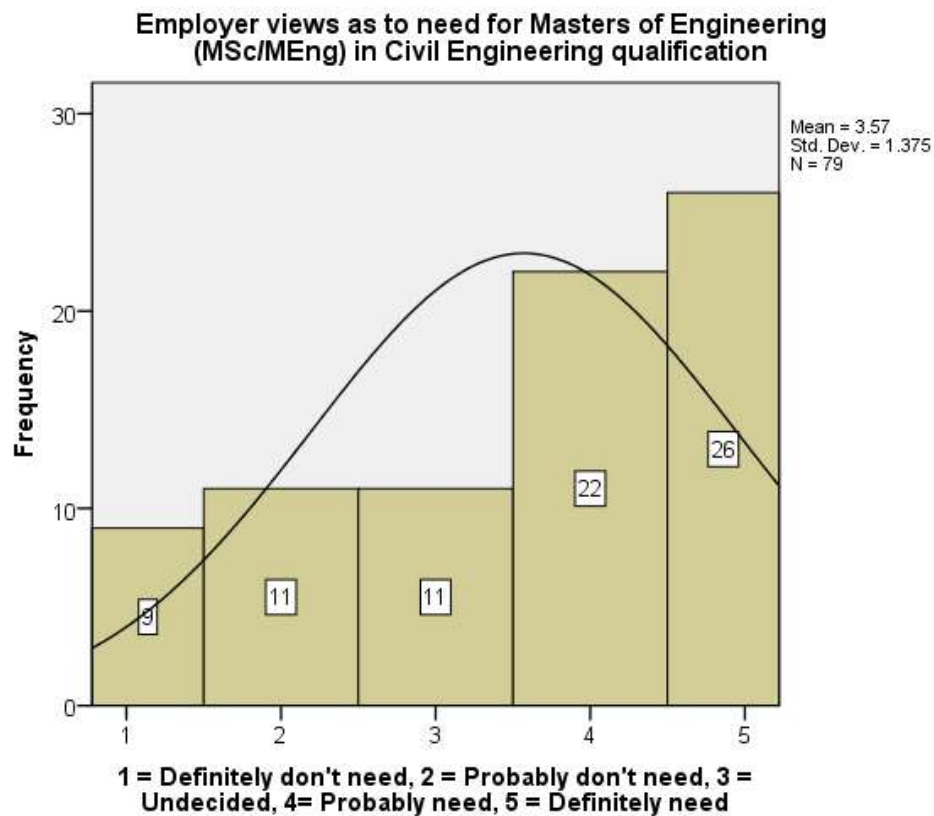
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	6	6.4	7.6	7.6
	Probably don't need	11	11.7	13.9	21.5
	Undecided	8	8.5	10.1	31.6
	Probably need	22	23.4	27.8	59.5
	Definitely need	32	34.0	40.5	100.0
Total		79	84.0	100.0	
Missing	System	15	16.0		
Total		94	100.0		



**FIGURE 14: Civil Eng employer views: BEng Tech Hons (n=79)**

**TABLE 14: Civil Eng employer views as to need for Masters of Engineering (MSc/MEng) in Civil Engineering**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	9	9.6	11.4	11.4
	Probably don't need	11	11.7	13.9	25.3
	Undecided	11	11.7	13.9	39.2
	Probably need	22	23.4	27.8	67.1
	Definitely need	26	27.7	32.9	100.0
	Total	79	84.0	100.0	
Missing	System	15	16.0		
Total		94	100.0		



**FIGURE 15: Civil Eng employer views: Master of Engineering (n=79)**

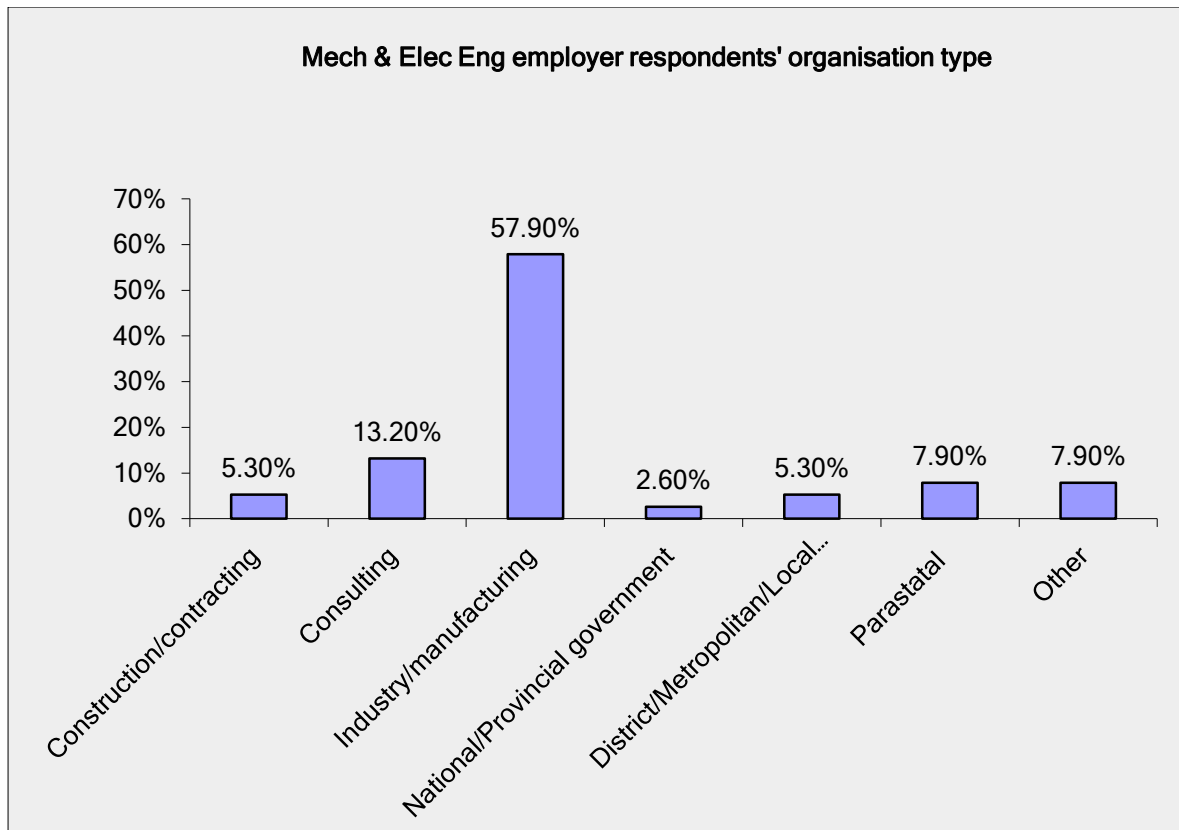
#### **4.1.3 Electrical and Mechanical Engineering employer demographics**

##### Distribution of respondents by organisation

Results of the type of organisation where Electrical & Mechanical employer representatives work are presented in Table 15 and Figure 16.

**TABLE 15: Electrical & Mechanical employers' organisation type (n=38)**

Type of organisation	Count	Percentage
Construction/contracting	2	5.3%
Consulting	5	13.2%
Industry/manufacturing	22	57.9%
National/Provincial government	1	2.6%
District/Metropolitan/Local municipality	2	5.3%
Parastatal (wholly, or partly owned government entity)	3	7.9%
Other	3	7.9%



**FIGURE 16: Mech & Elec Engineering employers' organisation categories (n=73)**

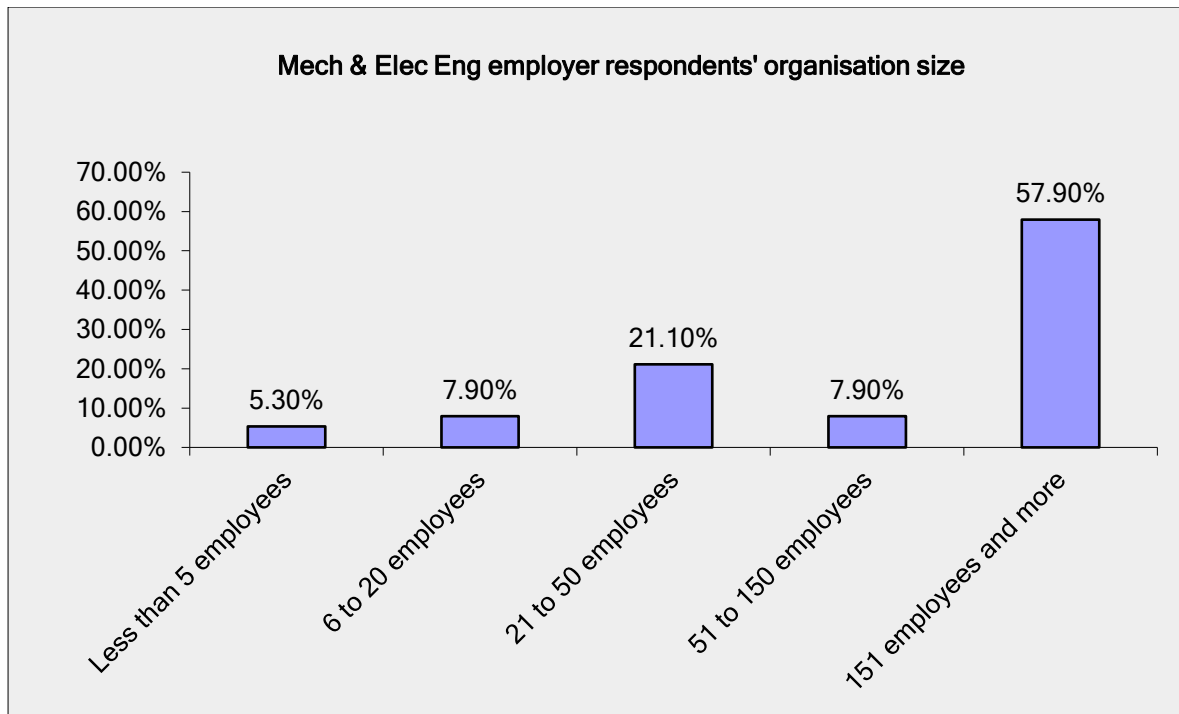
The results revealed that 57.90% of the respondents are working in industry/manufacturing, while 13.20% of respondents are working at consulting firms. Parastatals had a 7.90% representation, with smaller representations from municipalities, government departments and construction companies.

#### Size of organisation

Companies for whom employer representative's work varied in size are shown in Table 16 and Figure 17. Information on the distribution of respondents by size of the enterprise was established to allow for a comparison of the views of employer representatives working for bigger and smaller companies.

**TABLE 16: Electrical & Mechanical employers: number of workers in organisation (n=38)**

Number of workers	Count	Percentage
Less than 5 employees	2	5.30%
6 to 20 employees	3	7.90%
21 to 50 employees	8	21.10%
51 to 150 employees	3	7.90%
151 employees and more	22	57.90%



**FIGURE 17: Mech & Elec Engineering employers' organisation size (n=38)**

Table 16 shows that 57.90% of the respondents work within companies that employ between 151 workers or more. Respondents who are employed in companies where there are less than 5 workers were in the minority at 5.30%.

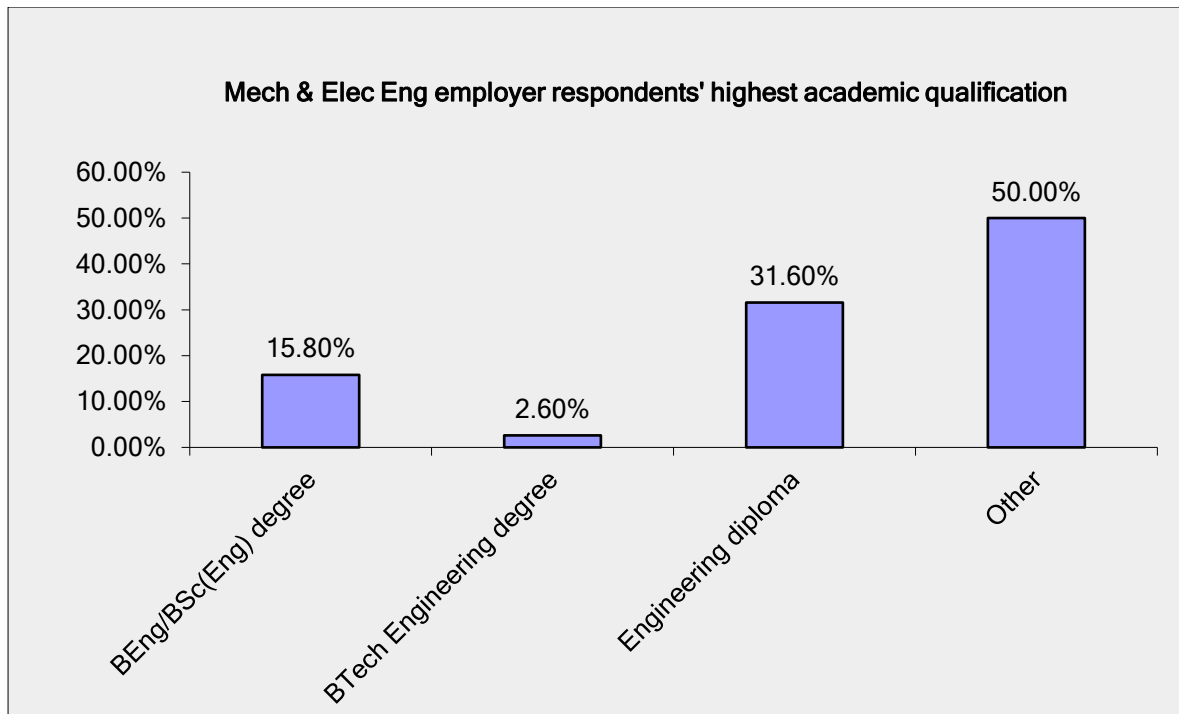
#### Academic qualifications of respondents

It was deemed useful to establish the academic qualifications of respondents to determine whether the views of employer representatives vary depending on their academic qualifications. Table 17 and Figure 18 show the distribution of academic qualification among Electrical & Mechanical respondents.

**TABLE 17: Electrical & Mechanical employers: academic qualification status of respondents (n=38)**

Academic qualification status of respondents	Count	Percentage
BEng/BSc(Eng) degree	6	15.80%
BTech Engineering degree	1	2.60%
Engineering diploma	12	31.60%
Other	19	50.00%

Table 17 indicates that 15.80% of the respondents have an Engineering degree with 31.60% having an Engineering Diploma while 50.00% have other qualifications.



**FIGURE 18: Academic qualification of Mech & Elec Engineering respondents (n=38)**

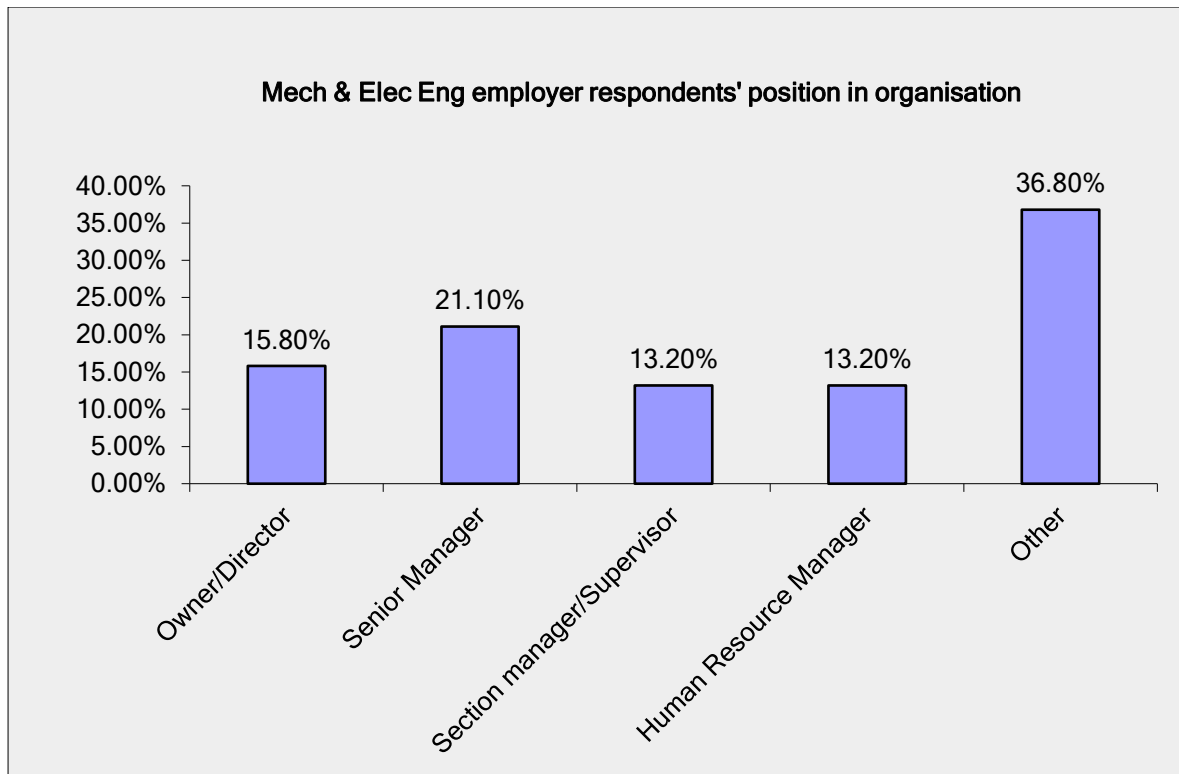
#### Respondents' position in the company

Respondents were predominantly drawn from senior management and supervisor groups with a near equal distribution among these groups. Results on the distribution of respondents by position are indicated in Table 18 and Figure 19.

**TABLE 18: Electrical & Mechanical employers: respondents' position in the organisation (n=38)**

Respondents' position in the organisation	Count	Percentage
Owner/Director	6	15.80%
Senior Manager	8	21.10%
Section manager/Supervisor	5	13.20%
Human Resource Manager	5	13.20%
Other	14	36.80%





**FIGURE 19: Mech & Elec Engineering employers' position in organisation (n=38)**

Positions listed by respondents in the category 'Other' include the following:

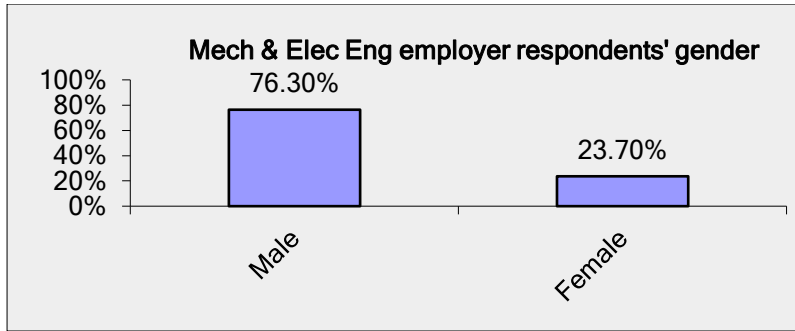
- Business Development Consultant
- Acting Senior Manager
- Office manager/Electrical technician
- Production manager
- Project Planning Specialist
- Sales, dispatching, inventory management
- Senior Engineer
- Senior Training Officer (Technical)
- Specialist
- Technical Training Manager
- Technical Training Specialist
- Training Manager

#### Distribution of respondents by gender

Table 19 and Figure 20 show that respondents by gender. It indicates that male respondents were, at 76.30% the majority, with females making up 23.70% of the respondents.

**TABLE19: Electrical & Mechanical employers: gender of respondents (n=38)**

Gender of respondents	Count	Percentage
Male	29	76.30%
Female	9	23.70%



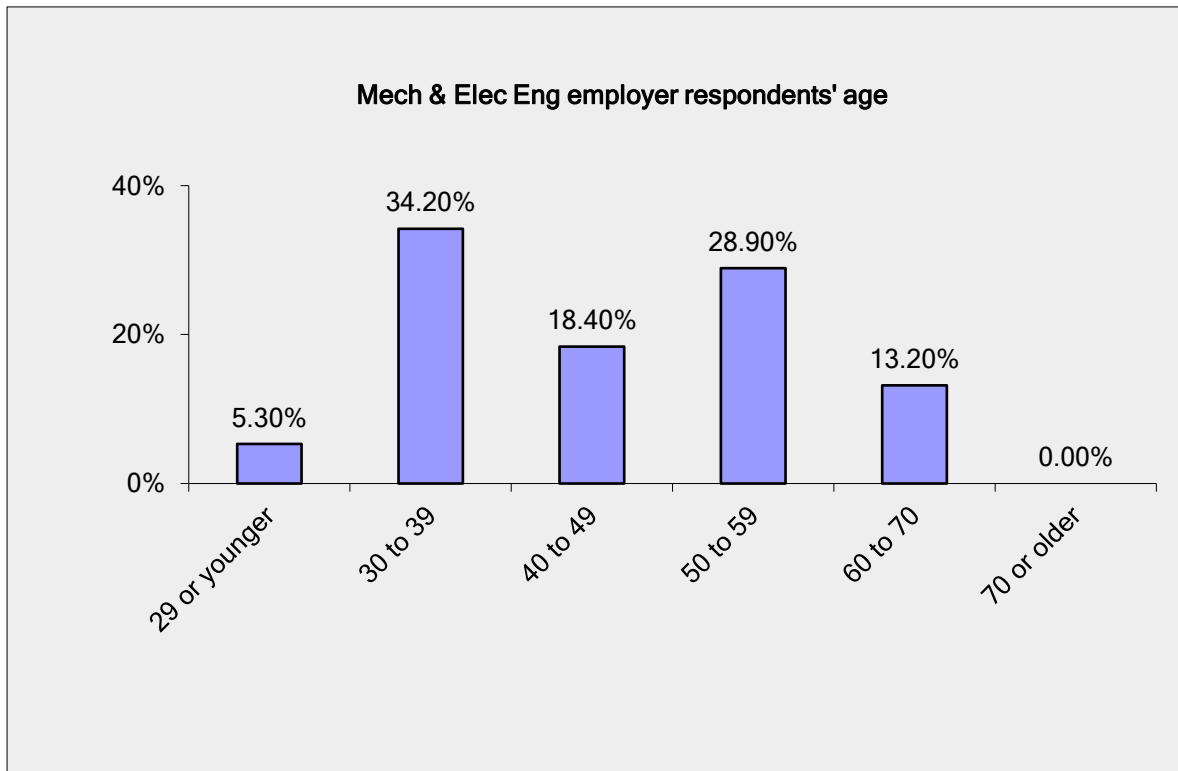
**FIGURE 20: Gender of Mech & Elec Engineering respondents (n=38)**

Distribution of respondents by age

The responses per age distribution is shown in Table 20 and Figure 21. The largest group of respondents at 34.20% to be in the age group 30 to 39.

**TABLE 20: Electrical & Mechanical employers: age of respondents (n=38)**

Age of respondents	Count	Percentage
29 or younger	2	5.3%
30 to 39	13	34.20%
40 to 49	7	18.40%
50 to 59	11	28.90%
60 to 70	5	13.20%
70 or older	0	0.00%



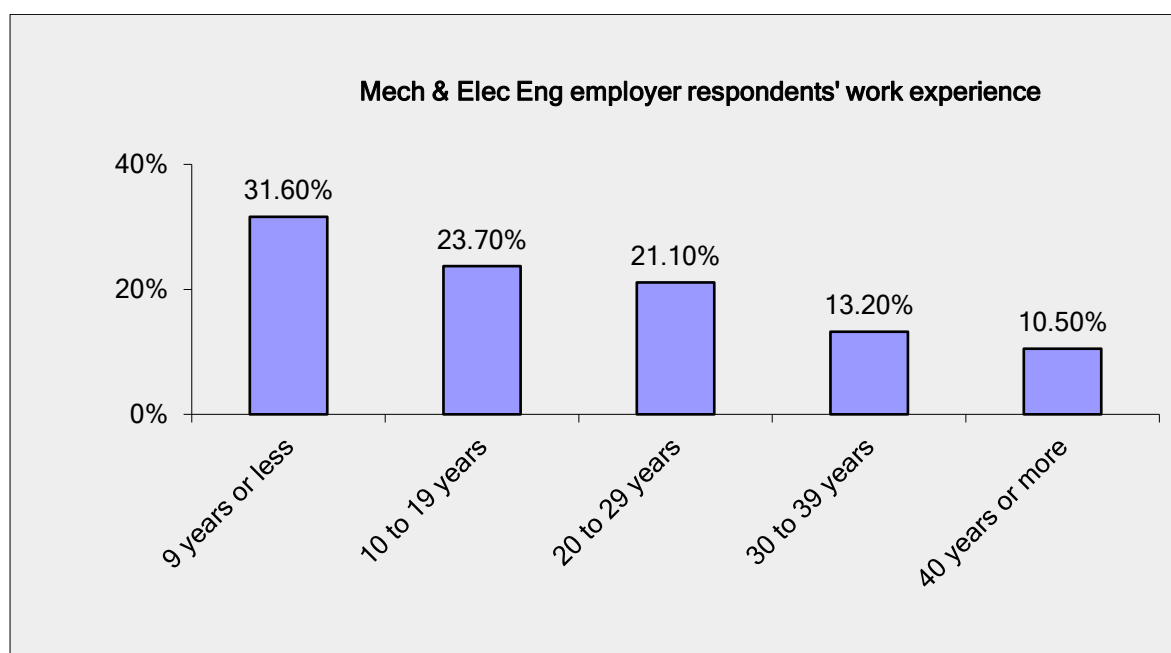
**FIGURE 21: Age of Mech & Elec Engineering respondents (n=38)**

### Distribution of respondents by experience

Information on experience of respondents is shown in Table 21 and Figure 22. This data was obtained to establish the degree to which respondents, with different levels of experience agree on graduate competencies in the workplace.

**TABLE 21: Electrical & Mechanical employers: experience of respondents (n=38)**

Experience of respondents	Count	Percentage
9 years or less	12	31.6%
10 to 19 years	9	23.70%
20 to 29 years	8	21.10%
30 to 39 years	5	13.20%
40 years or more	4	10.50%



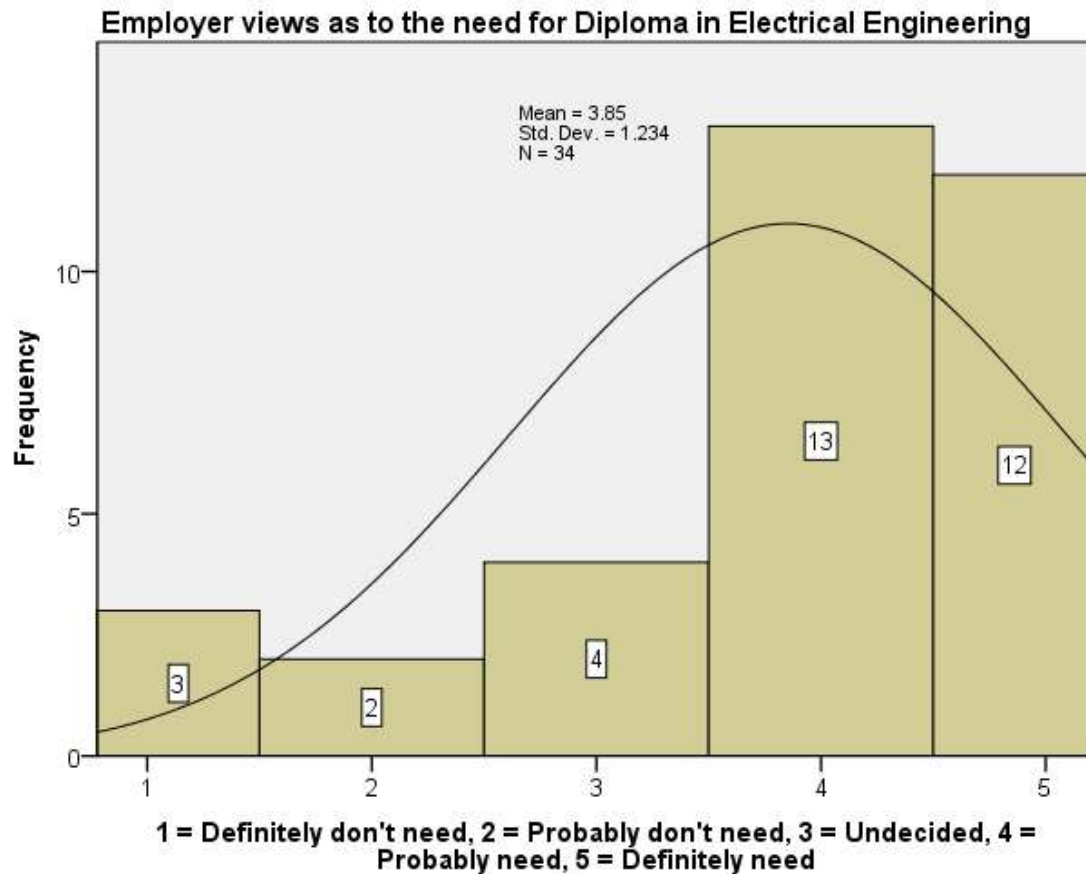
**FIGURE 22: Work experience of Mech & Elec Engineering respondents (n=38)**

### 4.1.4 Employer views as to Electrical Engineering qualifications needs

Tables 22-26 and Figures 23-27 provide information on the distribution of employer responses as to the need for Electrical Engineering qualifications that WSU is consider offering.

**TABLE 22: Employer views as to need for Diploma in Electrical Engineering**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
Definitely don't need	3	5.6	8.8	8.8
Probably don't need	2	3.7	5.9	14.7
Undecided	4	7.4	11.8	26.5
Probably need	13	24.1	38.2	64.7
Definitely need	12	22.2	35.3	100.0
Total	34	63.0	100.0	
Missing				
System	20	37.0		
Total	94	54	100.0	

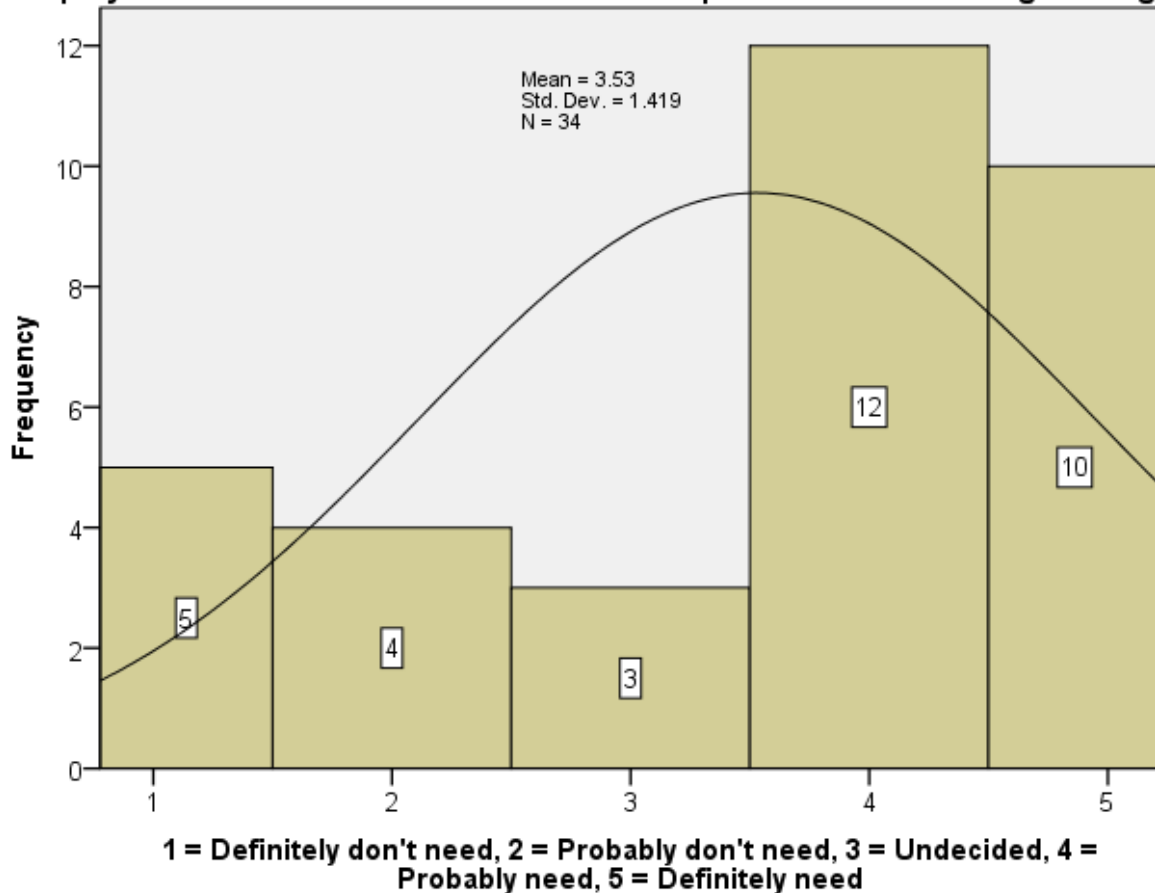


**FIGURE 23: Employer views: Diploma in Electrical Engineering (n=34)**

**TABLE 23: Employer views as to need for Advanced Diploma in Electrical Engineering**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	5	9.3	14.7	14.7
	Probably don't need	4	7.4	11.8	26.5
	Undecided	3	5.6	8.8	35.3
	Probably need	12	22.2	35.3	70.6
	Definitely need	10	18.5	29.4	100.0
	Total	34	63.0	100.0	
Missing	System	20	37.0		
Total		94	54	100.0	

### Employer views as to the need for Advanced Diploma in Electrical Engineering

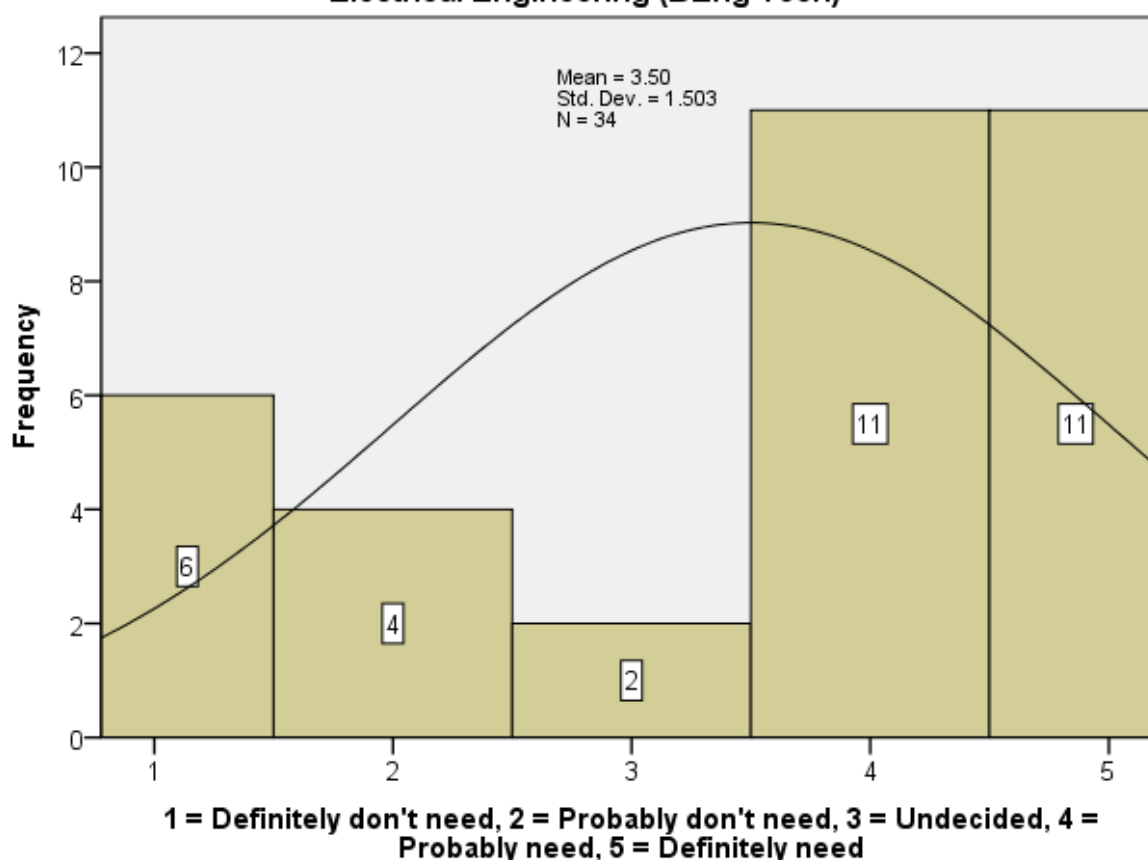


**FIGURE 24: Employer views: Advanced Diploma in Electrical Engineering (n=34)**

**TABLE 24: Employer views as to need for Bachelor of Engineering Technology in Electrical Engineering (BEng Tech)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	6	11.1	17.6	17.6
	Probably don't need	4	7.4	11.8	29.4
	Undecided	2	3.7	5.9	35.3
	Probably need	11	20.4	32.4	67.6
	Definitely need	11	20.4	32.4	100.0
	Total	34	63.0	100.0	
Missing	System	20	37.0		
Total		94	54	100.0	

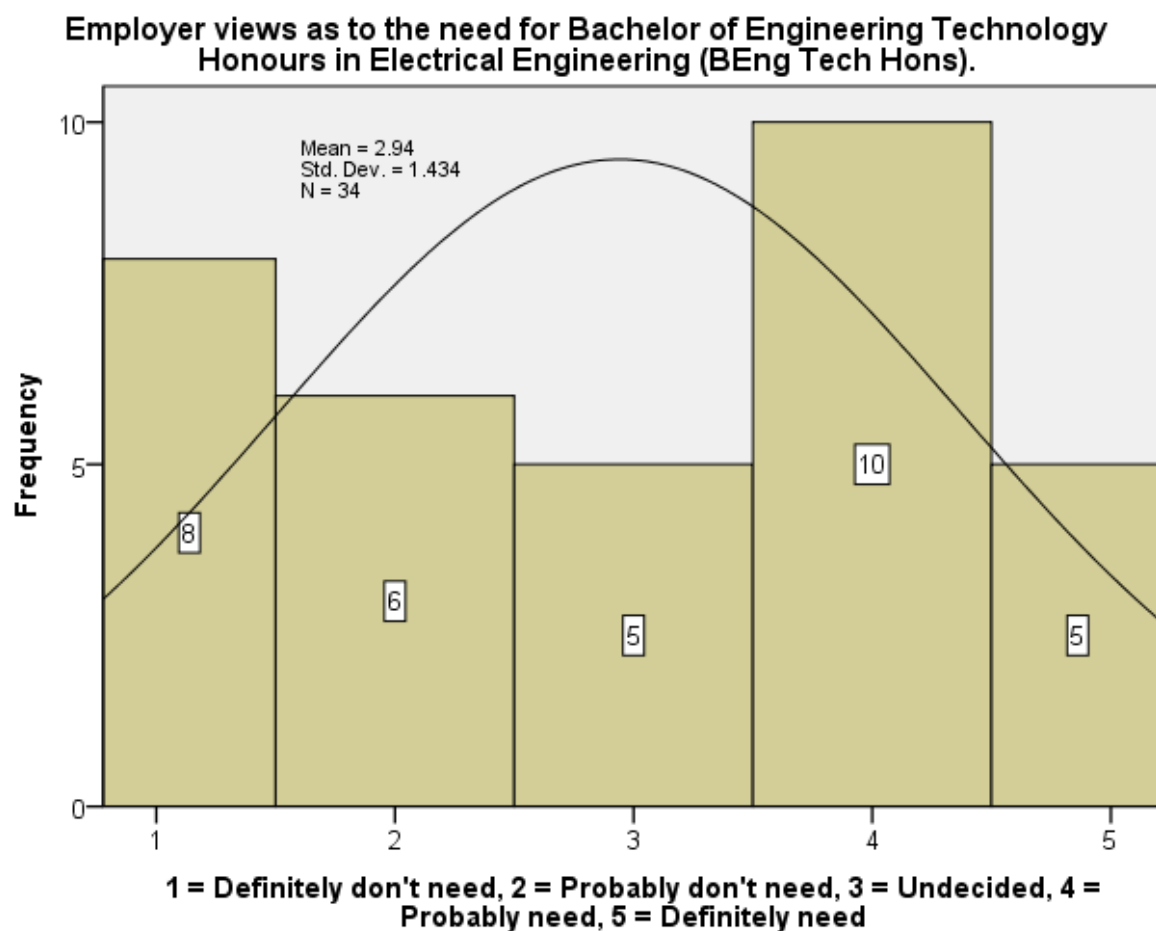
**Employer views as to the need for Bachelor of Engineering Technology in  
Electrical Engineering (BEng Tech)**



**FIGURE 25: Employer views: BEng Tech in Electrical Engineering (n=34)**

**TABLE 25: Employer views as to need for Bachelor of Engineering Technology Honours in Electrical Engineering (BEng Tech Hons)**

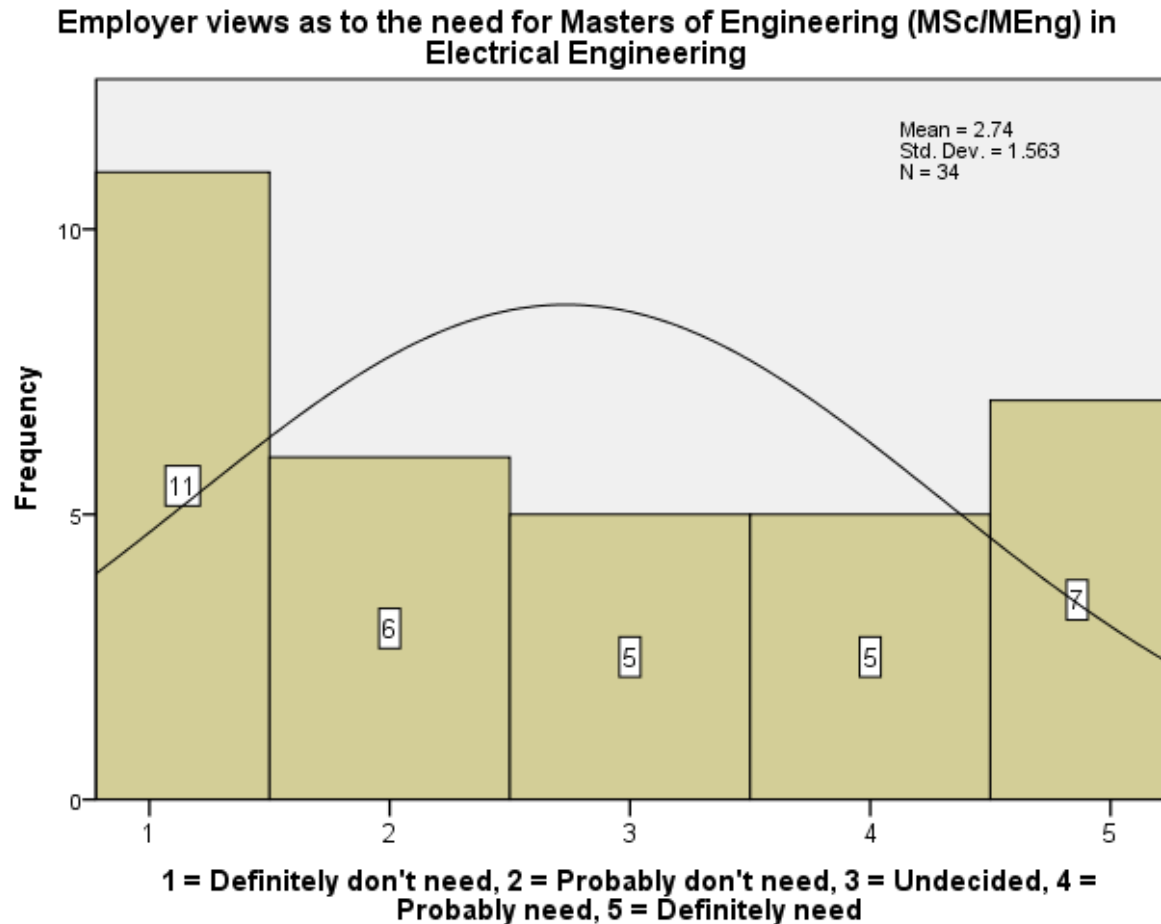
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	8	14.8	23.5	23.5
	Probably don't need	6	11.1	17.6	41.2
	Undecided	5	9.3	14.7	55.9
	Probably need	10	18.5	29.4	85.3
	Definitely need	5	9.3	14.7	100.0
	Total	34	63.0	100.0	
Missing	System	20	37.0		
Total		94	54	100.0	



**FIGURE 26: Employer views: BEng Tech Hons in Electrical Engineering (n=34)**

**TABLE 26: Employer views as to need for Masters of Engineering (MSc/MEng) in Electrical Engineering**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	11	20.4	32.4	32.4
	Probably don't need	6	11.1	17.6	50.0
	Undecided	5	9.3	14.7	64.7
	Probably need	5	9.3	14.7	79.4
	Definitely need	7	13.0	20.6	100.0
	Total	34	63.0	100.0	
Missing	System	20	37.0		
Total		94	54	100.0	



**FIGURE 27: Employer views: Master of Engineering in Elec Engineering (n=34)**

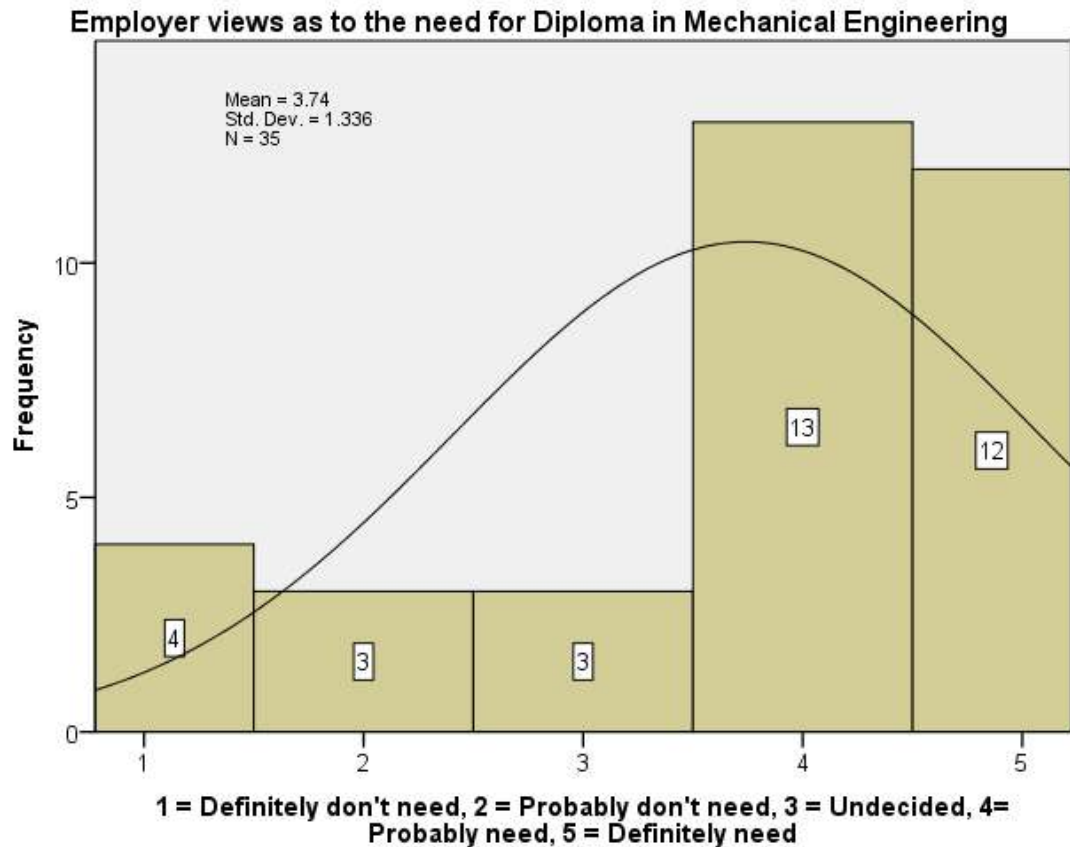
#### 4.1.5 Employer views as to Mechanical qualifications needs

Tables 27-31 and Figures 28-32 provide information on the distribution of employer responses as to the need for Mechanical engineering qualifications that WSU is considering offering.

**TABLE 27: Mech & Elec Eng employer views: Diploma in Mechanical Engineering**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	4	7.4	11.4	11.4
	Probably don't need	3	5.6	8.6	20.0
	Undecided	3	5.6	8.6	28.6
	Probably need	13	24.1	37.1	65.7
	Definitely need	12	22.2	34.3	100.0
Total		35	64.8	100.0	
Missing	System	19	35.2		
Total		54	100.0		



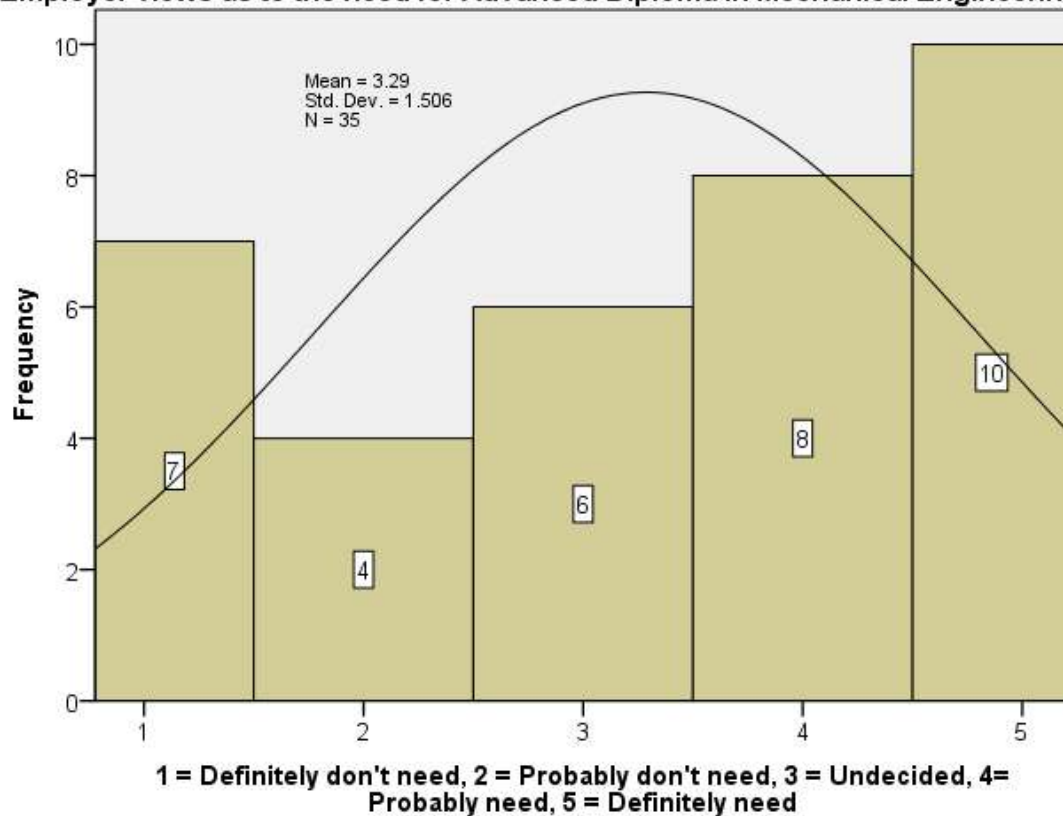


**FIGURE 28: Mech & Elec Eng employer views: Diploma in Mechanical Engineering (n=35)**

**TABLE 28: Mech & Elec Eng employer views as to need for Advanced Diploma in Mechanical Engineering**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	7	13.0	20.0	20.0
	Probably don't need	4	7.4	11.4	31.4
	Undecided	6	11.1	17.1	48.6
	Probably need	8	14.8	22.9	71.4
	Definitely need	10	18.5	28.6	100.0
Total		35	64.8	100.0	
Missing	System	19	35.2		
Total		54	100.0		

**Employer views as to the need for Advanced Diploma in Mechanical Engineering**

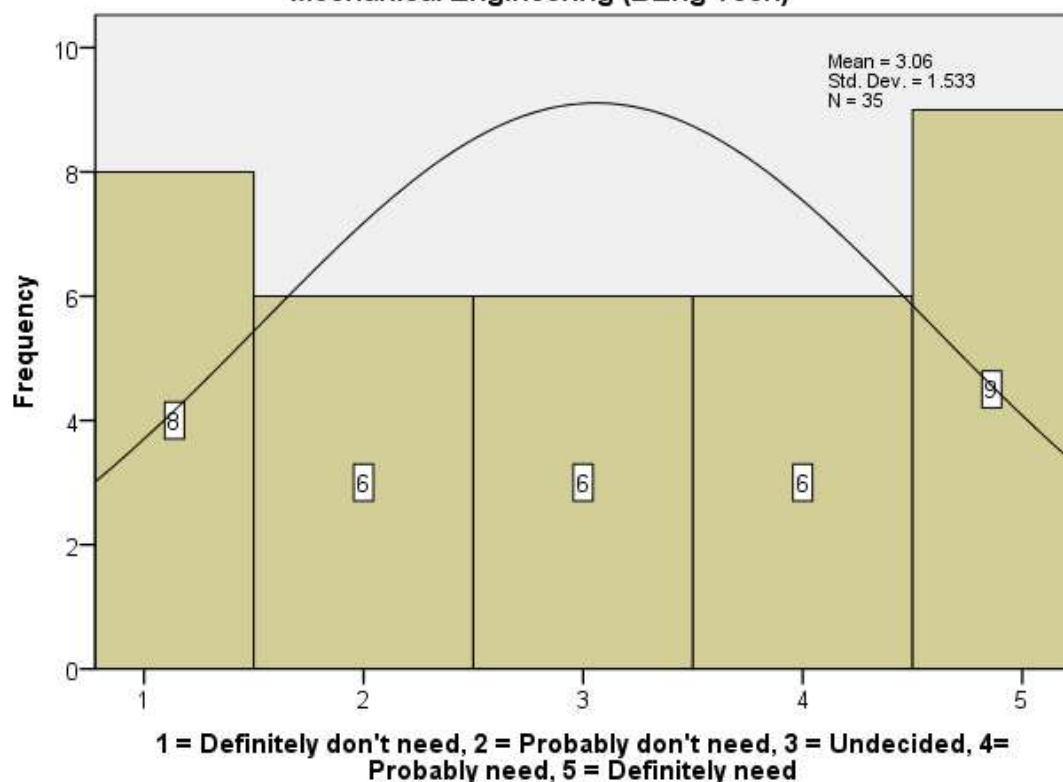


**FIGURE 29: Mech & Elec Eng employer views: Advanced Diploma in Mechanical Engineering (n=35)**

**TABLE 29: Mech & Elec Eng employer views as to need for Bachelor of Engineering Technology in Mechanical Engineering (BEng Tech)**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
Definitely don't need	8	14.8	22.9	22.9
Probably don't need	6	11.1	17.1	40.0
Undecided	6	11.1	17.1	57.1
Probably need	6	11.1	17.1	74.3
Definitely need	9	16.7	25.7	100.0
Total	35	64.8	100.0	
Missing				
System	19	35.2		
Total	54	100.0		

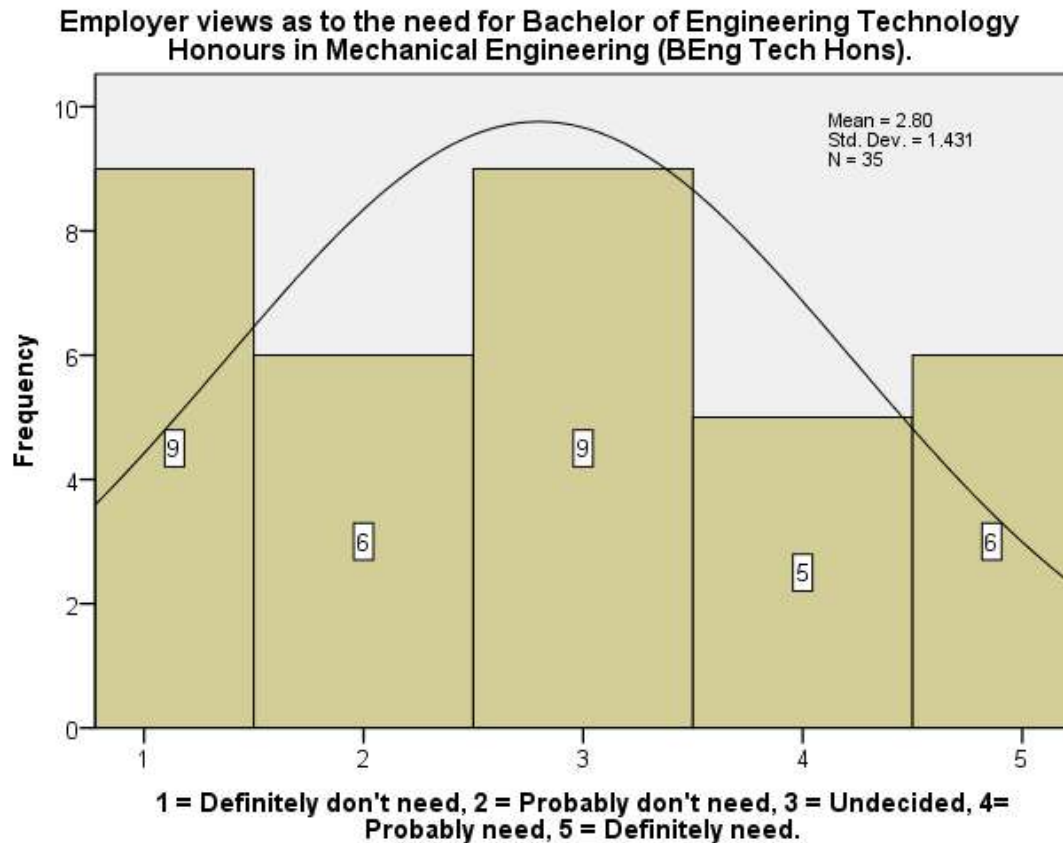
**Employer views as to the need for Bachelor of Engineering Technology in Mechanical Engineering (BEng Tech)**



**FIGURE 30: Mech & Elec Eng employer views: BEng Tech in Mechanical Engineering (n=35)**

**TABLE 30: Mech & Elec Eng employer views as to need for Bachelor of Engineering Technology Honours in Mechanical Engineering (BEng Tech Hons)**

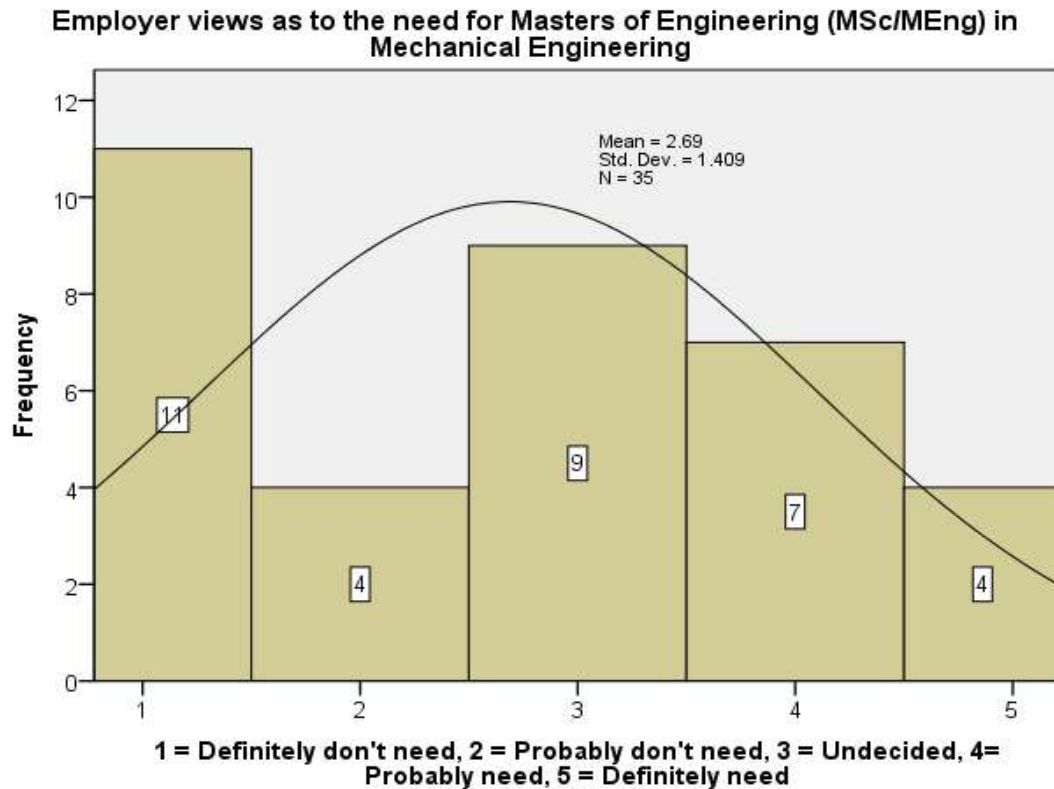
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	9	16.7	25.7	25.7
	Probably don't need	6	11.1	17.1	42.9
	Undecided	9	16.7	25.7	68.6
	Probably need	5	9.3	14.3	82.9
	Definitely need	6	11.1	17.1	100.0
	Total	35	64.8	100.0	
Missing	System	19	35.2		
Total		54	100.0		



**FIGURE 31: Mech & Elec Eng employer views: BEng Tech(Hons) in Mechanical Engineering (n=35)**

**TABLE 31: Mech & Elec Eng employer views as to need for Masters of Engineering (MSc/MEng) in Mechanical Engineering**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely don't need	11	20.4	31.4	31.4
	Probably don't need	4	7.4	11.4	42.9
	Undecided	9	16.7	25.7	68.6
	Probably need	7	13.0	20.0	88.6
	Definitely need	4	7.4	11.4	100.0
	Total	35	64.8	100.0	
Missing	System	19	35.2		
Total		54	100.0		



**FIGURE 32: Mech & Elec Eng employer views: Masters in Mechanical Engineering (n=35)**

#### 4.1.6 Employment of graduates

It was deemed useful to establish how many Civil Engineering Diploma graduates from Walter Sisulu University had been employed by the respondents in the last five years.

##### Civil Engineering

The number and distribution of graduate employment among respondents for WSU Civil Engineering graduates are shown in Table 32 below.

**TABLE 32: Number of Civil Engineering Diploma graduates from WSU employed by respondents' organisation (n=94)**

Number of graduates	Frequency	Percent	Cumulative Percent
0	49	52.1	52.1
1	6	6.4	58.5
2	10	10.6	69.1
3	7	7.4	76.5
4	5	5.3	81.8
5	5	5.3	87.1
6	3	3.2	90.3
7	1	1.1	91.4
8	4	4.3	95.7
10	1	1.1	96.8
20	1	1.1	97.9
30	1	1.1	99.0
200	1	1.1	100.0
Total	94	100.0	100.0

### Mechanical & Electrical Engineering

The number and distribution of graduate employment among respondents for WSU Mechanical and Electrical Engineering graduates are shown in Table 33 below.

**TABLE 33: Number of Mechanical & Electrical Engineering Diploma graduates from WSU employed by respondents' organisation (n=54)**

Number of graduates		Frequency	Percent	Cumulative Percent
Valid	unknown	1	1.9	1.89
	0	29	53.7	55.6
	1	3	5.6	61.1
	2	3	5.6	66.7
	3	2	3.7	70.4
	5	4	7.4	77.8
	8	2	3.7	81.5
	10	3	5.6	87.0
	12	1	1.9	88.9
	15	2	3.7	92.6
	20	1	1.9	94.4
	30	2	3.7	98.2
	50	1	1.9	100.0
	Total	54	100.0	100.0

### **4.1.7 Employer ratings of competencies of WSU engineering graduates**

The question posed to participants for this section was: "On average, how would you rate the competency of Diploma graduates from WSU"? Competency descriptions provided were similar to that contained in the ECSA Qualification Standard (ECSA 2016) but for practical purposes abbreviated wording was used as the ECSA descriptions are quite lengthy. Respondents had to make a choice as to the competency of graduates on the following rating scale: "very low", "low", "neither high nor low", "high" and "very high". In order to assess the importance of the competencies (on the basis of the responses), the ratings were treated as a five-point ordinal Likert scale, with a linear allocation of values (1, 2, 3, 4, 5) given to the ratings increments from "very low" to "very high".

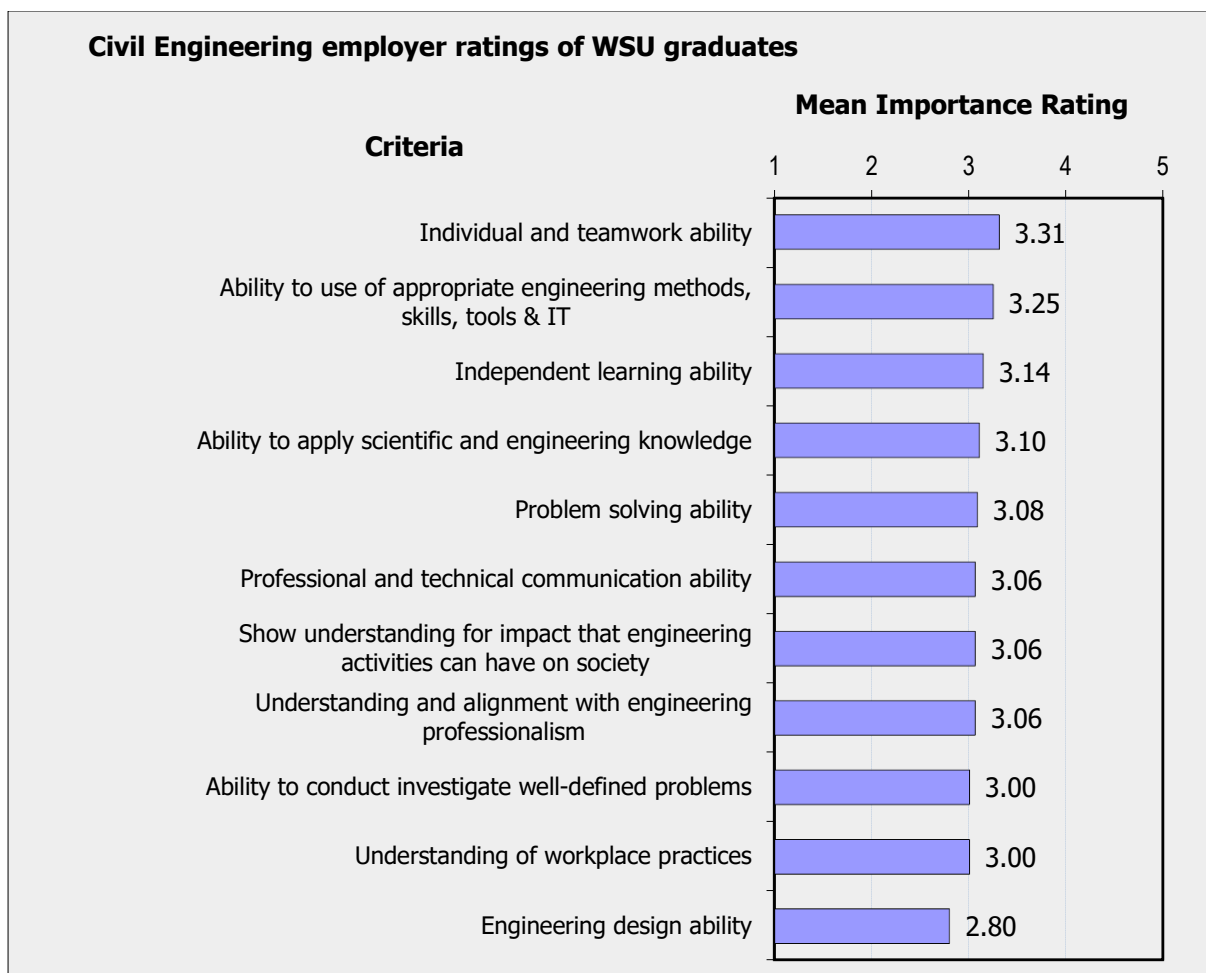
### Civil Engineering

The mean ratings of respondents on the competency of Civil Engineering Diploma graduates are presented in Table 34 & 35 and Figures 33.

For the Civil Engineering employer cohort the overall mean of the eleven ratings considered was 3.08. The "individual and teamwork ability" competency had the highest rating at 3.31. The competency "ability to use appropriate engineering methods, skills, tools and IT" were the competency with the next highest rating. The "engineering design ability" competency received the lowest rating at 2.80. The top and bottom ratings were broadly similar to the findings of Nielsen (2000) and Griesel and Parker (2009), yielding similar lower competency ratings for: "ability to conduct investigations", "communication", "understanding workplace practices" and "problem solving ability".

**TABLE 34: Employer ratings of WSU Civil Engineering Diploma graduates (n=49)**

Parameter		Problem solving ability	Ability to apply scientific and engineering knowledge	Engineering design ability	Ability to conduct investigate well-defined problems	Ability to use of appropriate engineering methods, skills, tools & IT	Professional and technical communication ability	Show understanding for impact that engineering activities can have on society	Individual and teamwork ability	Independent learning ability	Understanding and alignment with engineering professionalism	Understanding of workplace practices
N	Valid	49	49	49	49	49	49	49	49	49	49	49
	Missing	45	45	45	45	45	45	45	45	45	45	45
Mean		3.082	3.102	2.796	3.000	3.245	3.061	3.061	3.306	3.143	3.061	3.000
Median		3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000
Mode		3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000
Std. Deviation		.909	.896	.866	.890	.804	.899	.713	.847	.890	.964	1.000
Variance		.827	.802	.749	.792	.647	.809	.517	.717	.792	.934	1.000
Skewness		-.166	-.570	.215	-.185	-.732	-.661	-.793	-1.074	-.661	-.271	.000
Std. Error of Skewness		.340	.340	.340	.340	.340	.340	.340	.340	.340	.340	.340

**FIGURE 33: Employer ratings on the competencies displayed by WSU Civil Engineering Diploma graduates WSU (n=49)**

**TABLE 35: Ranked mean ratings across and within Civil Eng employer subgroups - highest (green) to lowest (red) (n=49)**

Description of respondents with sub group attribute	n	Problem solving ability	Ability to apply scientific and engineering knowledge	Engineering design ability	Ability to conduct investigate well-defined problems	Ability to use of appropriate engineering methods, skills, tools & IT	Professional and technical communication ability	Show understanding for impact that engineering activities can have on society	Individual and teamwork ability	Independent learning ability	Understanding and alignment with engineering professionalism	Understanding of workplace practices	Mean rating within subgroup
Age: Up to 29yrs	1	4.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	5.00	5.00	<b>4.36</b>
Organisation: Metro/District/Local muni	5	4.00	4.00	4.00	4.40	4.20	3.80	3.80	3.80	4.00	4.40	4.40	<b>4.07</b>
Organisation: Construction	4	4.25	3.50	2.75	3.50	4.00	4.00	3.50	3.50	4.00	3.00	3.75	<b>3.61</b>
Size of org: 51-200 employees	6	3.50	3.33	3.17	3.17	3.67	3.67	3.00	3.83	3.50	3.83	3.83	<b>3.50</b>
Qualification: Diploma	10	3.80	3.60	3.20	3.70	3.80	3.40	3.10	3.40	3.60	3.20	3.30	<b>3.46</b>
Position: Section Manager/Supervisor	17	3.24	3.24	3.18	3.29	3.41	3.24	3.24	3.59	3.41	3.47	3.41	<b>3.34</b>
Size of org: 21-50 employees	6	3.33	3.50	3.00	3.17	3.17	3.17	3.33	3.67	3.67	3.33	3.00	<b>3.30</b>
Experience: 10-19yrs	19	3.37	3.26	2.89	3.21	3.32	3.26	3.26	3.42	3.42	3.21	3.26	<b>3.26</b>
Qualification: BTech degree	17	3.06	3.35	2.94	3.12	3.29	3.12	3.35	3.65	3.35	3.41	3.12	<b>3.25</b>
Size of org: Less than 5 employees	2	3.50	3.50	3.00	3.50	3.50	3.50	3.00	3.50	2.50	2.50	3.50	<b>3.23</b>
Gender: Male	43	3.19	3.23	2.88	3.09	3.33	3.12	3.12	3.42	3.26	3.16	3.09	<b>3.17</b>
Age: 29-39yrs	22	3.27	3.18	2.86	3.18	3.27	3.27	3.00	3.27	3.23	3.09	3.18	<b>3.17</b>
Position: Owner/Director	11	3.36	3.27	2.73	2.82	3.36	3.36	3.09	3.64	3.09	3.09	2.91	<b>3.16</b>
Experience: 9yrs or less	7	3.14	3.14	2.86	3.29	3.14	3.14	2.71	3.14	3.00	3.14	3.29	<b>3.09</b>
Experience: 20-29yrs	10	3.00	2.90	2.90	2.80	3.40	2.90	3.10	3.40	3.10	3.00	2.90	<b>3.04</b>
Organisation: Parastatal	3	2.67	3.33	2.33	3.00	3.00	3.33	3.00	3.33	2.67	3.33	3.33	<b>3.03</b>
Age: 50-59yrs	8	3.00	3.13	2.75	2.88	3.25	3.00	3.00	3.25	3.13	3.00	2.75	<b>3.01</b>
Age: 40-49yrs	8	2.88	2.88	2.63	2.63	3.13	2.75	3.38	3.50	3.13	3.13	3.00	<b>3.00</b>
Experience: 40yrs +	4	3.00	3.00	2.75	2.75	3.50	3.25	2.75	3.50	2.75	3.00	2.75	<b>3.00</b>
Size of org: More than 200 employees	32	2.94	3.00	2.72	3.00	3.19	2.88	3.00	3.13	3.03	2.91	2.84	<b>2.97</b>
Organisation: Consulting	35	2.89	2.97	2.71	2.80	3.09	2.86	2.97	3.26	3.00	2.89	2.71	<b>2.92</b>
Qualification: Other qualif	11	2.91	2.82	2.64	2.73	3.18	2.91	2.91	3.18	2.91	2.91	3.00	<b>2.92</b>
Position: Snr Manager	12	2.92	3.00	2.67	2.92	3.08	2.83	3.00	3.00	3.08	2.75	2.75	<b>2.91</b>
Size of org: 6-20 employees	3	3.00	2.67	2.33	2.00	3.00	3.33	3.33	3.33	3.00	3.00	2.67	<b>2.88</b>
Age: 60yrs +	10	2.80	3.00	2.70	2.80	3.10	2.80	2.90	3.20	2.90	2.80	2.60	<b>2.87</b>
Experience: 30-39yrs	9	2.56	3.00	2.44	2.67	2.89	2.67	3.00	3.00	2.89	2.78	2.44	<b>2.76</b>
Position: Other	9	2.67	2.78	2.33	2.78	3.00	2.67	2.78	2.78	2.78	2.67	2.67	<b>2.72</b>
Qualification: BEng/BSc degree	11	2.64	2.55	2.36	2.45	2.73	2.82	2.73	2.82	2.64	2.55	2.55	<b>2.62</b>
Gender: Female	6	2.33	2.17	2.17	2.33	2.67	2.67	2.67	2.50	2.33	2.33	2.33	<b>2.41</b>
Organisation: Central/Prov gov.	2	2.50	2.00	2.00	2.00	2.50	2.50	2.00	2.50	2.50	2.50	2.50	<b>2.32</b>

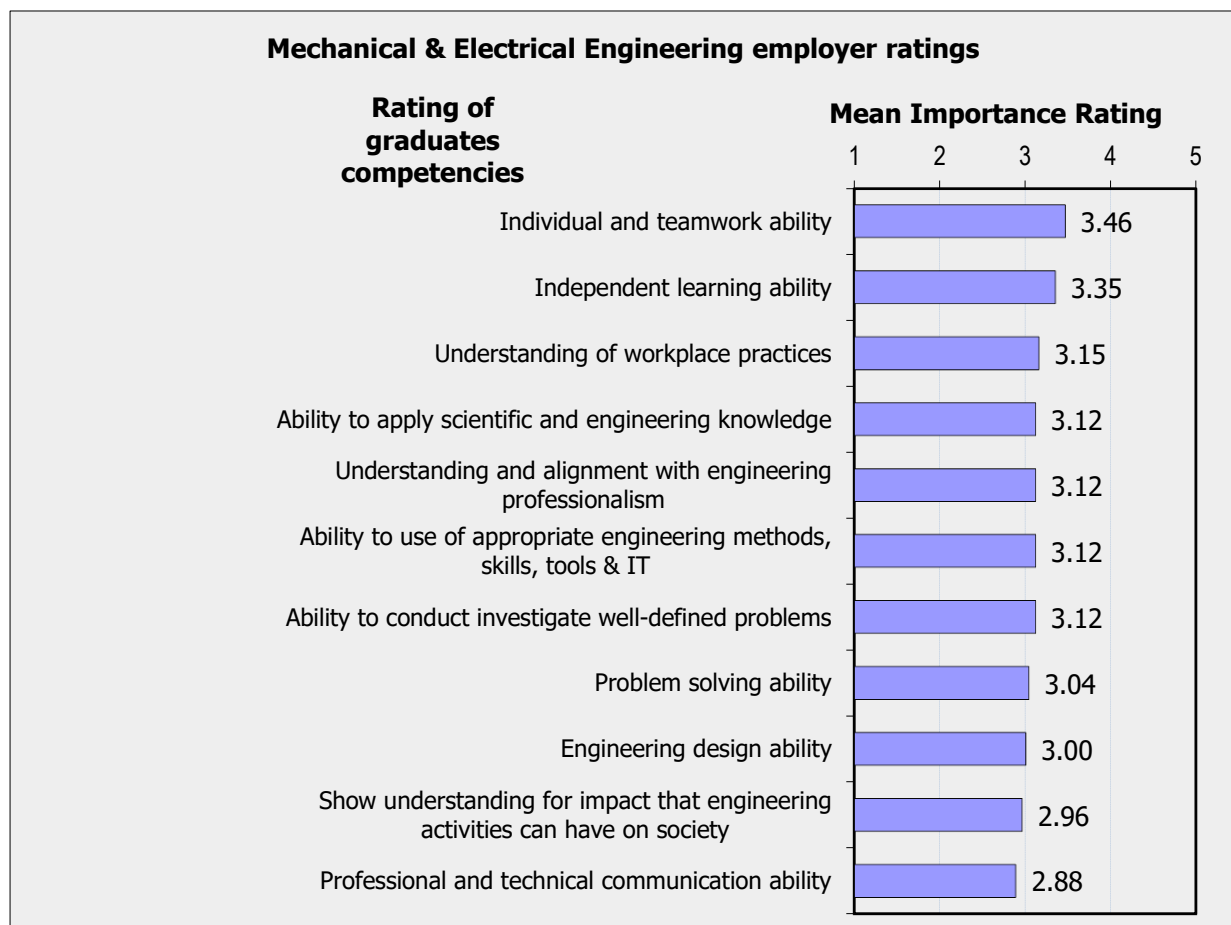


### Mechanical and Electrical Engineering

The mean ratings of respondents on the competency of Mechanical and Electrical Engineering Diploma graduates are presented in Table 36 & 37 and Figures 34 & 35.

**TABLE 36: Employer ratings of Mechanical & Electrical Engineering Diploma graduates from WSU (n=26)**

Parameter		Problem solving ability	Ability to apply scientific and engineering knowledge	Engineering design ability	Ability to conduct investigate well-defined problems	Ability to use of appropriate engineering methods, skills, tools & IT	Professional and technical communication ability	Show understanding for impact that engineering activities can have on	Individual and teamwork ability	Independent learning ability	Understanding and alignment with engineering professionalism	Understanding of workplace practices
N	Valid	26	26	24	26	26	26	25	26	26	26	26
	Missing	28	28	30	28	28	28	29	28	28	28	28
Mean		3.038	3.115	3.000	3.115	3.115	2.885	2.960	3.462	3.346	3.115	3.154
Median		3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	3.00	3.00
Mode		3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00 <sup>a</sup>	3.00 <sup>a</sup>	4.00
Std. Deviation		1.113	1.107	1.103	1.033	1.071	1.033	0.841	1.067	1.093	0.864	0.967
Variance		1.238	1.226	1.217	1.066	1.146	1.066	0.707	1.138	1.195	0.746	0.935
Skewness		-0.081	-0.436	0.000	-0.247	-0.458	-0.226	-0.378	-0.427	-0.170	-0.639	-0.330
Std. Error of Skewness		0.456	0.456	0.472	0.456	0.456	0.456	0.464	0.456	0.456	0.456	0.456



**FIGURE 34: Employer ratings as to the competencies displayed by Mechanical & Electrical Engineering Diploma graduates from WSU (n=26)**

**TABLE 37: Ranked mean ratings across and within Mech & Elec Eng employer subgroups - highest (green) to lowest (red) (n=26)**

Description of respondents with sub group attribute	n	Problem solving ability	Ability to apply scientific and engineering knowledge	Engineering design ability	Ability to conduct investigate well-defined problems	Ability to use of appropriate engineering methods, skills, tools & IT	Professional and technical communication ability	Show understanding for impact that engineering activities can have on society	Individual and teamwork ability	Independent learning ability	Understanding and alignment with engineering professionalism	Understanding of workplace practices	Mean rating within subgroup
Age: 40-49yrs	4	4.00	3.75	3.75	4.00	4.00	3.25	3.25	4.25	4.00	3.50	3.75	<b>3.77</b>
Size of org: 51-150	2	4.00	4.00	3.50	4.00	3.50	3.50	3.50	4.00	4.00	4.00	3.50	<b>3.77</b>
Organisation: Other	2	4.00	2.50	2.50	3.00	4.00	3.50	3.50	5.00	5.00	4.00	4.00	<b>3.73</b>
Position: Owner/Director	4	3.50	3.25	3.25	3.50	3.75	3.75	3.75	4.25	4.25	3.75	3.50	<b>3.68</b>
Organisation: Nat/Prov gov.	1	4.00	4.00	3.00	3.00	4.00	3.00	3.00	4.00	4.00	3.00	4.00	<b>3.55</b>
Organisation: Parastatal	3	3.33	3.00	3.67	3.67	3.33	3.67	3.00	4.00	3.67	3.33	3.67	<b>3.48</b>
Qualification: BEng/BSc	4	3.50	3.50	3.33	3.50	3.50	3.00	3.25	4.00	3.50	3.75	3.50	<b>3.48</b>
Size of org: 6-20	3	3.00	3.00	3.33	3.00	4.00	3.00	3.67	4.00	4.33	3.67	3.00	<b>3.45</b>
Experience: 10-19yrs	7	3.57	3.43	3.67	3.71	3.29	3.14	3.00	3.71	3.29	3.43	3.29	<b>3.41</b>
Position: /Supervisor	3	2.67	3.67	3.50	3.33	3.33	2.67	3.33	3.67	3.67	3.67	3.33	<b>3.35</b>
Experience: 20-29yrs	5	3.40	3.80	3.00	3.40	3.60	3.20	3.00	3.60	3.60	3.00	3.20	<b>3.35</b>
Gender: Male	20	3.25	3.35	3.17	3.40	3.25	3.15	3.11	3.75	3.55	3.25	3.30	<b>3.32</b>
Age: Up to 29yrs	2	3.50	3.00	3.50	2.50	4.50	2.00	3.00	3.50	4.00	3.50	3.50	<b>3.32</b>
Experience: 30-39yrs	3	3.00	3.00	3.00	2.67	3.00	3.33	3.33	4.00	3.33	3.33	4.00	<b>3.27</b>
Position: Snr Manager	6	3.50	3.67	3.17	3.33	3.00	3.17	3.00	3.50	3.17	3.17	3.33	<b>3.27</b>
Organisation: Consulting	4	3.00	3.25	3.67	3.00	3.75	2.50	3.25	3.50	3.25	3.50	3.25	<b>3.27</b>
Qualification: Other	14	3.29	3.14	3.00	3.21	3.00	3.00	2.93	3.43	3.36	3.07	3.29	<b>3.16</b>
Size of org: + 151	14	3.21	3.36	3.15	3.29	2.93	3.07	2.86	3.29	3.00	3.00	3.21	<b>3.12</b>
Position: Other	9	3.11	3.22	3.25	3.33	3.11	2.89	2.78	3.22	3.11	3.00	3.00	<b>3.09</b>
Age: 30-39yrs	10	2.90	3.20	3.00	3.30	2.90	2.90	2.90	3.10	3.10	3.10	3.00	<b>3.04</b>
Age: 60yrs +	3	2.33	2.00	2.00	2.33	2.67	2.33	4.00	4.33	4.33	3.33	3.33	<b>3.00</b>
Organisation: Industry	15	2.80	3.07	2.86	3.07	2.73	2.73	2.86	3.13	3.07	2.93	2.87	<b>2.92</b>
Qualification: Diploma	8	2.38	2.88	2.88	2.75	3.13	2.63	2.86	3.25	3.25	2.88	2.75	<b>2.87</b>
Experience: 9yrs or less	9	2.67	2.78	2.67	2.89	2.89	2.56	2.89	3.00	3.33	3.00	2.89	<b>2.87</b>
Age: 50-59yrs	7	2.86	3.14	2.83	2.86	2.71	3.14	2.57	3.14	2.71	2.71	2.86	<b>2.87</b>
Organisation: Municipality	1	3.00	4.00	2.00	3.00	3.00	3.00	2.00	3.00	3.00	2.00	3.00	<b>2.82</b>
Size of org: 21-50	7	2.43	2.43	2.33	2.57	3.00	2.29	2.67	3.43	3.43	2.86	3.00	<b>2.77</b>
Gender: Female	6	2.33	2.33	2.50	2.17	2.67	2.00	2.50	2.50	2.67	2.67	2.67	<b>2.45</b>
Experience: 40yrs +	2	2.00	2.00	2.50	2.00	2.50	2.00	2.00	3.50	3.00	2.50	2.50	<b>2.41</b>
Position: HR Manager	4	2.00	1.50	1.75	1.75	2.50	1.75	2.00	3.00	3.00	2.25	2.75	<b>2.20</b>

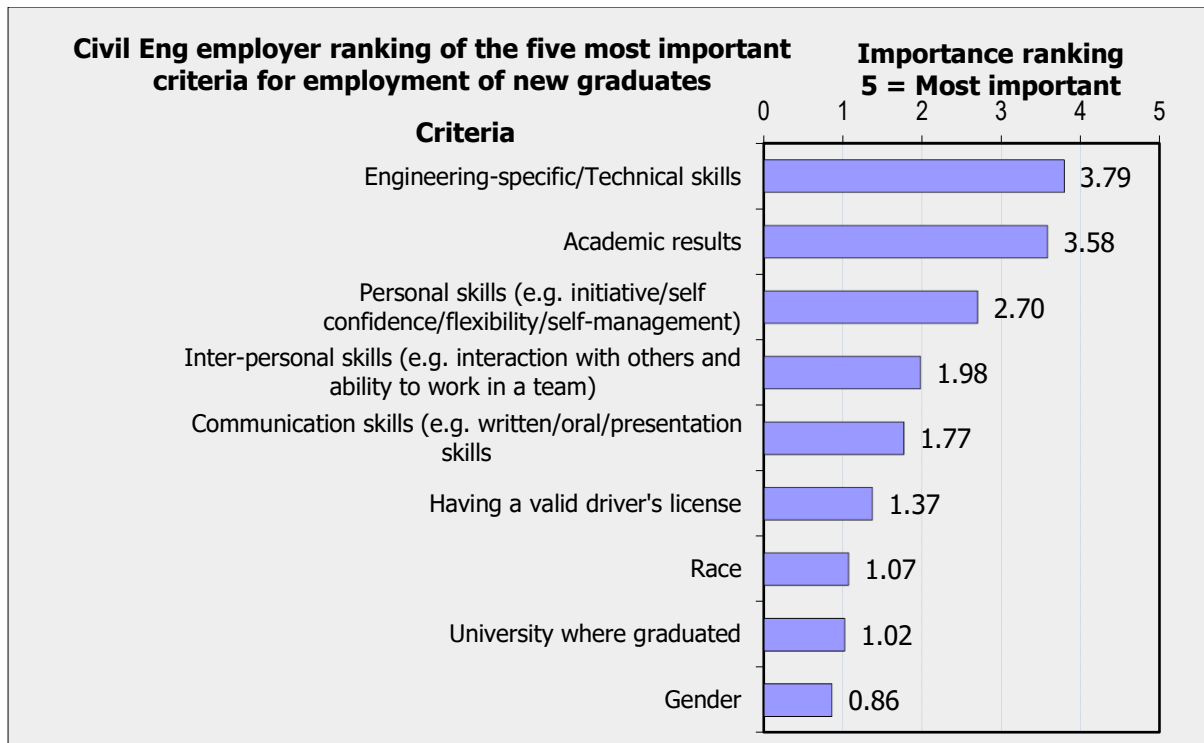
The overall mean of the eleven ratings was 3.12, which was somewhat higher than the overall rating average for the Civil Engineering cohort. The “individual and teamwork ability” competency had the highest rating at 3.46. The competencies of “independent learning ability” were the competency with the next highest rating. The “professional and technical communication ability” competency received the lowest rating at 2.88 with the following competency ratings also at the lower end of the scale: “show understanding for impact that engineering activities can have on society” (2.96), “engineering design ability” (3.00) and “problem solving ability” (3.04).

#### **4.1.8 Employer ranking as to the five most important criteria used in the recruitment of newly qualified engineering graduates**

Employers were asked to indicate the five most important criteria used in the recruitment of newly qualified engineering graduates within their organisation. An analysis of the results among Civil Engineering employers are provided in Table 38 below.

**TABLE 38: Civil Engineering employers’ rankings of five most important criteria used in the recruitment of newly qualified engineering graduates (n=43)**

<b>Answer Options</b>	<b>Most important criteria</b>	<b>2nd most important criteria</b>	<b>3rd most important criteria</b>	<b>4th most important criteria</b>	<b>5th most important criteria</b>	<b>Rating Average</b>	<b>Response Count</b>
Engineering-specific/Technical skills	18	13	4	4	1	3.79	40
Personal skills (e.g. initiative/self-confidence/flexibility/self-management)	15	11	6	6	5	3.58	43
Academic results	8	10	8	4	4	2.70	34
University where graduated	2	5	10	9	7	1.98	33
Inter-personal skills (e.g. interaction with others and ability to work in a team)	0	3	10	11	12	1.77	36
Communication skills (e.g. written/oral/presentation skills)	3	3	3	5	13	1.37	27
Having a valid driver's license	4	3	3	1	3	1.07	14
Gender	1	1	5	9	2	1.02	18
Race	1	3	3	3	5	0.86	15

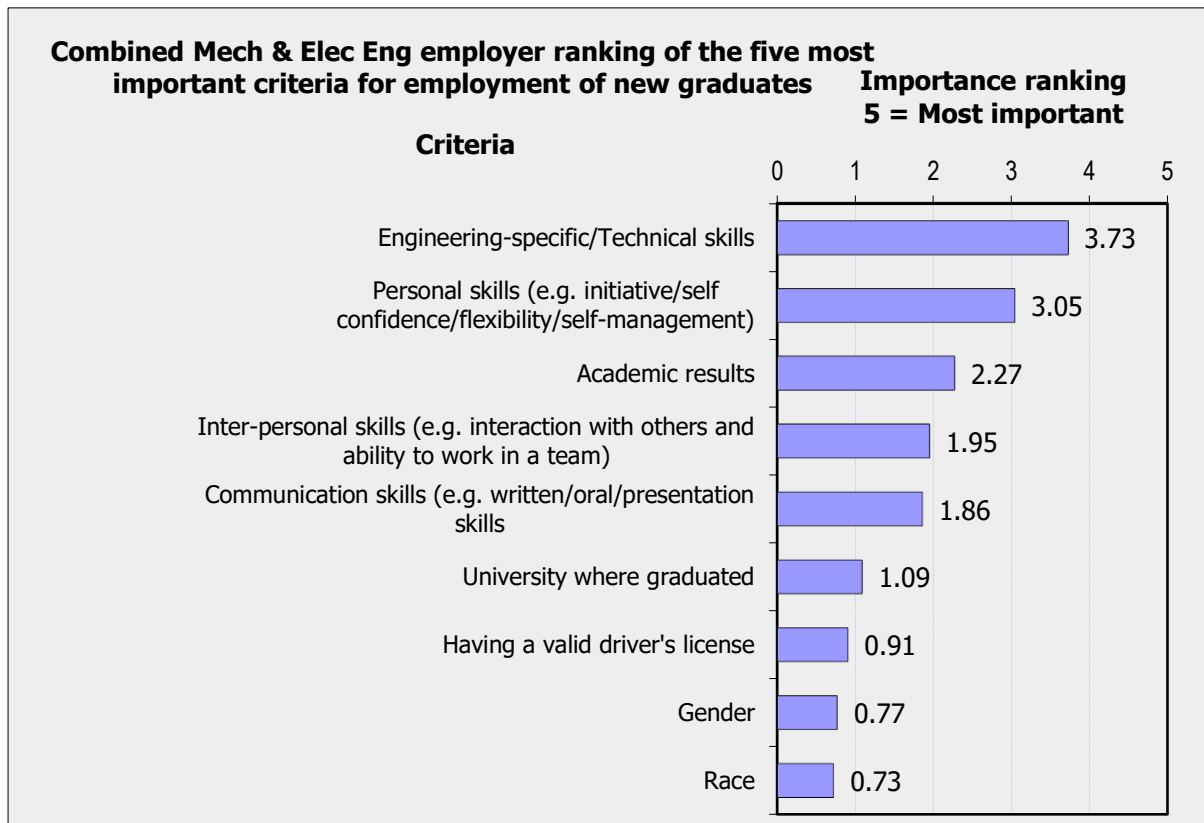


**FIGURE 35: Civil Engineering employers' rankings of the five most important criteria used in the recruitment of newly qualified engineering graduates (n=43)**

An analysis of the results among Electrical and Mechanical Engineering employers as to the five most important criteria used in the recruitment of newly qualified engineering graduates within their organisation are provided in Table 39 and Figure 36 below.

**TABLE 39: Elec & Mech Engineering employers' rankings of five most important criteria used in the recruitment of newly qualified engineering graduates (n=21)**

Combined Elec & Mech Eng employers ranking as to the five most important criteria used in the recruitment of newly qualified engineering graduates							
Answer Options	Most important criteria	2nd most important criteria	3rd most important criteria	4th most important criteria	5th most important criteria	Rating Average	Response Count
Engineering-specific/Technical skills	11	4	1	3	2	3.73	21
Personal skills (e.g. initiative/self-confidence/flexibility/self-management)	6	4	4	4	1	3.05	19
Academic results	4	5	1	3	1	2.27	14
Inter-personal skills (e.g. interaction with others and ability to work in a team)	2	3	4	3	3	1.95	15
Communication skills (e.g. written/oral/presentation skills)	1	4	4	2	4	1.86	15
University where graduated	2	1	2	2	0	1.09	7
Having a valid driver's license	2	0	2	0	4	0.91	8
Gender	0	0	3	2	4	0.77	9
Race	0	2	1	1	3	0.73	7



**FIGURE 36: Elec & Mech Engineering employers' rankings of the five most important criteria used in the recruitment of newly qualified engineering graduates (n=21)**

The results indicate that "Engineering-specific/Technical skills" and "Academic results" are the major considerations when graduates are considered for employment. It is however equally important to note that the so-called "soft skills" of "Inter-personal skills", "Personal skills" and "Communication skills" are also highly valued.

#### **4.1.9. Employers' views as to other qualifications that WSU should consider offering**

Respondents were asked to indicate if there are any other qualifications that WSU should consider offering. The following are some of the responses that were received.

##### Civil Engineering employers

- Degree in Urban Engineering
- Post graduate qualification in Project Management

##### Mechanical & Electrical Engineering employers

- Mechatronics Diploma
- Industrial Engineering Diploma
- Diploma in Logistics
- Diploma in Electronic Engineering
- Post Graduate qualification in Engineering Management

#### **4.1.10. Employers' views as to other competency areas that should be strengthened in the curriculum**

Respondents were asked to indicate if there are any specific competency areas that need to be strengthened in the qualifications that WSU are planning to offer. The following are some of the responses that were received.

##### Civil Engineering employers

- Design related
  - Increased exposure to design software packages, design of services and understanding of design codes/practices
  - Drafting and design, not just the use of CAD packages but a better understanding of how to produce engineering drawings.
  - Design packages other than AutoCAD.
  - Design quality control processes
- Currency of content
  - Content of engineering subjects must be based on current best practice.
- Computer literacy
  - MS Word and Excel skills should be at a high level of competency
- Project Management
  - Project Management principles and the typical stakeholder structures applicable to engineering projects
  - Contract Management and Administration
  - Procurement Regulations, Tender Documentation and Contract Documentation
  - Public Sector (Government) works i.e. procurement, PMFA, MFMA etc.
- Communication
  - Communication and social skills for the professional environment
  - Language competency - particularly written technical language
  - Report writing skills
- Soft skills
  - Time management skills
  - Critical thinking skills
  - Self-development skills
- Human resource aspects
  - Labour laws
  - Safety at the workplace
- Professionalism
  - Engineering ethics
- Financial
  - Business Management Skills

##### Mechanical & Electrical Engineering employers

- Design related
  - Basics of engineering drawing should be introduced for the electrical curriculum
- Technical skills
  - Hand tools skills
- Training for purpose
  - Curriculum to incorporate thinking towards the global workloads demands - digital analytics, informatics, business analysts etc.
- Problem solving ability
  - Improved problem solving methodology

- Logical fault finding
  - Database analytical skills
- Computer literacy
  - Digital literacy ability
  - Strong basic word processing ability
- Management
  - Applying general engineering practices and principles
  - Project management ability
- Communication
  - Language competency
  - Report writing skills
  - Presentation skills
- Soft skills
  - Development of pro-activeness
  - Energy/drive/self-motivation/self-driven
  - Exposure to industrial psychology
  - Development of strategic thinking ability
- Professionalism
  - Exposure to governance and professional ethics
- Labour issues
  - Understanding the role of corporate Social Investment
- Business management
  - Understanding where engineering fits in to the business environment

#### **4.1.11. Employers' qualitative comments as to graduate competencies**

Respondents were invited to add comments in answering the question relating to graduate competencies. The following thematic concepts were derived from the comments:

##### Individuality

A number of respondents indicated that it is difficult to generalise as the competencies of graduates vary on an individual basis. This is how three of the respondents described this phenomenon:

*Difficult to answer as this depends highly on the individual.*

*It is difficult to put people in a box and they are very different.*

*Take note that company culture plays a big role on the expressiveness of the young graduates and gender.*

*The gap between strong and weaker students in basic life skills, day to day planning, problem solving etc. can be enormous.*

##### Personal attributes

Some respondents commented that the graduates lack personal attributes that are desirable in the workplace. Here are some of the respondents' comments:

*Most of the graduates I have worked with need to be told what to do and they do not take any step further unless asked to do so.*

*The issues that I have encountered are not related to curriculum but are rather personal traits. The students that we have taken on as students do not seem to be eager to learn or hungry for information. This makes it difficult for me to mentor them since I cannot tell their areas of interests due to lack morale from their side.*

*Graduates need to be taught to take responsibility for their careers.*

*Students require generally a "make-over" to use them effectively.*

*Most important: Willingness to learn and grow, and discipline to take responsibility for this.*

*Ability to understand the importance of roles and responsibilities on work produced. Understanding where the money that they are paid with comes from and taking responsibility in terms of ensuring productivity and profitability.*

*Creative thinking, taking initiative & responsibility and professional communication is lacking.*

*Graduates need to be better at lateral thinking - not just following a "recipe" for everything.*

*General professionalism, time management etc. lacking.*

#### Workplace exposure

The value of workplace exposure in preparing students on what to expect in the workplace, before he/she actually graduates appear to impact positively on how respondents rate such students. As one respondent commented:

*The incumbents are in most cases students who have been in the employ of the company and have thus been trained and coaxed in these attributes, hence the good scores*

#### Company focus

Some respondents commented that the emphasis for companies in the construction sector differs from other sectors. As one respondent stated:

*Construction companies do not encourage graduates to further their studies, they want them to gain experience*

#### Limited problem solving skills

Some respondents commented as to the inability of graduates in solving basic problems and need to re-train them. The following comments summarises it:

*Inability to undertake basic engineering calculations.*

*Inability to solve problems using basics not computers.*

*Inability to ask the right answers in order to solve the problem. Candidates have no idea to formulate problems/solutions.*

*I think the areas covered are fine however the level of skill in these areas are generally very low. All the graduates we employed had to be trained from "ground level". They generally say things like "I think we did something like that at school" but they have*



*very poor knowledge and design knowledge, even with basic calculations like channel flow, simply supported beams, how to specify a pump, etc. they cannot do. We first train them to use Auto CAD and use them for drawings until they understand how things fit together. We then slowly start training them in basic design and report writing. We found that we cannot give them a basic problem and leaving them to design it.*

#### Limited design skills

Respondents commented as to the limited ability demonstrated by graduates in performing design functions and need to train them in the workplace. The following are some of the comments:

*Candidates seemed unprepared for reality of a design office.*

*Graduates are employed by the department expecting them to design these infrastructures, only to find that everything is new to them.*

*We allocate most young people about 6 months to become competent in using the CAD and the associated design software. This is a core skill they need to develop before they can become productive in the design office.*

*Graduates don't have a realistic idea of the pressures of a design office. They need to hit the ground running. They would cope better if they had a better idea of what the office environment, and expectations of the rest of the team, are. Job shadow opportunities should be made possible on a much larger scale.*

#### Limited communication skills

Respondents indicated that some graduates were did not meet workplace expectations in terms of the communication abilities. The following are comments that relates to this theme:

*Written communication especially is very poor and not emphasized enough. Verbal communication skills also need improving in the longer term to ensure follow ups etc.*

*Technical Report Writing Skills lacking*

## 4.2 Student Demand Study

The responses received from prospective Civil Engineering students as to the engineering qualifications that WSU are consider offering are described below.

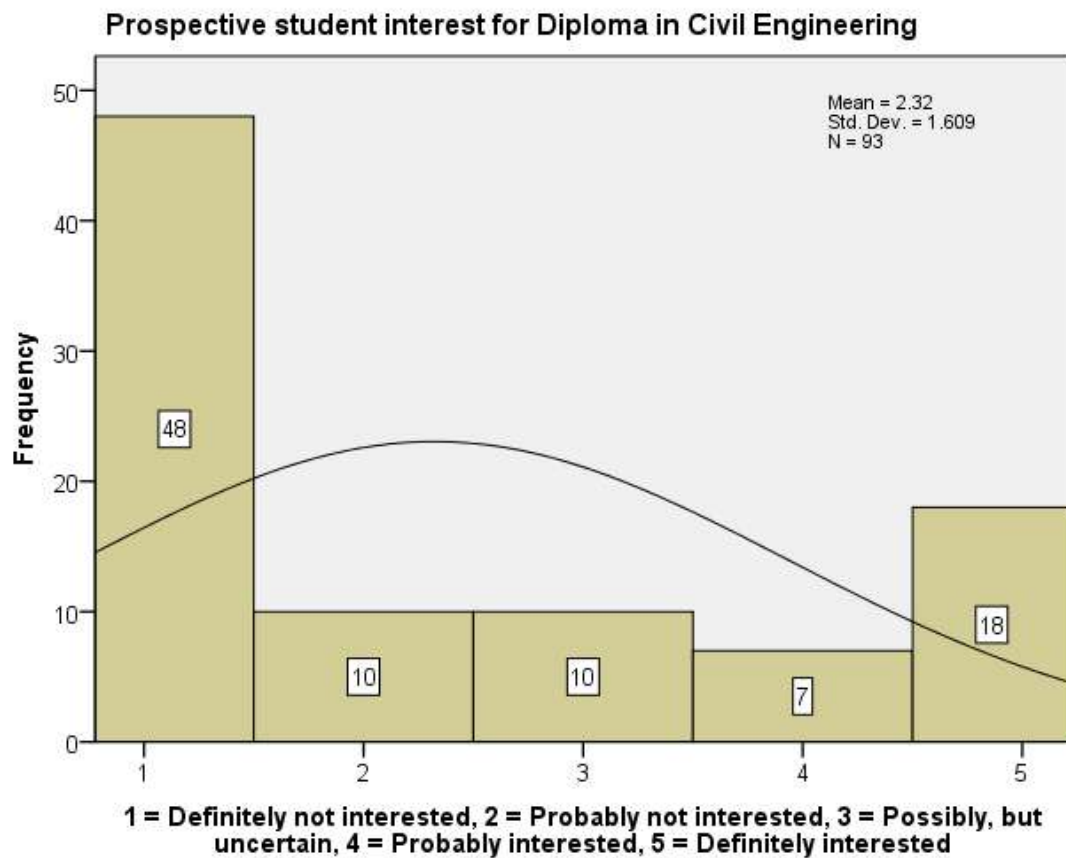
### 4.2.1 Prospective Civil Engineering students

#### Student views on qualifications

The responses received from prospective Civil Engineering students on the respective engineering qualifications that WSU are consider offering are described in Tables 40-44 and Figures 37-41 below.

**TABLE 40: Views of prospective students: Diploma in Civil Engineering**

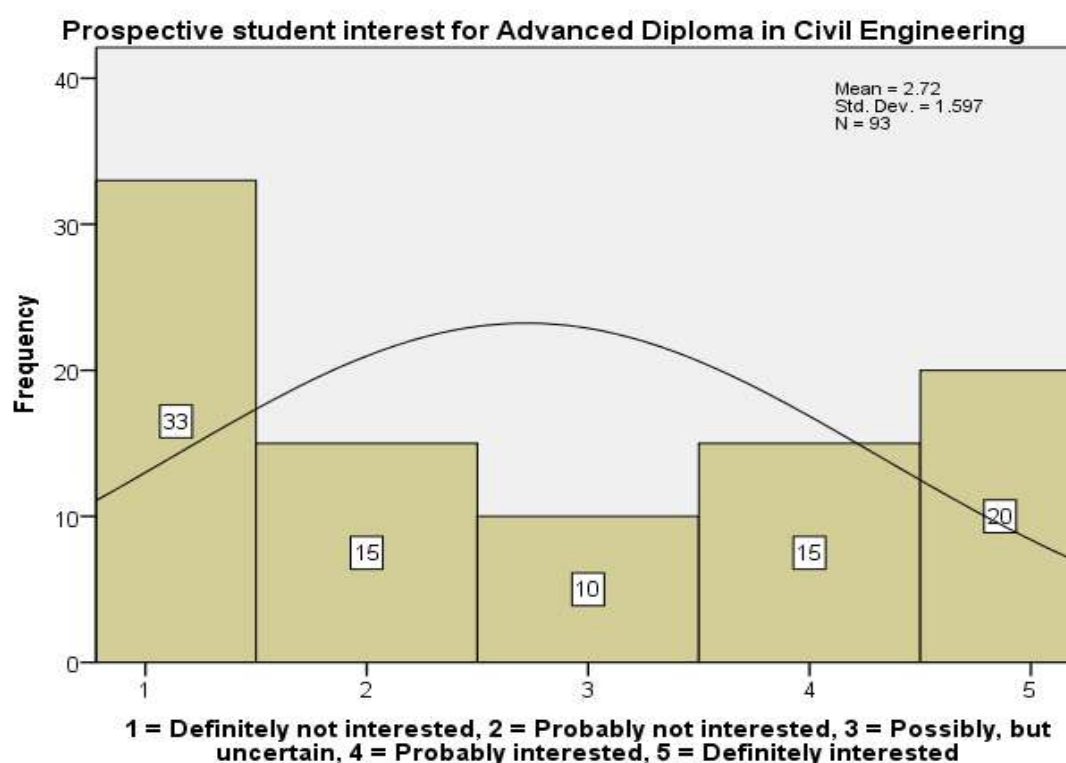
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	48	44.9	51.6	51.6
	Probably not interested	10	9.3	10.8	62.4
	Possibly, but uncertain	10	9.3	10.8	73.1
	Probably interested	7	6.5	7.5	80.6
	Definitely interested	18	16.8	19.4	100.0
	Total	93	86.9	100.0	
Missing	System	14	13.1		
Total		107	100.0		



**FIGURE 37: Views of prospective students as to the need for Diploma in Civil Engineering (n=93)**

**TABLE 41: Views of prospective students: Advanced Diploma in Civil Engineering**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	33	30.8	35.5	35.5
	Probably not interested	15	14.0	16.1	51.6
	Possibly, but uncertain	10	9.3	10.8	62.4
	Probably interested	15	14.0	16.1	78.5
	Definitely interested	20	18.7	21.5	100.0
	Total	93	86.9	100.0	
Missing	System	14	13.1		
Total		107	100.0		

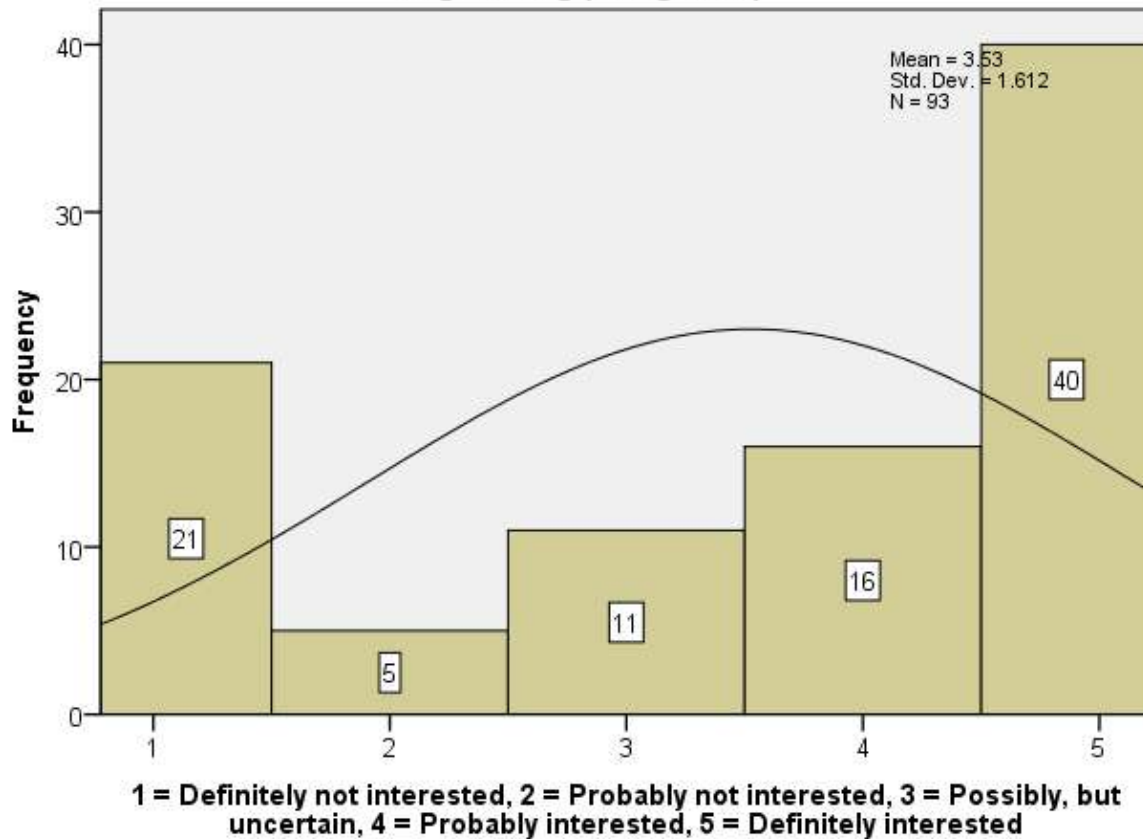


**FIGURE 38: Views of prospective students as to the need for Advanced Diploma in Civil Engineering (n=93)**

**TABLE 42: Views of prospective students: Bachelor of Engineering Technology in Civil Engineering (BEng Tech)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	21	19.6	22.6	22.6
	Probably not interested	5	4.7	5.4	28.0
	Possibly, but uncertain	11	10.3	11.8	39.8
	Probably interested	16	15.0	17.2	57.0
	Definitely interested	40	37.4	43.0	100.0
	Total	93	86.9	100.0	
Missing	System	14	13.1		
Total		107	100.0		

**Prospective student interest for Bachelor of Engineering Technology in Civil Engineering (BEng Tech)**

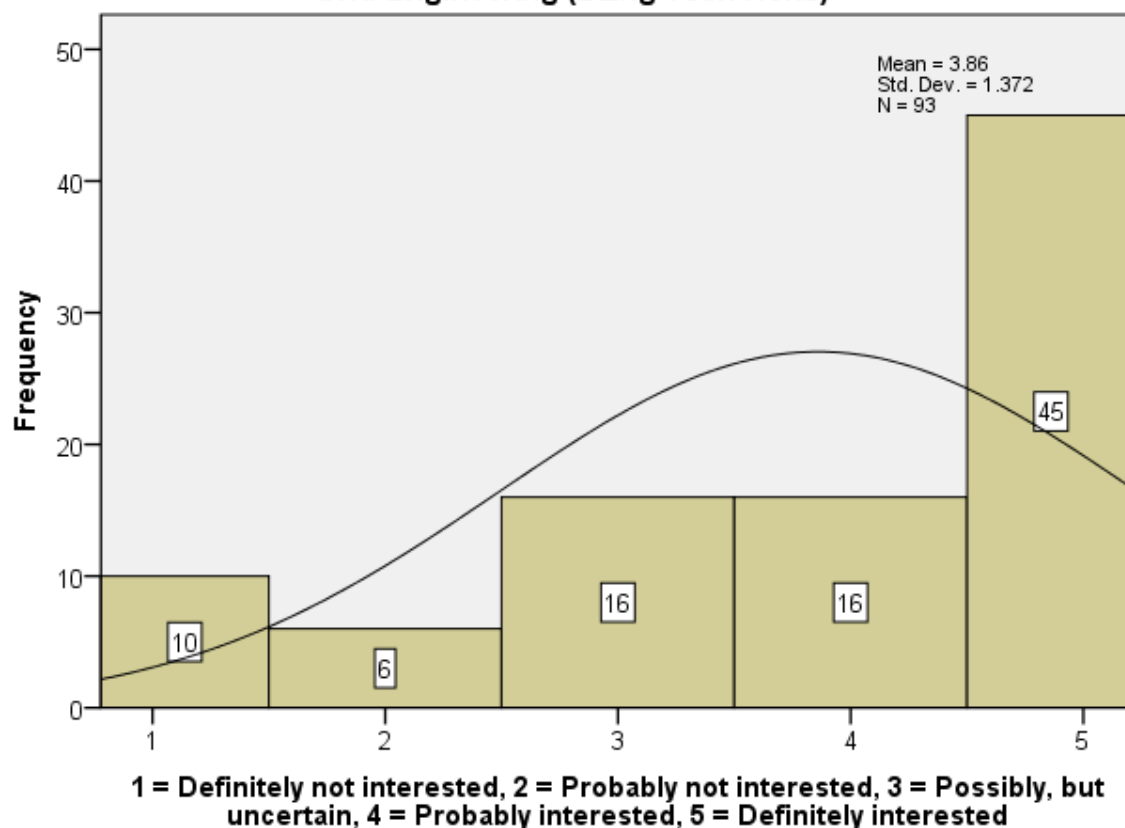


**FIGURE 39: Views of prospective students as to the need for BEng Tech in Civil Engineering (n=93)**

**TABLE 43: Views of prospective students: Bachelor of Engineering Technology Honours in Civil Engineering (BEng Tech Hons)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	10	9.3	10.8	10.8
	Probably not interested	6	5.6	6.5	17.2
	Possibly, but uncertain	16	15.0	17.2	34.4
	Probably interested	16	15.0	17.2	51.6
	Definitely interested	45	42.1	48.4	100.0
	Total	93	86.9	100.0	
Missing	System	14	13.1		
Total		107	100.0		

**Prospective student interest for Bachelor of Engineering Technology Honours in Civil Engineering (BEng Tech Hons)**

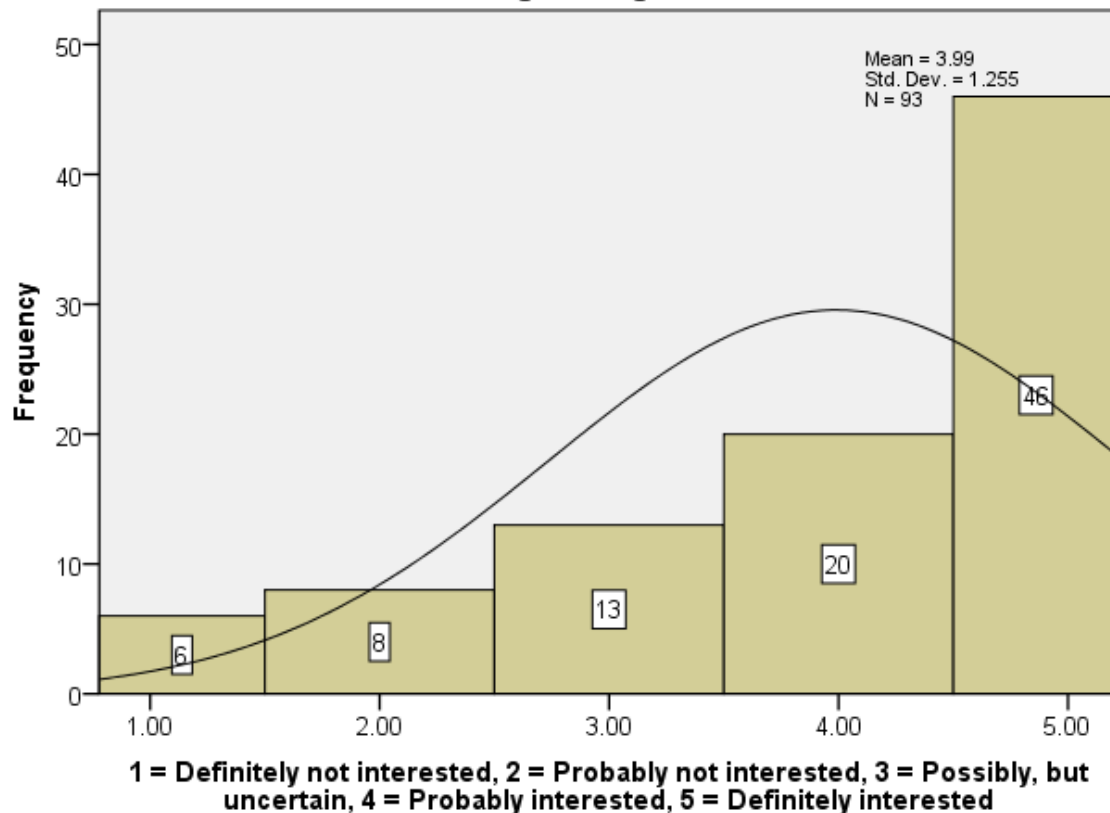


**FIGURE 40: Views of prospective students as to the need for BEng Tech(Hons) in Civil Engineering (n=93)**

**TABLE 44: Views of prospective students: Masters of Engineering (MSc/MEng) in Civil Engineering**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	6	5.6	6.5	6.5
	Probably not interested	8	7.5	8.6	15.1
	Possibly, but uncertain	13	12.1	14.0	29.0
	Probably interested	20	18.7	21.5	50.5
	Definitely interested	46	43.0	49.5	100.0
	Total	93	86.9	100.0	
Missing	System	14	13.1		
Total		107	100.0		

**Prospective students interest for Masters of Engineering (MSc/MEng) in Civil Engineering**



**FIGURE 41: Views of prospective students as to the need for Masters in Civil Engineering (n=93)**

Planned year of enrolment

The responses received from prospective Civil Engineering students as to the planned year in which they wish to enrol are described in Tables 45-49 below.

**TABLE 45: Prospective students preferred year of enrolment: Diploma in Civil Eng (n=33)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	18	16.8	54.5	54.5
	2019	6	5.6	18.2	72.7
	2020	3	2.8	9.1	81.8
	2022 and beyond	6	5.6	18.2	100.0
	Total	33	30.8	100.0	
Missing	System	74	69.2		
Total		107	100.0		

**TABLE 46: Prospective students preferred year of enrolment: Advanced Diploma in Civil Engineering (n=44)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	21	19.6	47.7	47.7
	2019	9	8.4	20.5	68.2
	2020	4	3.7	9.1	77.3
	2021	4	3.7	9.1	86.4
	2022 and beyond	6	5.6	13.6	100.0
	Total	44	41.1	100.0	
Missing	System	63	58.9		
Total		107	100.0		

**TABLE 47: Prospective students preferred year of enrolment: Bachelor of Engineering Technology in Civil Engineering (BEng Tech) (n=65)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	41	38.3	63.1	63.1
	2019	10	9.3	15.4	78.5
	2020	4	3.7	6.2	84.6
	2021	4	3.7	6.2	90.8
	2022 and beyond	6	5.6	9.2	100.0
	Total	65	60.7	100.0	
Missing	System	42	39.3		
Total		107	100.0		

**TABLE 48: Prospective students preferred year of enrolment: Bachelor of Engineering Technology Honours in Civil Eng (BEng Tech Hons) (n=75)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	16	15.0	21.3	21.3
	2019	18	16.8	24.0	45.3
	2020	16	15.0	21.3	66.7
	2021	14	13.1	18.7	85.3
	2022 and beyond	11	10.3	14.7	100.0
	Total	75	70.1	100.0	
Missing	System	32	29.9		
Total		107	100.0		

**TABLE 49: Prospective students preferred year of enrolment: Masters of Engineering (MSc/MEng) in Civil Engineering (n=77)**

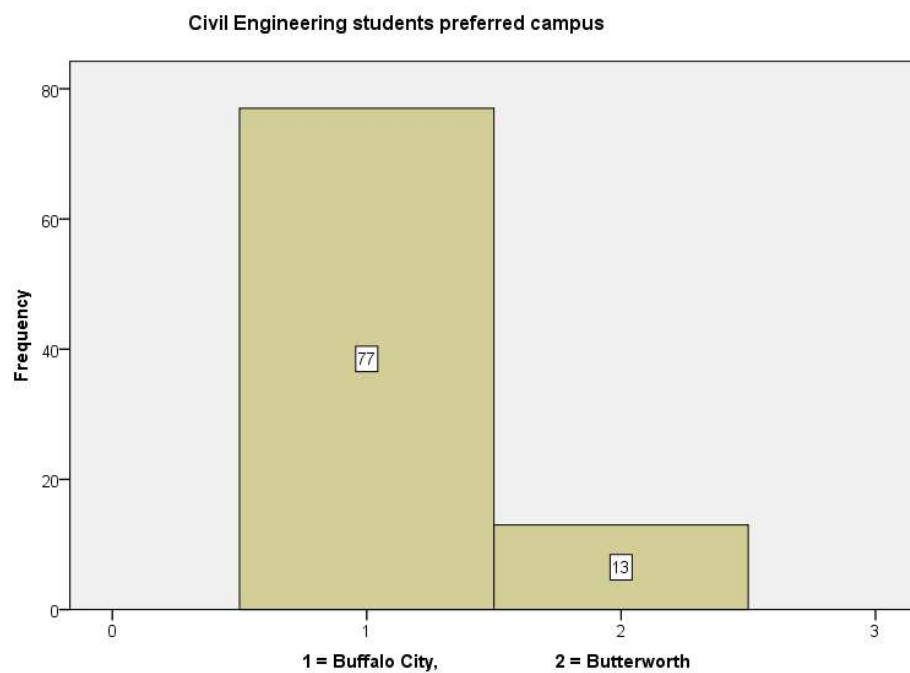
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	9	8.4	11.7	11.7
	2019	11	10.3	14.3	26.0
	2020	11	10.3	14.3	40.3
	2021	14	13.1	18.2	58.4
	2022 and beyond	32	29.9	41.6	100.0
	Total	77	72.0	100.0	
Missing	System	30	28.0		
Total		107	100.0		

### Preferred campus for tuition

The responses received from prospective Civil Engineering students as to their preferred campus for tuition are described in Table 50 and Figure 42 below.

**TABLE 50: Civil Eng students preferred campus (to attend contact sessions) (n=90)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Buffalo City (East London)	77	72.0	85.6	85.6
	Butterworth (Ibika)	13	12.1	14.4	100.0
	Total	90	84.1	100.0	
Missing	System	17	15.9		
Total		107	100.0		



**FIGURE 42: Civil Eng students preferred campus of tuition (to attend face to face/contact sessions) (n=90)**

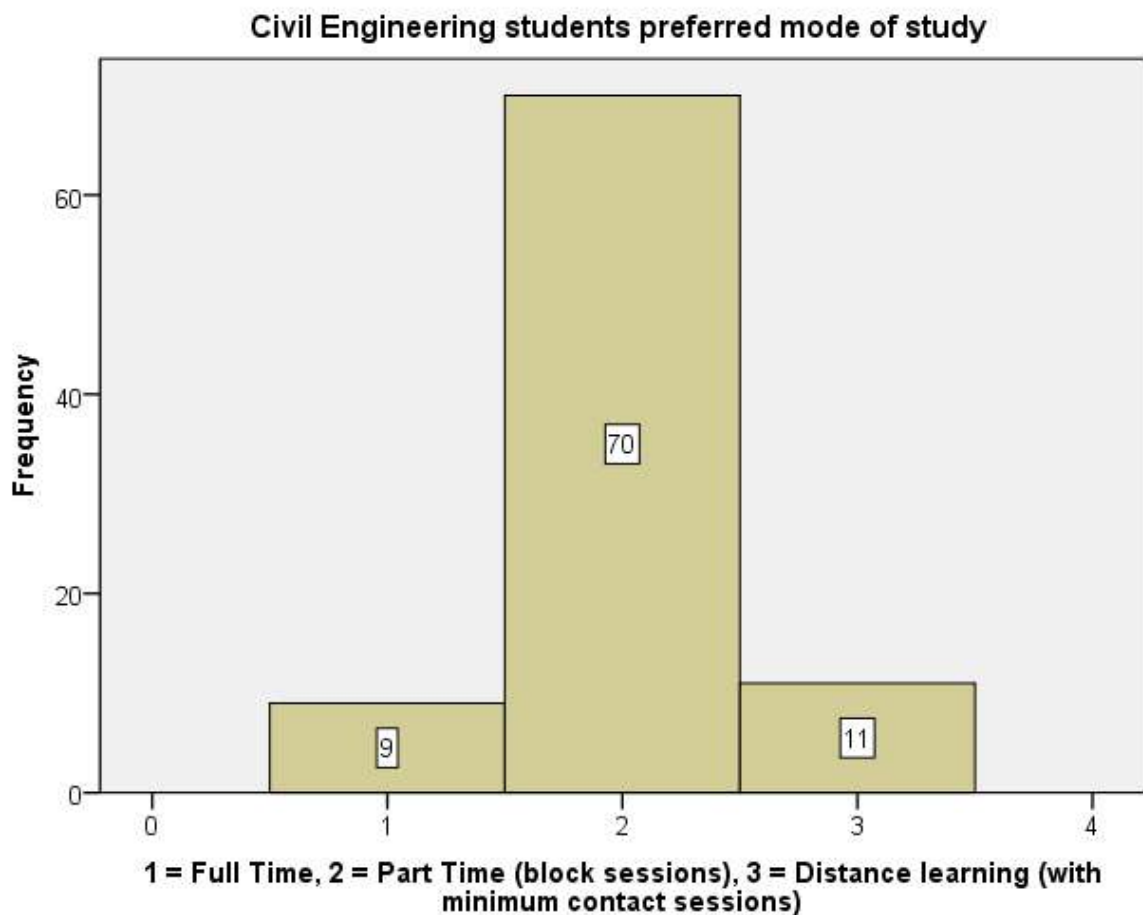
### Preferred mode of study

The responses received from prospective Civil Engineering students as to their preferred campus for tuition are described in Table 51 and Figure 43 below.

**TABLE 51: Civil Engineering students preferred mode of study (n=90)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Full time	9	8.4	10.0	10.0
	Part Time (block sessions)	70	65.4	77.8	87.8
	Distance learning (minimum contact sessions)	11	10.3	12.2	100.0
	Total	90	84.1	100.0	
Missing	System	17	15.9		
Total		107	100.0		





**FIGURE 43: Civil Eng students preferred mode of tuition (n=90)**

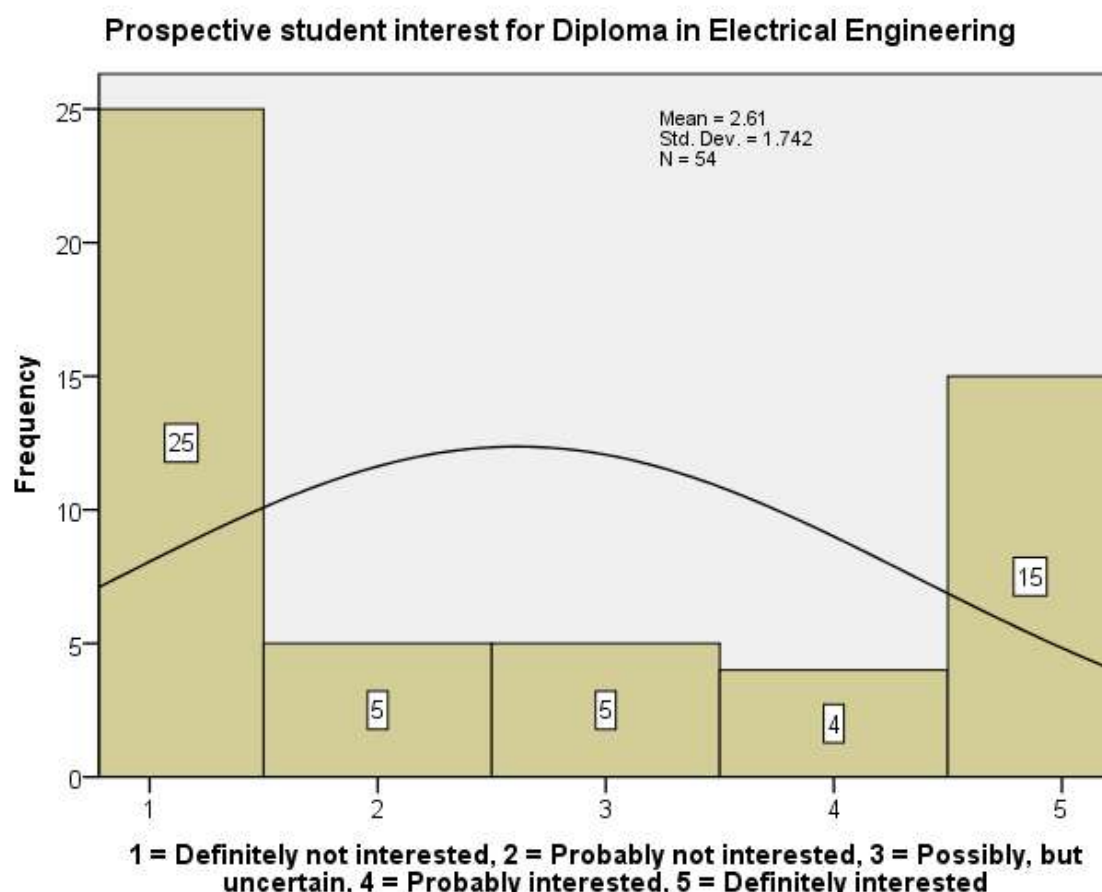
#### 4.2.2 Prospective Electrical Engineering students

##### Student views on qualifications

The responses received from prospective Electrical Engineering students as to the range of engineering qualifications that WSU is considering to offer are described in Tables 52-56 and Figures 44-48 below.

**TABLE 52: Views of prospective students: Diploma in Electrical Engineering (n=54)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	25	44.6	46.3	46.3
	Probably not interested	5	8.9	9.3	55.6
	Possibly, but uncertain	5	8.9	9.3	64.8
	Probably interested	4	7.1	7.4	72.2
	Definitely interested	15	26.8	27.8	100.0
	Total	54	96.4	100.0	
Missing	System	2	3.6		
Total		56	100.0		

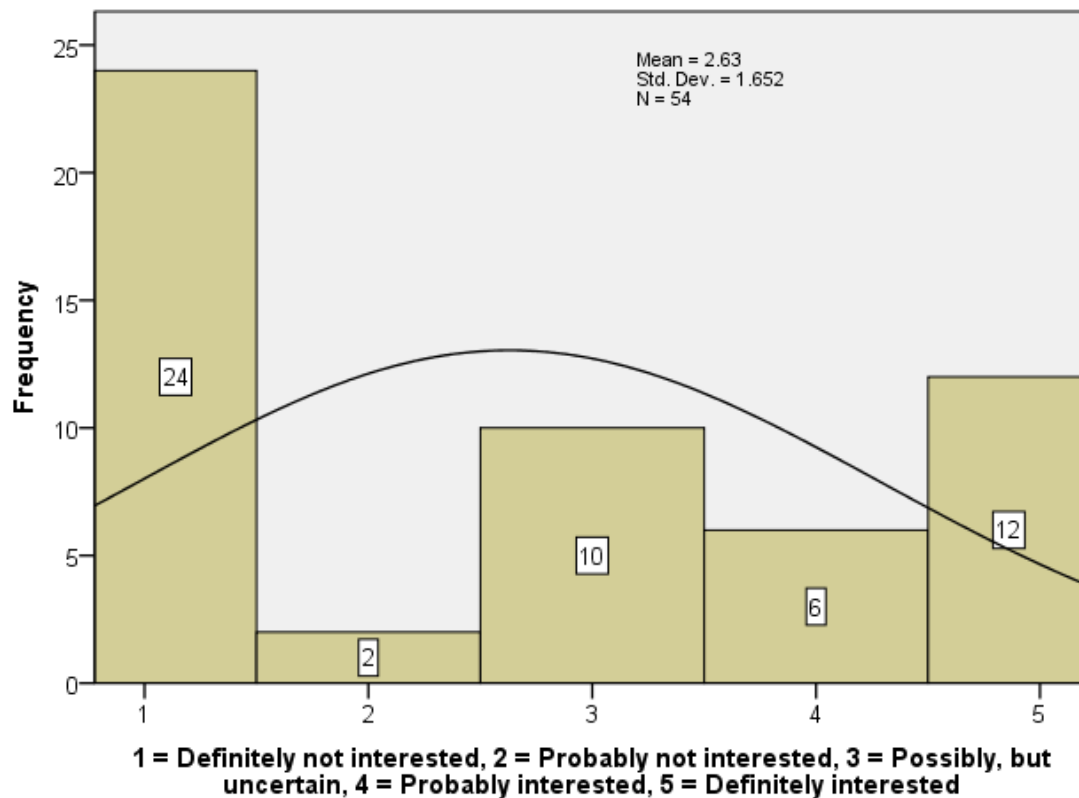


**FIGURE 44: Views of prospective students as to the need for Diploma in Electrical Engineering (n=54)**

**TABLE 53: Views of prospective students: Advanced Diploma in Electrical Engineering (n=54)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	24	42.9	44.4	44.4
	Probably not interested	2	3.6	3.7	48.1
	Possibly, but uncertain	10	17.9	18.5	66.7
	Probably interested	6	10.7	11.1	77.8
	Definitely interested	12	21.4	22.2	100.0
	Total	54	96.4	100.0	
Missing	System	2	3.6		
Total		56	100.0		

### Prospective student interest for Advanced Diploma in Electrical Engineering

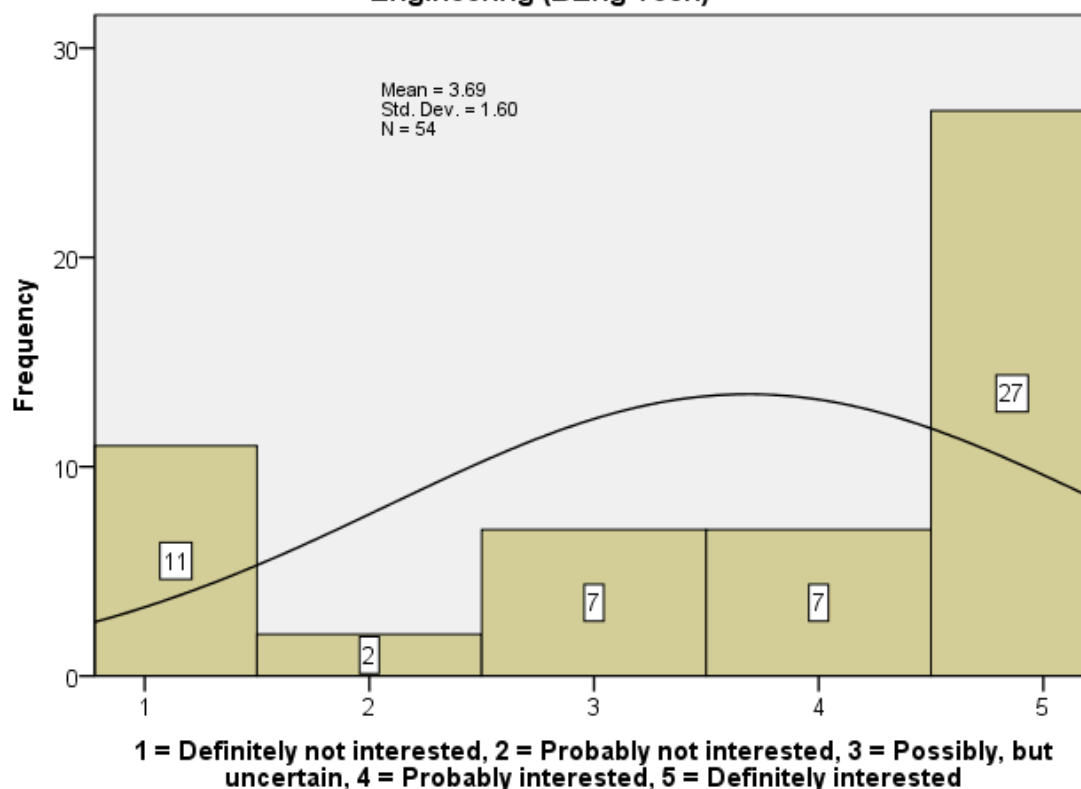


**FIGURE 45: Views of prospective students as to the need for Advanced Diploma in Electrical Engineering (n=54)**

**TABLE 54: Views of prospective students: Advanced Diploma in Electrical Engineering Bachelor of Engineering Technology in Electrical Engineering (BEng Tech) (n=54)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	11	19.6	20.4	20.4
	Probably not interested	2	3.6	3.7	24.1
	Possibly, but uncertain	7	12.5	13.0	37.0
	Probably interested	7	12.5	13.0	50.0
	Definitely interested	27	48.2	50.0	100.0
	Total	54	96.4	100.0	
Missing	System	2	3.6		
Total		56	100.0		

**Prospective student interest for Bachelor of Engineering Technology in Electrical Engineering (BEng Tech)**

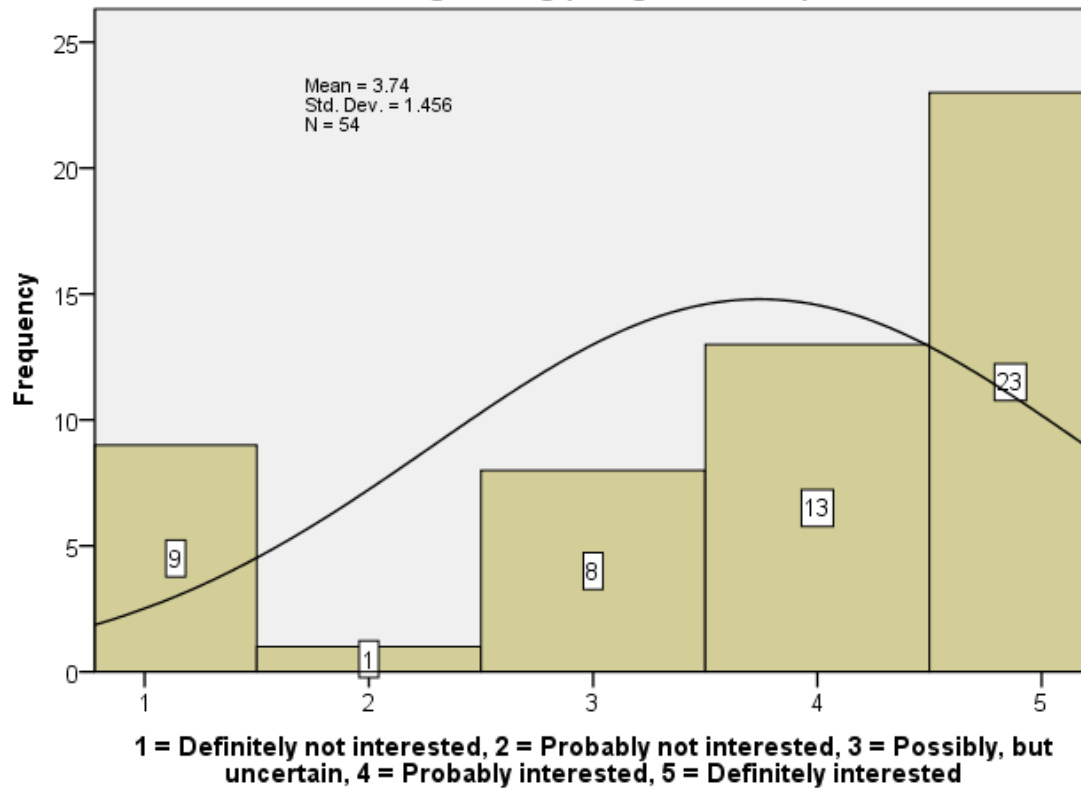


**FIGURE 46: Views of prospective students as to the need for BEng Tech in Electrical Engineering (n=54)**

**TABLE 55: Views of prospective students: Advanced Bachelor of Engineering Technology Honours in Electrical Engineering (BEng Tech Hons) (n=54)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	9	16.1	16.7	16.7
	Probably not interested	1	1.8	1.9	18.5
	Possibly, but uncertain	8	14.3	14.8	33.3
	Probably interested	13	23.2	24.1	57.4
	Definitely interested	23	41.1	42.6	100.0
	Total	54	96.4	100.0	
Missing	System	2	3.6		
Total		56	100.0		

**Prospective student interest for Bachelor of Engineering Technology Honours in Electrical Engineering (BEng Tech Hons).**

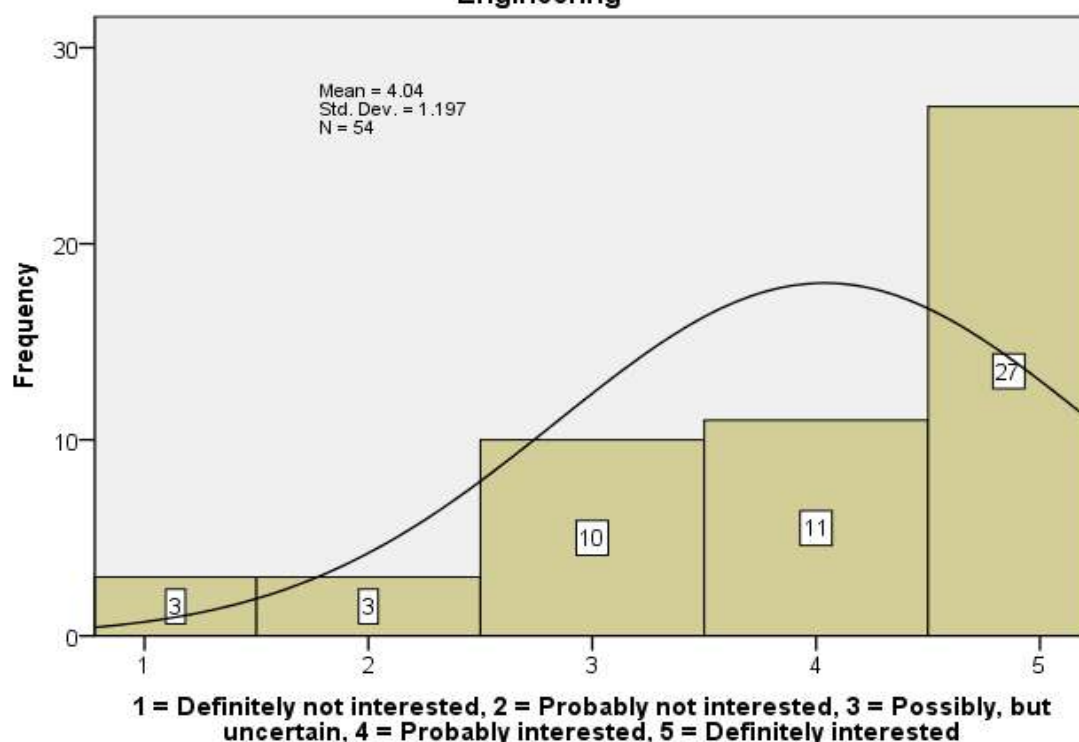


**FIGURE 47: Views of prospective students as to the need for BEng Tech(Hons) in Electrical Engineering (n=54)**

**TABLE 56: Views of prospective students: Masters of Engineering (MSc/MEng) in Electrical Engineering (n=54)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	3	5.4	5.6	5.6
	Probably not interested	3	5.4	5.6	11.1
	Possibly, but uncertain	10	17.9	18.5	29.6
	Probably interested	11	19.6	20.4	50.0
	Definitely interested	27	48.2	50.0	100.0
	Total	54	96.4	100.0	
Missing	System	2	3.6		
Total		56	100.0		

### Prospective student interest for Masters of Engineering (MSc/MEng) in Electrical Engineering



**FIGURE 48: Views of prospective students as to the need for Masters in Electrical Engineering (n=54)**

### Planned year of enrolment

The responses received from prospective Electrical Engineering students as to the planned year in which they wish to enrol are described in Tables 57-61 below.

**TABLE 57: Prospective students preferred date of enrolment: Diploma in Electrical Engineering (n=22)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	16	28.6	72.7	72.7
	2019	2	3.6	9.1	81.8
	2020	1	1.8	4.5	86.4
	2021	1	1.8	4.5	90.9
	2022 and beyond	2	3.6	9.1	100.0
	Total	22	39.3	100.0	
Missing	System	34	60.7		
Total		56	100.0		

**TABLE 58: Prospective students preferred date of enrolment: Diploma Advanced Diploma in Electrical Engineering (n=26)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	15	26.8	57.7	57.7
	2019	7	12.5	26.9	84.6
	2020	1	1.8	3.8	88.5
	2021	1	1.8	3.8	92.3
	2022 and beyond	2	3.6	7.7	100.0
	Total	26	46.4	100.0	
Missing	System	30	53.6		
Total		56	100.0		

**TABLE 59: Prospective students preferred date of enrolment: Bachelor of Engineering Technology in Electrical Engineering (BEng Tech) (n=39)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	16	28.6	41.0	41.0
	2019	10	17.9	25.6	66.7
	2020	8	14.3	20.5	87.2
	2021	4	7.1	10.3	97.4
	2022 and beyond	1	1.8	2.6	100.0
	Total	39	69.6	100.0	
Missing	System	17	30.4		
Total		56	100.0		

**TABLE 60: Prospective students preferred date of enrolment: Bachelor of Engineering Technology Honours in Electrical Eng (BEng Tech Hons) (n=42)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	5	8.9	11.9	11.9
	2019	7	12.5	16.7	28.6
	2020	13	23.2	31.0	59.5
	2021	8	14.3	19.0	78.6
	2022 and beyond	9	16.1	21.4	100.0
	Total	42	75.0	100.0	
Missing	System	14	25.0		
Total		56	100.0		

**TABLE 61: Prospective students preferred date of enrolment: Masters of Engineering (MSc/MEng) in Electrical Engineering**

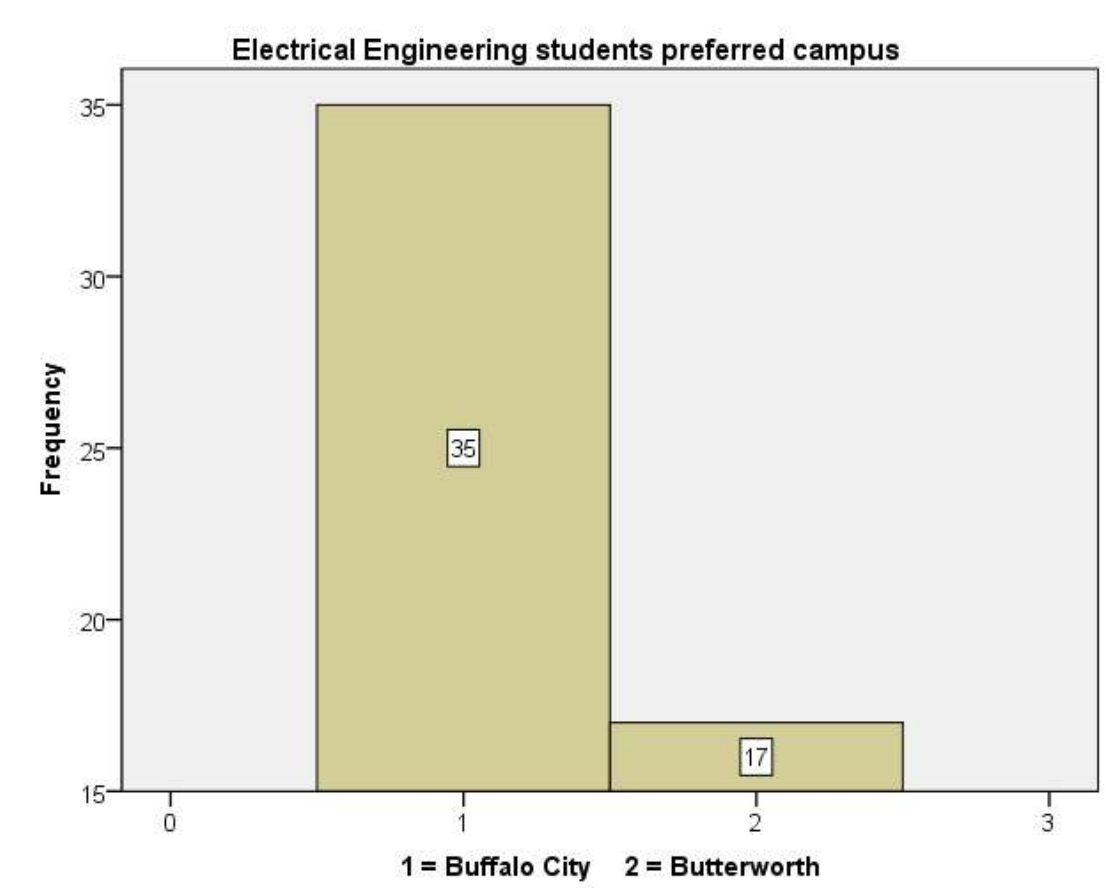
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	5	8.9	10.9	10.9
	2019	7	12.5	15.2	26.1
	2020	3	5.4	6.5	32.6
	2021	7	12.5	15.2	47.8
	2022 and beyond	24	42.9	52.2	100.0
	Total	46	82.1	100.0	
Missing	System	10	17.9		
Total		56	100.0		

### Preferred campus for tuition

The responses received from prospective Electrical Engineering students as to their preferred campus for tuition are described in Table 62 and Figure 49 below.

**TABLE 62: Electrical Eng students preferred campus** (to attend contact sessions)  
**(n=52)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Buffalo City (East London)	35	62.5	67.3	67.3
	Butterworth (Ibika)	17	30.4	32.7	100.0
	Total	52	92.9	100.0	
Missing	System	4	7.1		
Total		56	100.0		



**FIGURE 49: Electrical Eng students preferred campus of tuition** (to attend face to face/contact sessions) **(n=52)**

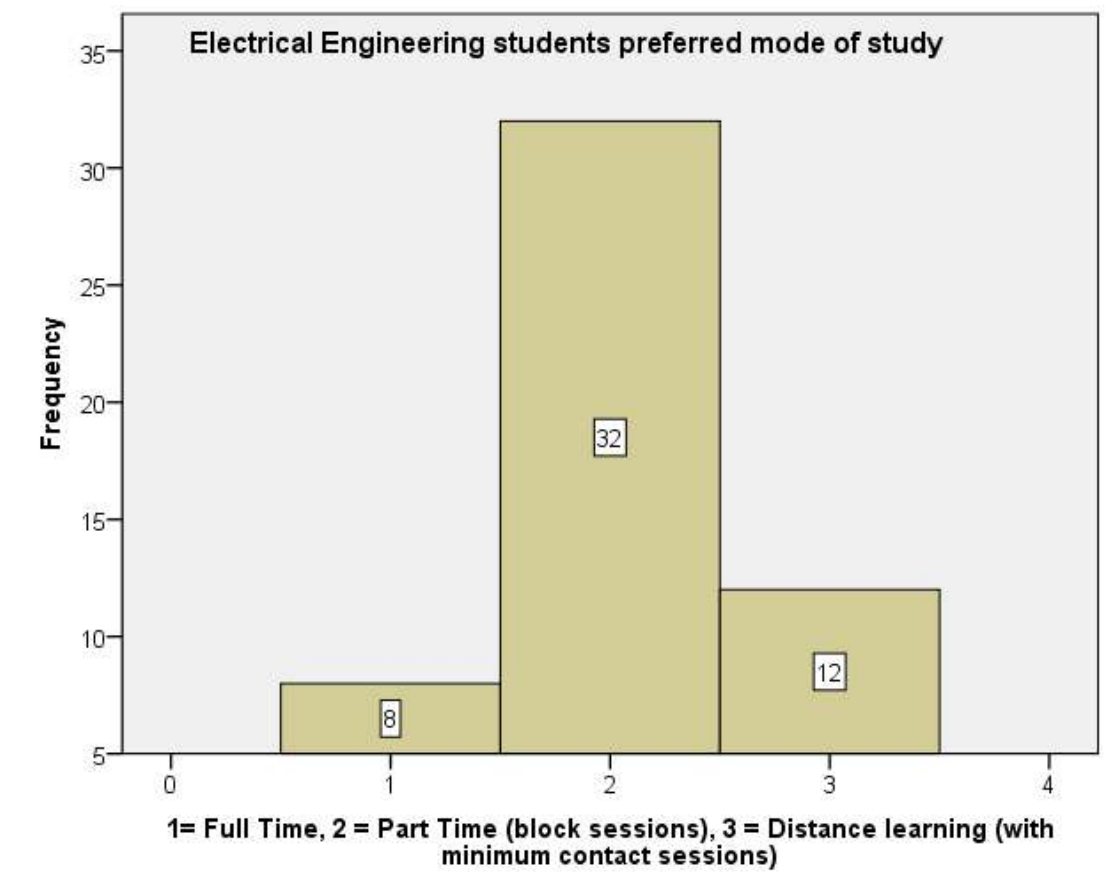


### Preferred mode of study

The responses received from prospective Electrical Engineering students as to their preferred campus for tuition are described in Table 63 and Figure 50 below.

**TABLE 63: Electrical Engineering students preferred mode of study (n=52)**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Full time	8	14.3	15.4	15.4
Valid Part Time (block sessions)	32	57.1	61.5	76.9
Valid Distance learning (minimum contact sessions)	12	21.4	23.1	100.0
Valid Total	52	92.9	100.0	
Missing System	4	7.1		
Total	56	100.0		



**FIGURE 50: Electrical Eng students preferred mode of tuition (n=52)**

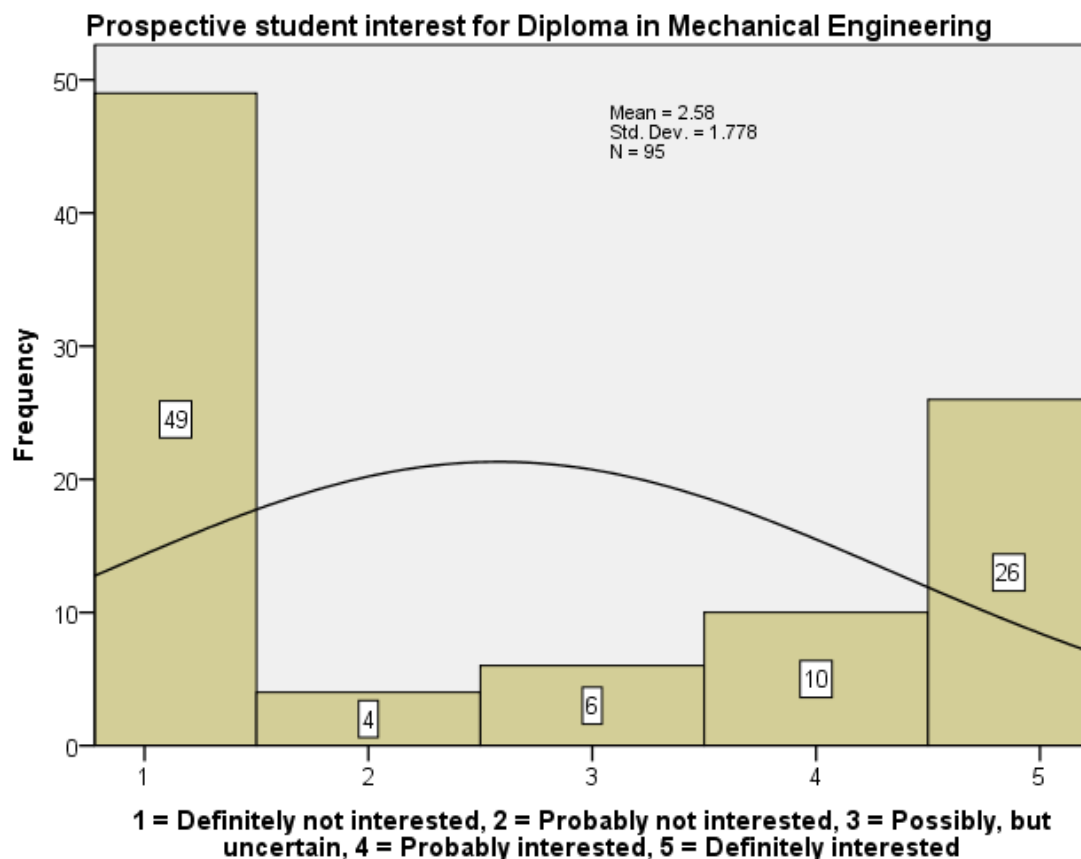
### 4.2.3 Prospective Mechanical Engineering students

#### Student views on qualifications

The responses received from prospective Mechanical Engineering students as to the engineering qualifications that WSU is consider offering are described in Tables 64-68 and Figures 51-55 below.

**TABLE 64: Views of prospective students: Diploma in Mechanical Engineering (n=95)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	49	47.6	51.6	51.6
	Probably not interested	4	3.9	4.2	55.8
	Possibly, but uncertain	6	5.8	6.3	62.1
	Probably interested	10	9.7	10.5	72.6
	Definitely interested	26	25.2	27.4	100.0
	Total	95	92.2	100.0	
Missing	System	8	7.8		
Total		103	100.0		

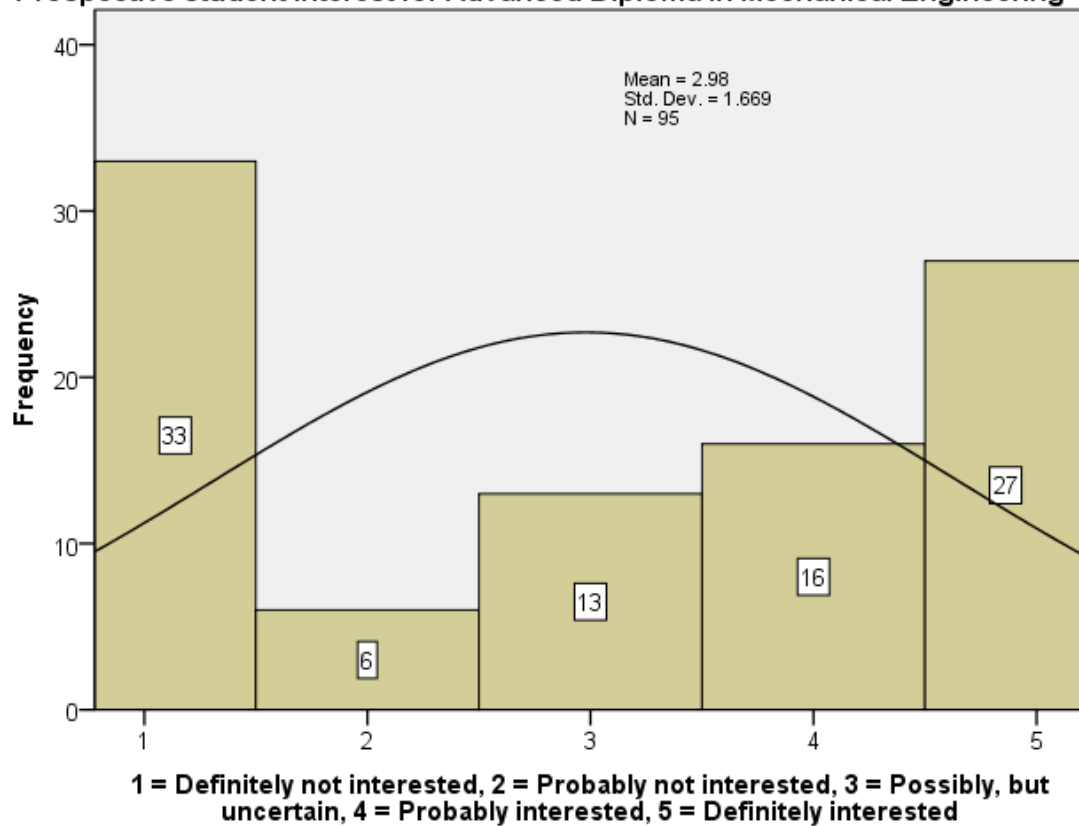


**FIGURE 51: Views of prospective students as to the need for Diploma in Mechanical Engineering (n=95)**

**TABLE 65: Views of prospective students: Advanced Diploma in Mechanical Engineering (n=95)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	33	32.0	34.7	34.7
	Probably not interested	6	5.8	6.3	41.1
	Possibly, but uncertain	13	12.6	13.7	54.7
	Probably interested	16	15.5	16.8	71.6
	Definitely interested	27	26.2	28.4	100.0
	Total	95	92.2	100.0	
Missing	System	8	7.8		
Total		103	100.0		

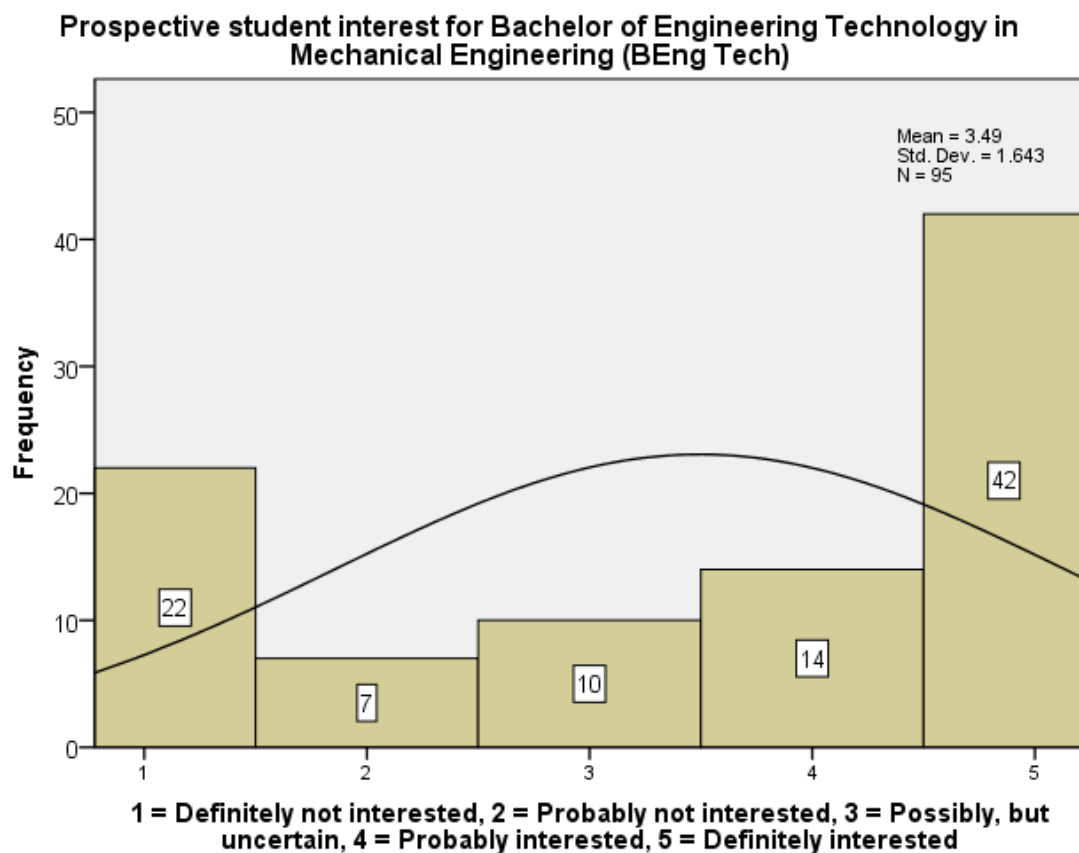
**Prospective student interest for Advanced Diploma in Mechanical Engineering**



**FIGURE 52: Views of prospective students as to the need for Advanced Diploma in Mechanical Engineering (n=95)**

**TABLE 66: Views of prospective students: Bachelor of Engineering Technology in Mechanical Engineering (BEng Tech) (n=95)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	22	21.4	23.2	23.2
	Probably not interested	7	6.8	7.4	30.5
	Possibly, but uncertain	10	9.7	10.5	41.1
	Probably interested	14	13.6	14.7	55.8
	Definitely interested	42	40.8	44.2	100.0
	Total	95	92.2	100.0	
Missing	System	8	7.8		
Total		103	100.0		

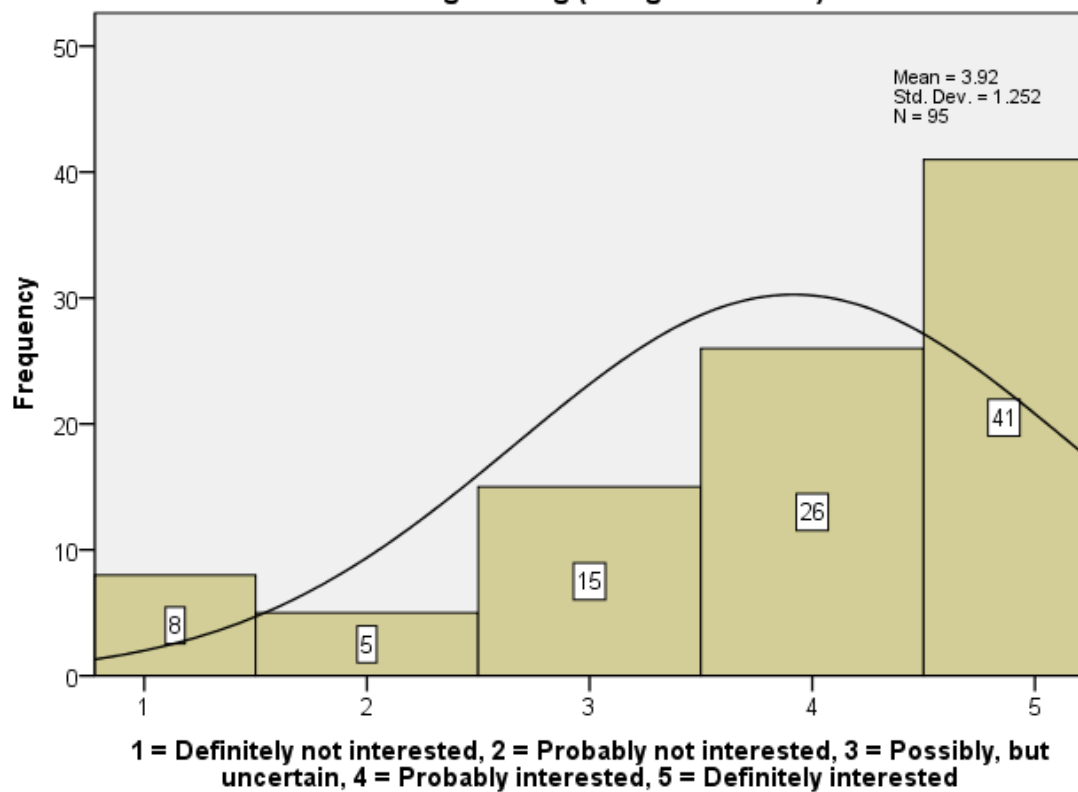


**FIGURE 53: Views of prospective students as to the need for BEng Tech in Mechanical Engineering (n=95)**

**TABLE 67: Views of prospective students: Bachelor of Engineering Technology Honours in Mechanical Engineering (BEng Tech Hons) (n=95)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	8	7.8	8.4	8.4
	Probably not interested	5	4.9	5.3	13.7
	Possibly, but uncertain	15	14.6	15.8	29.5
	Probably interested	26	25.2	27.4	56.8
	Definitely interested	41	39.8	43.2	100.0
	Total	95	92.2	100.0	
Missing	System	8	7.8		
Total		103	100.0		

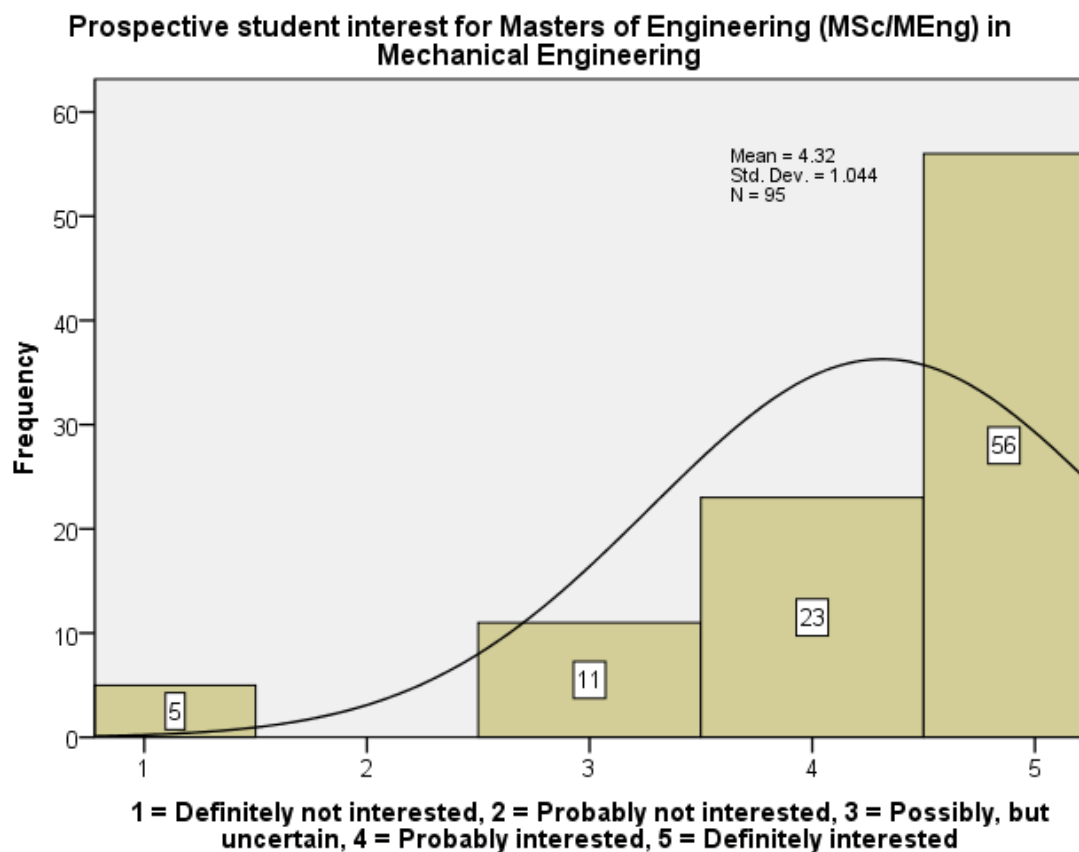
**Prospective student interest for Bachelor of Engineering Technology Honours in Mechanical Engineering (BEng Tech Hons).**



**FIGURE 54: Views of prospective students as to the need for BEng Tech(Hons) in Mechanical Engineering (n=95)**

**TABLE 68: Views of prospective students Masters of Engineering (MSc/MEng) in Mechanical Engineering (n=95)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely not interested	5	4.9	5.3	5.3
	Possibly, but uncertain	11	10.7	11.6	16.8
	Probably interested	23	22.3	24.2	41.1
	Definitely interested	56	54.4	58.9	100.0
	Total	95	92.2	100.0	
Missing	System	8	7.8		
Total		103	100.0		



**FIGURE 55: Views of prospective students as to the need for Masters in Mechanical Engineering (n=95)**

### Planned year of enrolment

The responses received from prospective Mechanical Engineering students as to the planned year in which they wish to enrol are described in Tables 69-73 below.

**TABLE 69: Prospective students preferred date of enrolment: Diploma in Mechanical Engineering (n=40)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	34	33.0	85.0	85.0
	2019	3	2.9	7.5	92.5
	2022 and beyond	3	2.9	7.5	100.0
	Total	40	38.8	100.0	
Missing	System	63	61.2		
Total		103	100.0		

**TABLE 70: Prospective students preferred date of enrolment: Advanced Diploma in Mechanical Engineering (n=53)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	39	37.9	73.6	73.6
	2019	7	6.8	13.2	86.8
	2020	3	2.9	5.7	92.5
	2021	2	1.9	3.8	96.2
	2022 and beyond	2	1.9	3.8	100.0
	Total	53	51.5	100.0	
Missing	System	50	48.5		
Total		103	100.0		

**TABLE 71: Prospective students preferred date of enrolment: Bachelor of Engineering Technology in Mechanical Engineering (BEng Tech) (n=61)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	40	38.8	65.6	65.6
	2019	7	6.8	11.5	77.0
	2020	10	9.7	16.4	93.4
	2022 and beyond	4	3.9	6.6	100.0
	Total	61	59.2	100.0	
Missing	System	42	40.8		
Total		103	100.0		

**TABLE 72: Prospective students preferred date of enrolment: Bachelor of Engineering Technology Honours in Mechanical Eng (BEng Tech Hons) (n=79)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	32	31.1	40.5	40.5
	2019	18	17.5	22.8	63.3
	2020	16	15.5	20.3	83.5
	2021	6	5.8	7.6	91.1
	2022 and beyond	7	6.8	8.9	100.0
	Total	79	76.7	100.0	
Missing	System	24	23.3		
Total		103	100.0		

**TABLE 73 Prospective students preferred date of enrolment: Masters of Engineering (MSc/MEng) in Mechanical Engineering (n=85)**

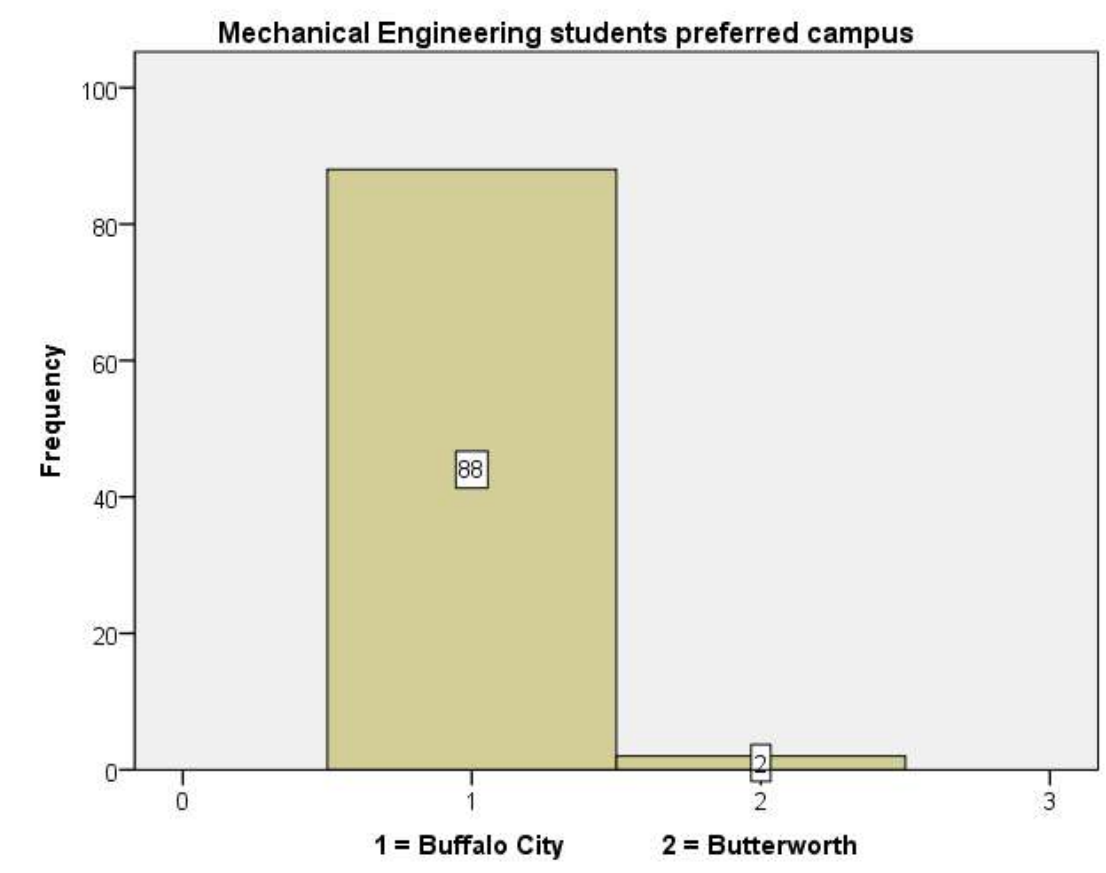
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2018	22	21.4	25.9	25.9
	2019	12	11.7	14.1	40.0
	2020	21	20.4	24.7	64.7
	2021	6	5.8	7.1	71.8
	2022 and beyond	24	23.3	28.2	100.0
	Total	85	82.5	100.0	
Missing	System	18	17.5		
Total		103	100.0		

#### Preferred campus for tuition

The responses received from prospective Mechanical Engineering students as to their preferred campus for tuition are described in Table 74 and Figure 56 below.

**TABLE 74: Mech Eng students preferred campus (to attend contact sessions) (n=90)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Buffalo City (East London)	88	85.4	97.8	97.8
	Butterworth (Ibika)	2	1.9	2.2	100.0
	Total	90	87.4	100.0	
Missing	System	13	12.6		
Total		103	100.0		



**FIGURE 56: Mechanical Eng students preferred campus of tuition (to attend face to face/contact sessions) (n=90)**

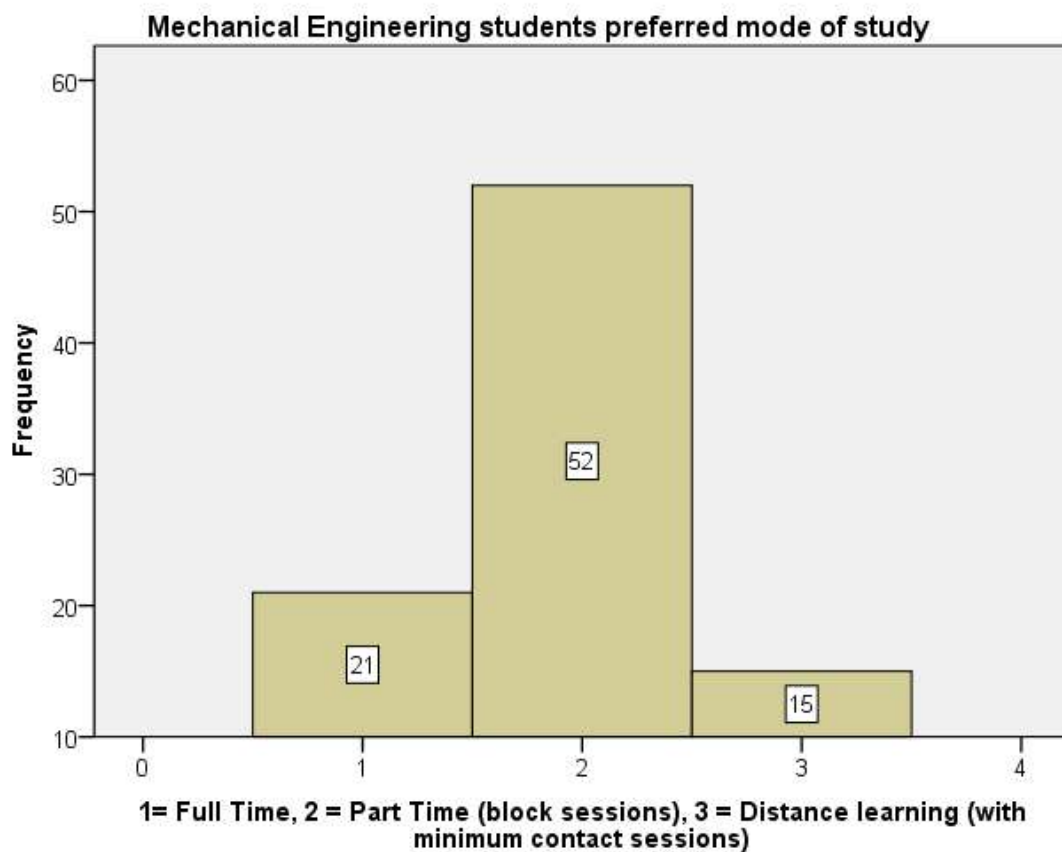


#### Preferred mode of study

The responses received from prospective Mechanical Engineering students as to their preferred campus for tuition are described in Table 75 and Figure 57 below.

**TABLE 75: Mechanical Engineering students preferred mode of study (n=88)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Full time	21	20.4	23.9	23.9
	Part Time (block sessions)	52	50.5	59.1	83.0
	Distance learning (minimum contact sessions)	15	14.6	17.0	100.0
	Total	88	85.4	100.0	
Missing	System	15	14.6		
Total		56	103	100.0	



**FIGURE 57: Electrical Eng students preferred campus of tuition (to attend face to face/contact sessions) (n=88)**

#### 4.2.4 Views of prospective students as to other qualifications

Prospective engineering students from all disciplines were ask to indicate if there are any other qualifications that WSU should consider offering. The following are some of the responses that were received.

#### Civil Engineering students

- Degrees in Urban and Structural Engineering
- Post graduate qualifications in Project Management
- Qualifications in Land Surveying
- Specialised short courses, e.g. AutoCAD, Project Management

#### Electrical Engineering students

- Qualifications in Mechatronics
- Qualifications in Industrial Engineering
- Post graduate qualifications and/or short courses in Project Management
- Specialised short courses, e.g. Control Systems

#### Mechanical Engineering students

- Qualifications in Mechatronics
- Qualifications in Industrial Engineering
- Qualifications in Quality Management
- Post graduate qualification in Project Management
- Specialised short courses, e.g. Safety, Project Management, Inventor and CAD

## **5. DISCUSSION & FINDINGS**

This report describes the results of an Employer and Student Demand Study that were undertaken to assess the programme desirability, impact or relevance of the range of HEQSF-aligned engineering programmes that WSU is consider offering. The qualifications that were the focus of this study ranged from NQF level 6 (Diploma) to NQF level 9 (Masters) and covered the disciplines of Civil, Electrical and Mechanical Engineering. A synopsis of the key points and findings of the two studies that were conducted are provided below.

### **Employer study**

The views of Civil, Electrical and Mechanical engineering employer representatives were obtained to determine:

- the extent to which their organisation need graduates with the HEQSF-aligned engineering qualifications that WSU are consider offering;
- whether there any other engineering qualification(s) which WSU should consider offering;
- how they rate the competencies of WSU engineering graduates;
- what criteria their organisation view as being the most important when recruiting engineering graduates;
- whether there are competency areas (needed in employment) that should be expanded on, or more comprehensively covered in the curriculum.

The findings to the questions posed to the employer representatives are summarised below.

#### Qualification needs

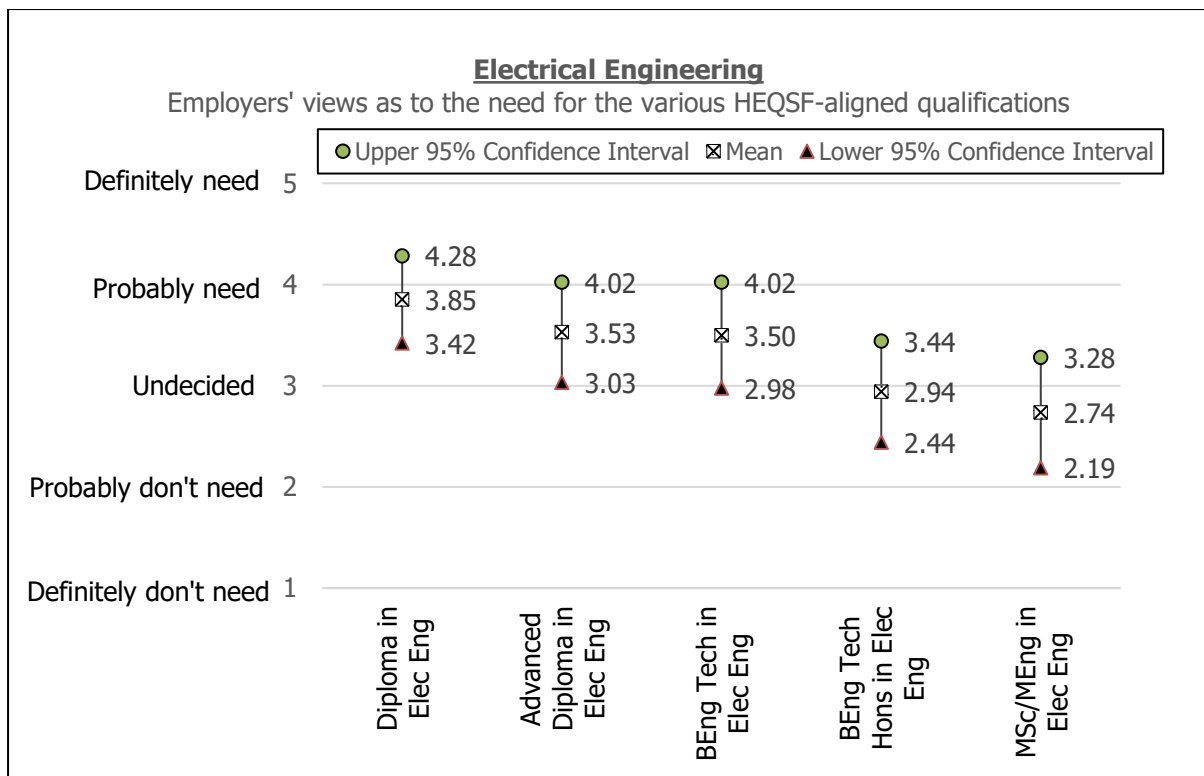
Civil Engineering employers expressed relative high needs for graduates with all the listed type of qualifications, with mean values ranging between “probably need” and “definitely need”, as can be seen from Figure 58. Employers expressed the strongest need for graduates with qualifications at the BEng Tech level. The Diploma programme yielded the second highest demand, followed by the Honours, Advanced Diploma and Masters programmes. What is noteworthy is that the Advanced Diploma, which has the same Exit Level Outcomes as that of the BEng Tech degree yielded a lower demand value. This can probably be attributed to employers not being familiar with the Advanced Diploma, given that it is a new qualification type, not traditionally offered by Universities offering engineering programmes. Demand for

graduates with post grad qualifications, i.e. with Honours and Masters Degrees, was significantly higher among Civil Engineering employers, in comparison with their counterparts in the Electrical and Mechanical sectors. This can likely be attributed a large percentage of Civil Engineering respondents working in the consulting sector, where specialisation within specific niche areas are essential.



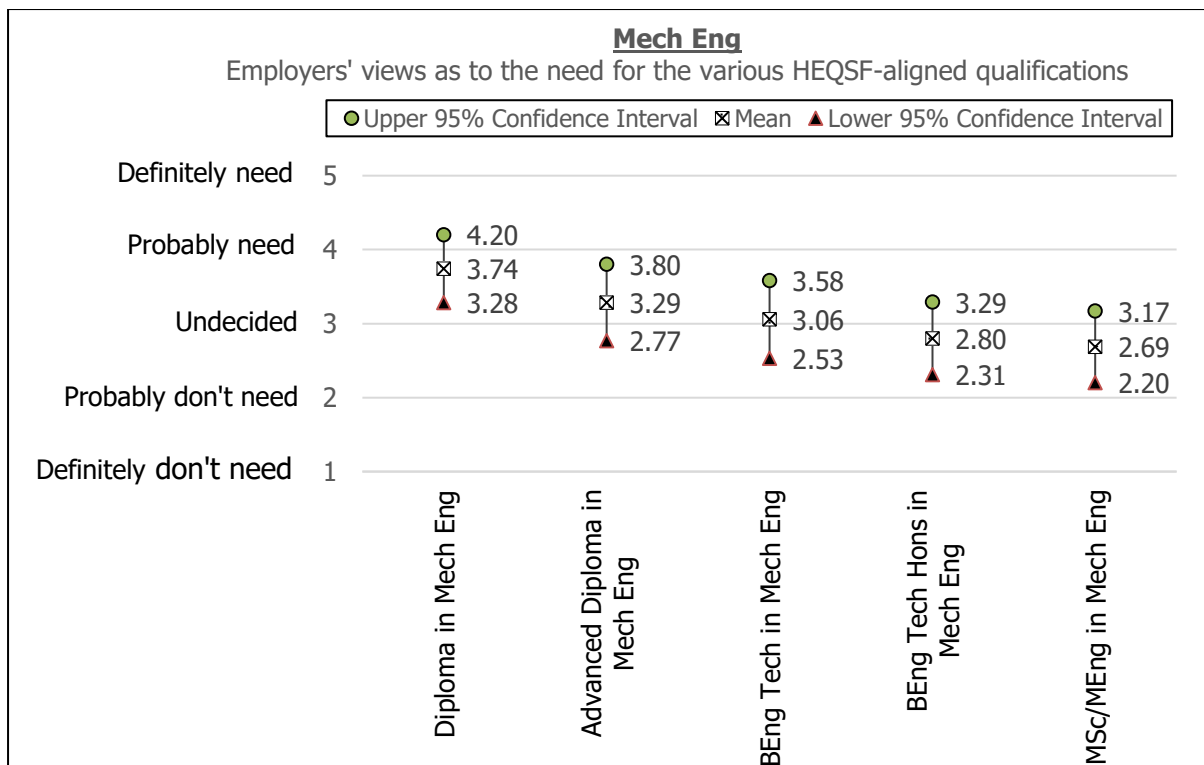
**FIGURE 58: Civil Engineering: Employers' views as to the need for the various HEQSF-aligned qualifications**

Responses from Electrical Engineering employers indicate the greatest need for graduates with qualifications pegged at NQF levels 6 and 7, i.e. the Diploma, Advanced Diploma and BEng Tech programmes, with these qualifications falling within the band of “probably need” to “definitely need”. A statistical analysis of Electrical Engineering employer responses are shown in Figure 59. The Diploma programme yielded the highest demand followed by the Advanced Diploma and BEng Tech programmes. There appear to be less of a demand from an employer’s perspective for the Honours and Masters programmes within this sector, with most employers indicating that they are “undecided” as to the need for such qualifications, or indicating that they “probably not need” such qualifications. Possible reasons for this could be that respondents deem graduates with base qualifications (e.g. Diploma level), to be sufficiently qualified for the work that they require; graduates with base qualifications being less costly to employ; employers undertaking staff development through in-house training. The results indicate that respondents within this sector, while seeking graduates with good undergraduate skills have a lesser need for employees with post graduate qualifications.



**FIGURE 59: Electrical Engineering: Employers' views as to the need for the various HEQSF-aligned qualifications**

Figure 60 indicates that Mechanical Engineering employers have the greatest need for graduates with Diploma qualifications, with a similar, but slightly lesser need shown for graduates with Advanced Diploma and BEng Tech degree qualifications. Similar to the views expressed by Electrical Engineering employers, Mechanical Engineering employers have a lesser demand for graduates with Honours and/or qualifications. Most employers in the Mechanical Engineering sector, indicated that they are “undecided” as to the need for such qualifications, or that they “probably not need” such qualifications. Possible reasons, may be similar to that which was reported in the previous paragraph for the Electrical Engineering sector.



**FIGURE 60: Mechanical Engineering: Employers' views as to the need for the various HEQSF-aligned qualifications**

Additional engineering qualification(s) that WSU should consider offering

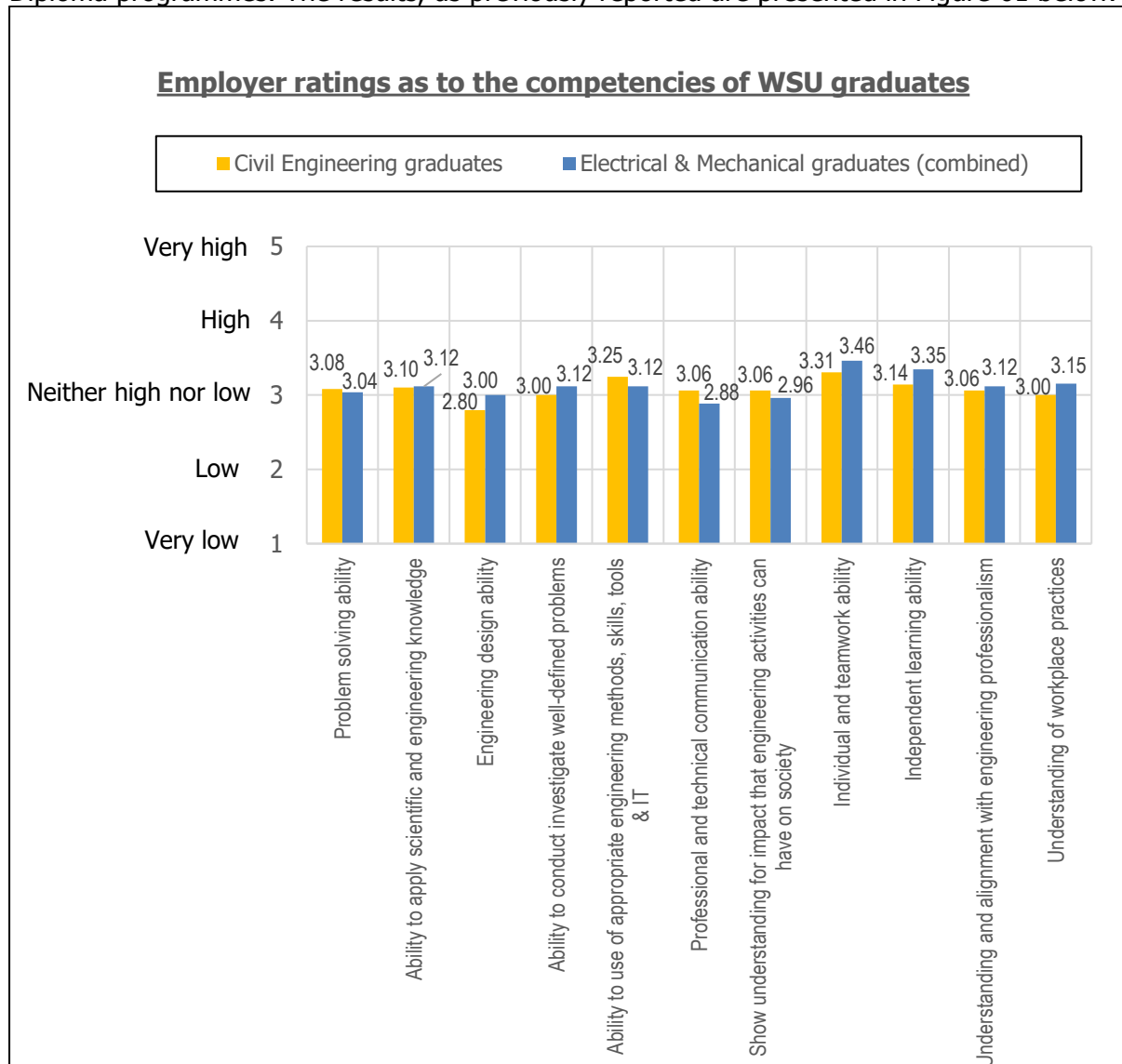
Employers were asked to indicate if there are any other Civil, Electrical and Mechanical Engineering qualifications that WSU should consider offering. Employer representatives suggested that WSU consider offering the following programmes, in addition to the generic qualifications in the three engineering disciplines.

- At Diploma level
  - Mechatronics
  - Industrial Engineering
  - Logistics
  - Electronic Engineering
- At Post Graduate level
  - Project Management
  - Engineering Management
- At Degree level
  - Urban Engineering

The suggestions made by employers are broadly aligned to the generic qualifications that WSU is considering. These “additional” qualifications that employers are interested in are all closely aligned to the generic engineering qualifications that WSU plans to offer, and it is likely that such “additional” qualifications can be nested within the generic and core discipline qualifications. Offering multiple programmes or streams may have a negative impact on the generic engineering qualifications being considered are negatively affected if there are more streams of specialisation, as class sizes at higher levels becomes smaller, which means that more resources are needed. Further work will therefore be required to assess the actual demand and feasibility for offering of these programmes.

### Competency ratings of WSU engineering graduates

Employers were asked to rate the competency of WSU Engineering graduates against the eleven Exit Level Outcomes, as contained in the ECSA qualifications standards for engineering Diploma programmes. The results, as previously reported are presented in Figure 61 below.



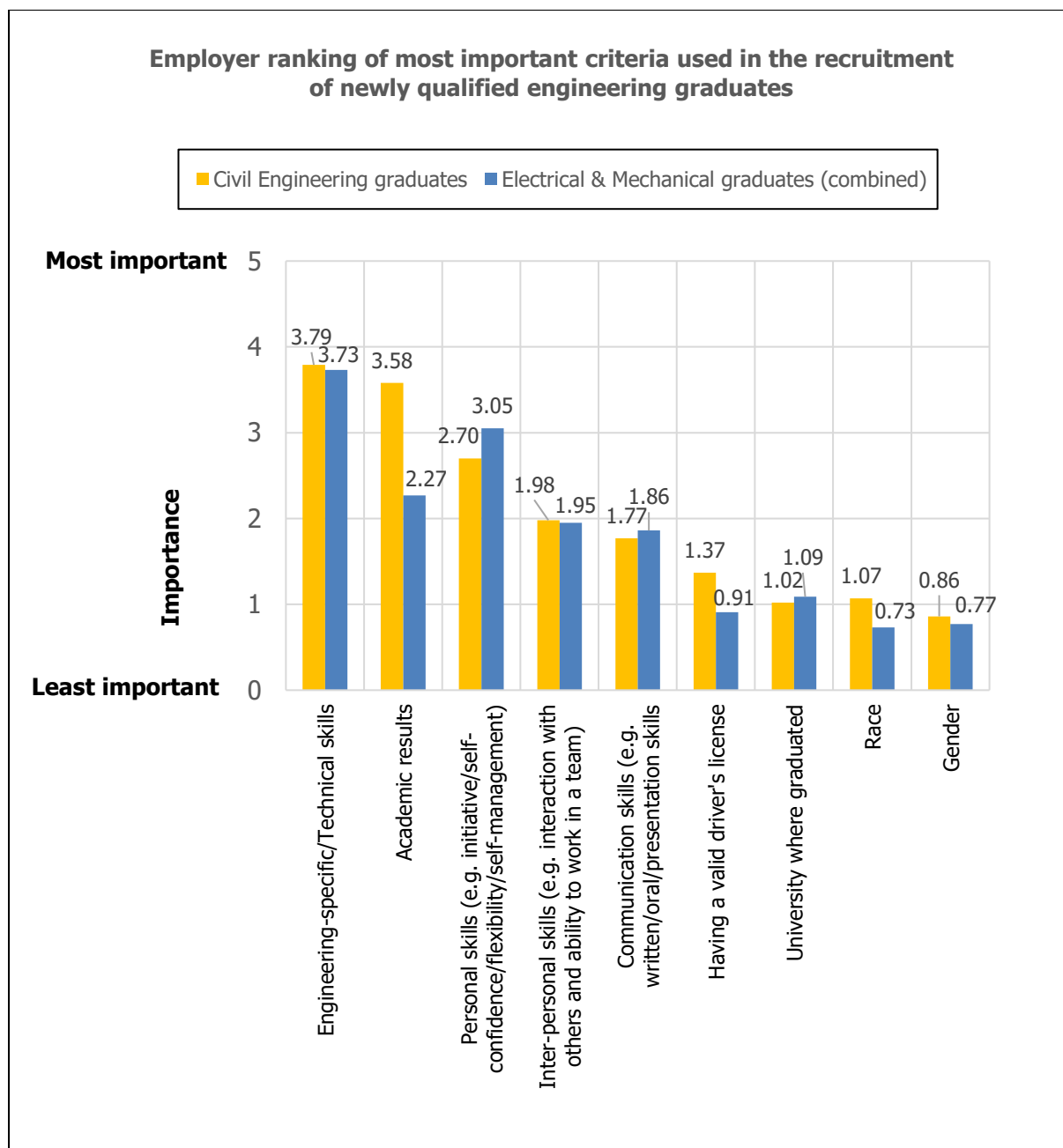
**FIGURE 61: Employer ratings as to the competencies of WSU graduates**

The results indicate a higher level of competency rating for Electrical and Mechanical Engineering graduates when compared to the Civil Engineering cohort for all eleven competencies that were considered. The overall mean rating for the combined group of Electrical and Mechanical Engineering graduates was 3.12, while the overall mean rating for the Civil Engineering group was 3.08. Employers therefore rated the collective competencies of WSU Engineering graduates as being slightly above the scale point of “neither high nor low”. Of the respective competencies listed the competency for “individual and teamwork ability” had the highest rating for both cohorts (3.46 and 3.31 respectively), while the competency rating for “independent learning ability” also ranked among the top three competencies for both cohorts (3.35 and 3.14 respectively). The “engineering design ability” yielded the lowest rating score for the Civil Engineering cohort (2.80), while “professional and technical communications skills” yielded the lowest rating for the Electrical and Mechanical Engineering cohort (2.88). The competencies with highest and lowest rankings broadly corresponded to the similar findings reported by Nielsen (2000) and Griesel and Parker (2009).

These studies yielded results that ranked graduate competencies for: “ability to conduct investigations”, “communication ability”, “understanding of workplace practices” and “problem solving ability” as being less well developed. Collecting evidence-based data such as this is valuable, as it informs the areas where the curriculum should be strengthened. Further research and investigations may be useful to supplement the information that was collected. This could include posing qualitative research questions to employers, which may be useful in exploring the specific areas of concerns that the results have highlighted. The diverse views expressed by employer representatives as to which graduate competencies are important can be linked to Holland’s theory on vocational behaviour, which states that each work environment values vocational competencies in a unique manner, with selection and prioritisation as to what is needed in a particular work environment being informed by associated self-perceptions and beliefs.

#### Criteria rating used for recruitment of engineering graduates

Employers were asked to indicate the five most important criteria used in the recruitment of newly qualified engineering graduates within their organisation. An analysis of the results for the respective employer cohorts is shown in Figure 62 below.



**FIGURE 62: Employers' rankings as to the most important criteria used in the recruitment of newly qualified engineering graduates**

Results for the question posed: "what criteria are the most important when recruiting engineering graduates?", indicate that employers rate "Engineering-specific/Technical skills" and "Academic results" as being the two most important criteria. Graduate competencies in "soft skills", such as "Inter-personal skills", "Personal skills" and "Communication skills" also ranked high on the list of important employment considerations. The results show that employers consider "soft skills", such as "Personal Skills" as being very important, with it (in the case of the Elec and Mech Engineering cohort) even being more important than the applicant's "Academic results".



### Competency areas to be more comprehensively covered in the curriculum

While the emphasis varied among the disciplines employers overall indicated that the following competency areas need to be strengthened in the curriculum for future qualifications.

- Design aspects, e.g.
  - Exposure to design software packages (Civil)
  - Understanding of design codes/practices (all disciplines)
  - Better understanding of how to produce engineering drawings (all disciplines)
  - Design quality control processes (all disciplines)
- Technical skills, e.g.
  - Hand tools skills (Electrical & Mechanical)
- Problem solving ability
  - Methodology of solving engineering problems (all disciplines)
  - Logical fault finding (Electrical & Mechanical)
- Project Management
  - Project Management principles applicable to engineering projects (all disciplines)
  - Contract Management and Administration (all disciplines)
- Currency of content
  - Ensuring content of engineering subjects are based on current practice (all disciplines)
  - Integrating aspects of global workloads demands - digital analytics, informatics, business analysts etc. (all disciplines)
- Computer literacy
  - Competency with relevant software packages (all disciplines)
- Communication
  - Communication and social skills for the professional environment (all disciplines)
  - Report writing skills (all disciplines)
- Soft skills
  - Time management skills (all disciplines)
  - Critical thinking skills (all disciplines)
  - Self-development skills (all disciplines)
- Human resource aspects
  - Safety at the workplace (all disciplines)
- Professionalism
  - Engineering ethics (all disciplines)
- Financial
  - Business Management Skills (all disciplines)

### **Students demand study**

The views of prospective Civil, Electrical and Mechanical engineering students were obtained to determine:

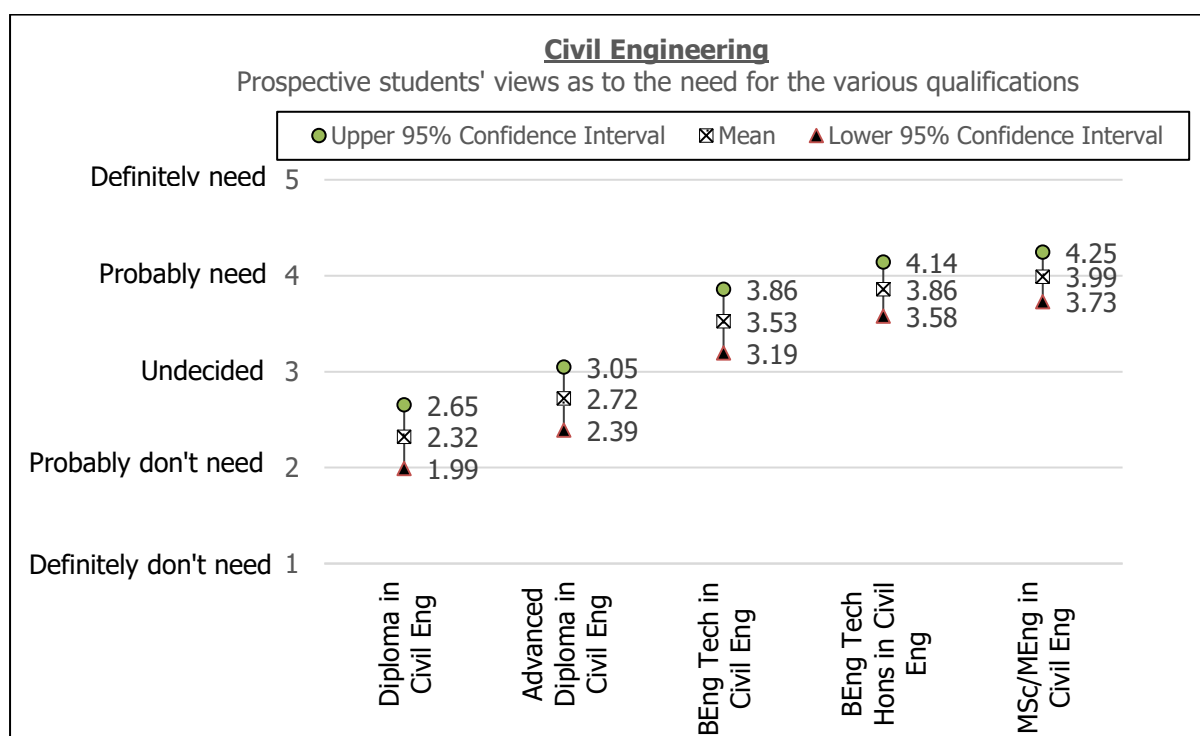
- whether the targeted group (comprising predominantly of WSU engineering alumni that graduated in the last 6 years) are interested in enrolling for the new HEQSF-aligned qualifications that WSU plans to offer;
- if interested, when are they likely to enrol for these qualifications;
- their preferred campus to study at;
- their preferred mode of study;
- whether there are any other engineering qualifications that they would like to see that WSU consider offering.

The findings to the questions posed to prospective civil, electrical and mechanical engineering students are summarised below.

### Interest among prospective students to enrol for the respective HEQSF-aligned qualifications that WSU is planning to offer

Prospective engineering students across all disciplines expressed limited interest for qualifications at the Diploma and, Advanced Diploma level but this should be read in the context that the survey sample were mostly alumni, who have already obtained these, or equivalent qualifications at these levels. It is therefore understandable that the survey cohort targeted had no specific need to enrol for these qualifications. As such, the views of employers, who expressed a high need for graduates with Diploma and Advanced Diploma qualifications are deemed a more reliable demand measure for these two qualifications.

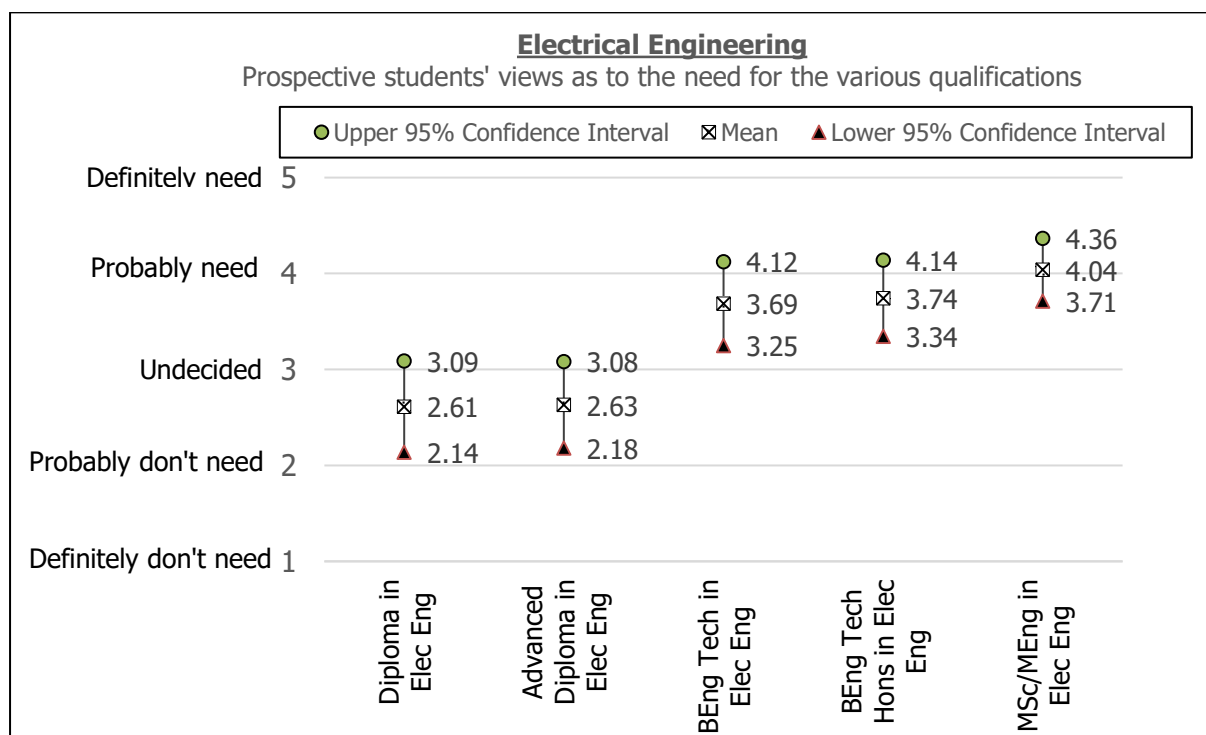
It also became clear during the survey that prospective students are not familiar with the new type of engineering qualifications, such as the Advanced Diploma that are provided within the HEQSF. Prospective students also have difficulty in comprehending that the Advanced Diploma (for engineering) have Exit Level Outcomes that are at the same level with exactly the same descriptions as that of the BEng Tech degree. Relative high needs were expressed by prospective students for the Civil Engineering qualifications at Bachelors, Honours and Masters degree qualifications, with the mean values of these qualifications ranging between 3.53 and 3.99. For post grad programmes the upper limit of the 95% Confidence Interval fell within the "definitely need" range, with the lower limit being within the "probably need" range. The demand for programmes at Honours and Masters level can possibly be attributed to many respondents working in the Civil Engineering consulting sector, a sector that values specialisation, which can often best be obtained through completion of higher level studies. The views of prospective Civil Engineering students, as to the need for the various qualifications, are graphically represented in Figure 63.



**FIGURE 63: Civil Engineering: Prospective students' views as to the need for the various qualifications**

Prospective Electrical Engineering students had similar views as that of Civil Engineering students insofar that they had a limited interest for qualifications at the Diploma and Advanced Diploma level. The reasons for this was explained in the previous section, resulting in the

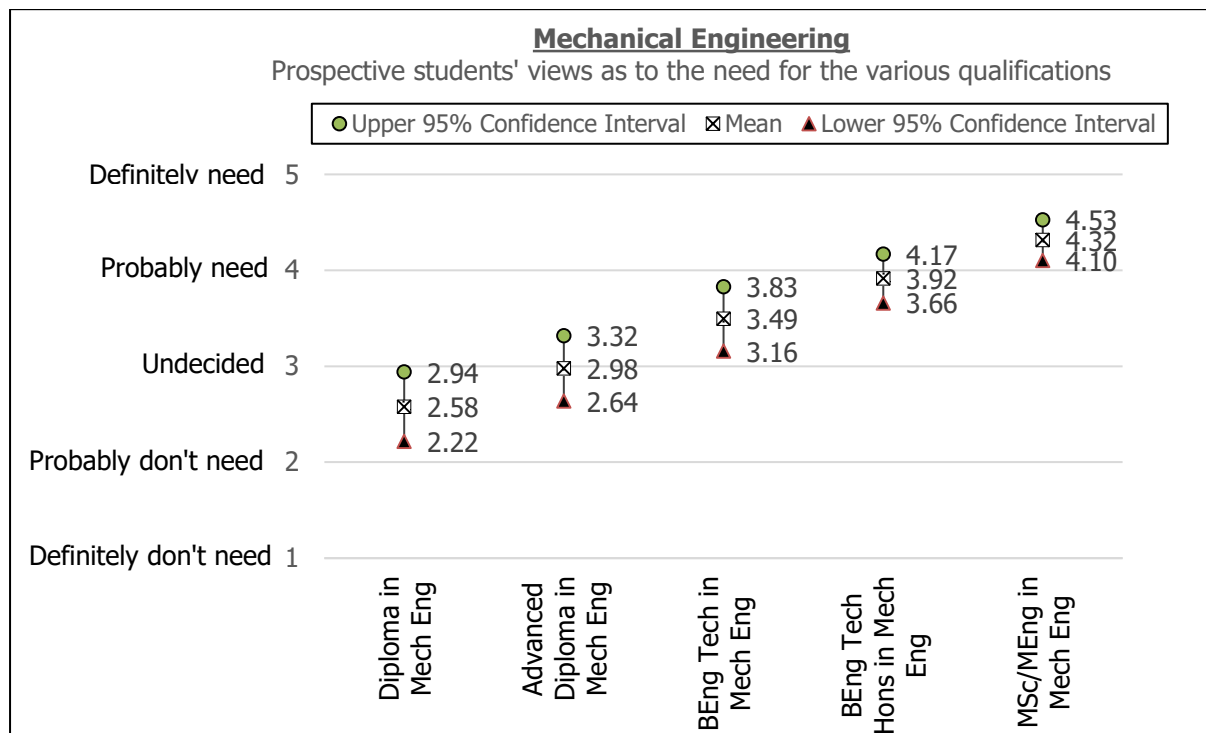
conclusion that the views of employers as to the need for the Diploma and Advanced Diploma qualifications represent a more useful needs assessment parameter for these two qualifications. Prospective Electrical Engineering students expressed a relative high interest for WSU to offer qualifications at Bachelors, Honours and Masters degree level, with the mean values for interest in these qualifications ranging between 3.69 and 4.04, which is slightly higher than the interest shown by the Civil Engineering student cohort for the same set of qualifications. The upper limits of the 95% Confidence Interval for Electrical Engineering post grad programmes, like the Civil Engineering results were located within the “definitely need” range, with the lower limit being within the “probably need” range. The expressed interest for WSU to offer programmes at Honours and Masters level can likely be attributed to a view among prospective Electrical Engineering students that specialisation will lead to better career prospects and allow the holders of such post grad qualifications to elevate their professional standing. The views of prospective Electrical Engineering students, as to the need for the various qualifications, are graphically represented in Figure 64.



**FIGURE 64: Electrical Engineering: Prospective students' views as to the need for the various qualifications**

Asked whether they are interested in enrolling for the new HEQSF-aligned qualifications that WSU plans to offer, prospective Mechanical Engineering students had similar views to what was expressed by the Civil and Electrical Engineering student cohorts, insofar that they had less of an interest for qualifications at the Diploma and Advanced Diploma level. The reasons for this, and conclusion on this was explained in the previous section. Prospective Mechanical Engineering students expressed a relative high interest for WSU to offer qualifications at Bachelors, Honours and Masters degree level, with the mean values for interest in these qualifications ranging between 3.49 and 4.32. The upper and lower limit of the 95% Confidence Interval for the Mechanical Engineering Masters programme was the highest, among all the engineering student cohorts and were located at both ends within the “definitely need” range. The Honours programme spanned the range between “probably need” to “definitely need”. The expressed interest for WSU to offer programmes at Honours and Masters degree level can likely be attributed to a view among prospective Mechanical

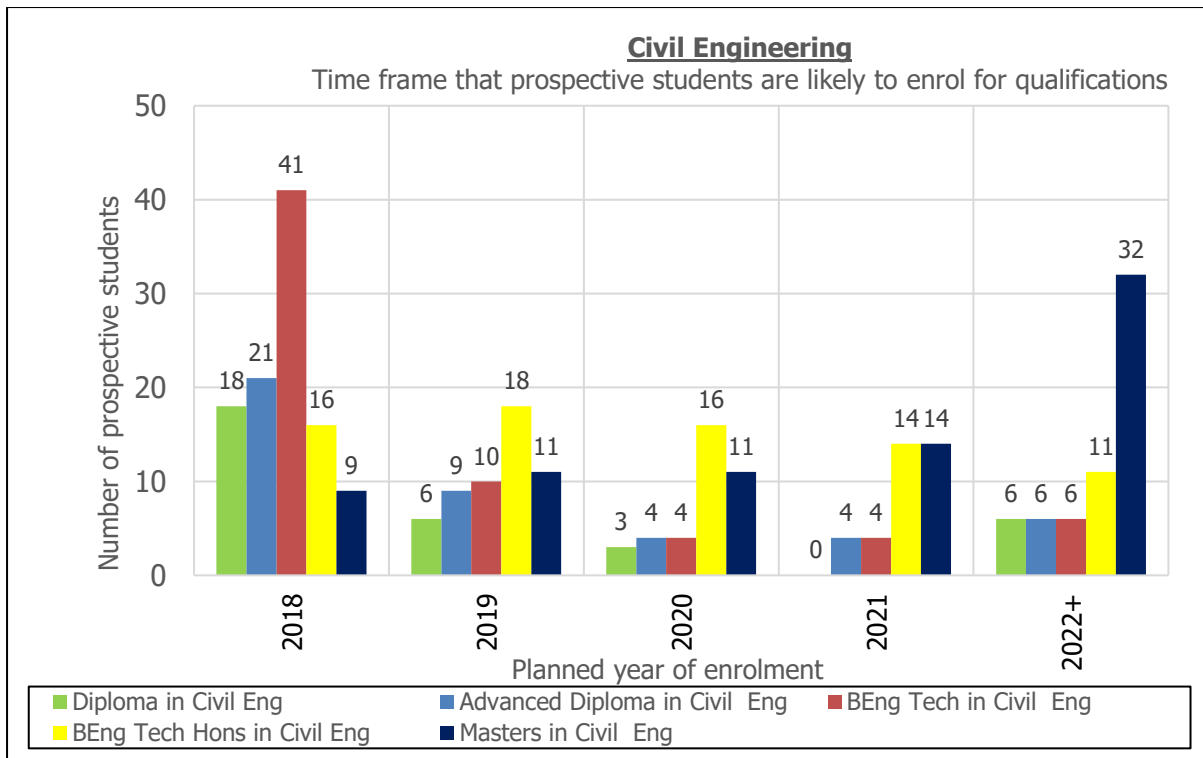
Engineering students that specialisation will lead to better career prospects and allow the holders of such post grad qualifications to elevate their professional standing. The views of prospective Mechanical Engineering students, as to the need for the various qualifications, are graphically represented in Figure 64.



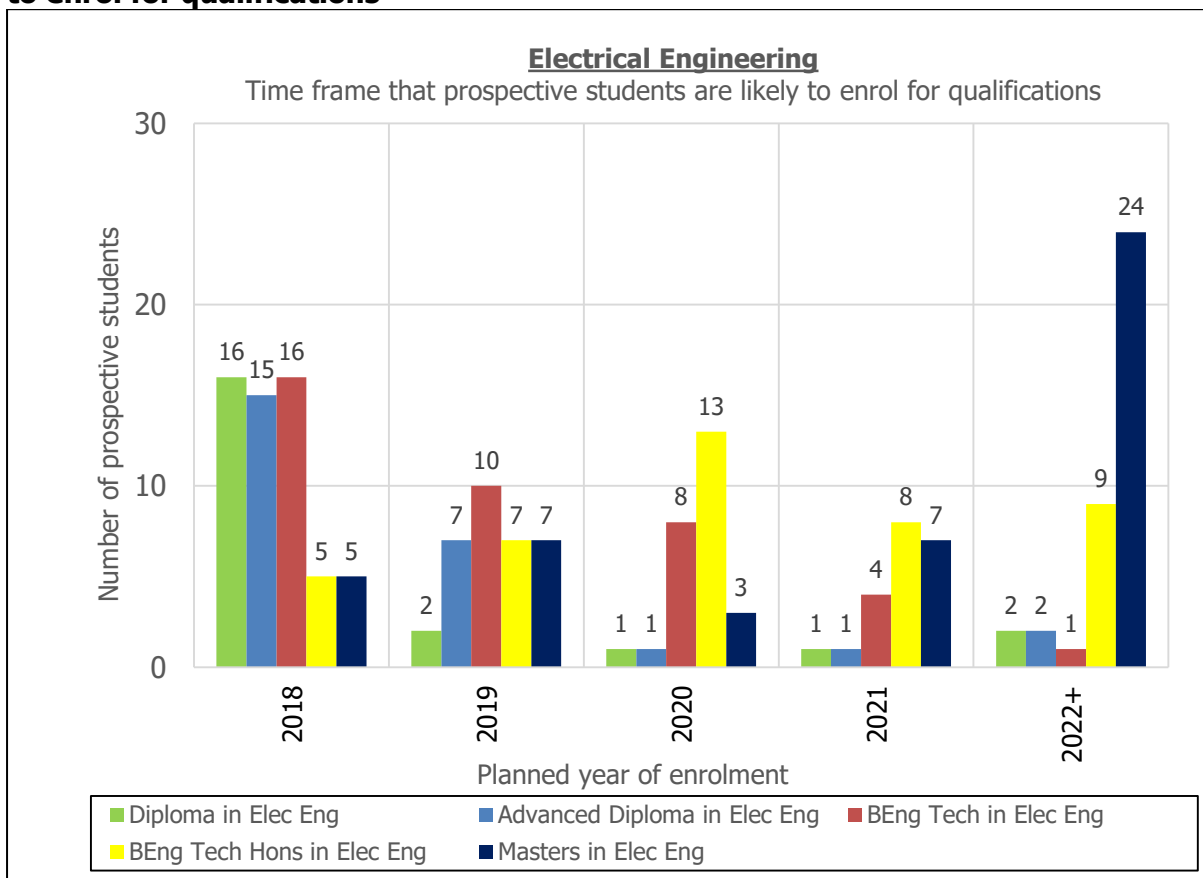
**FIGURE 65: Mechanical Engineering: Prospective students' views as to the need for the various qualifications**

Time frame that prospective students are likely to enrol for these qualifications

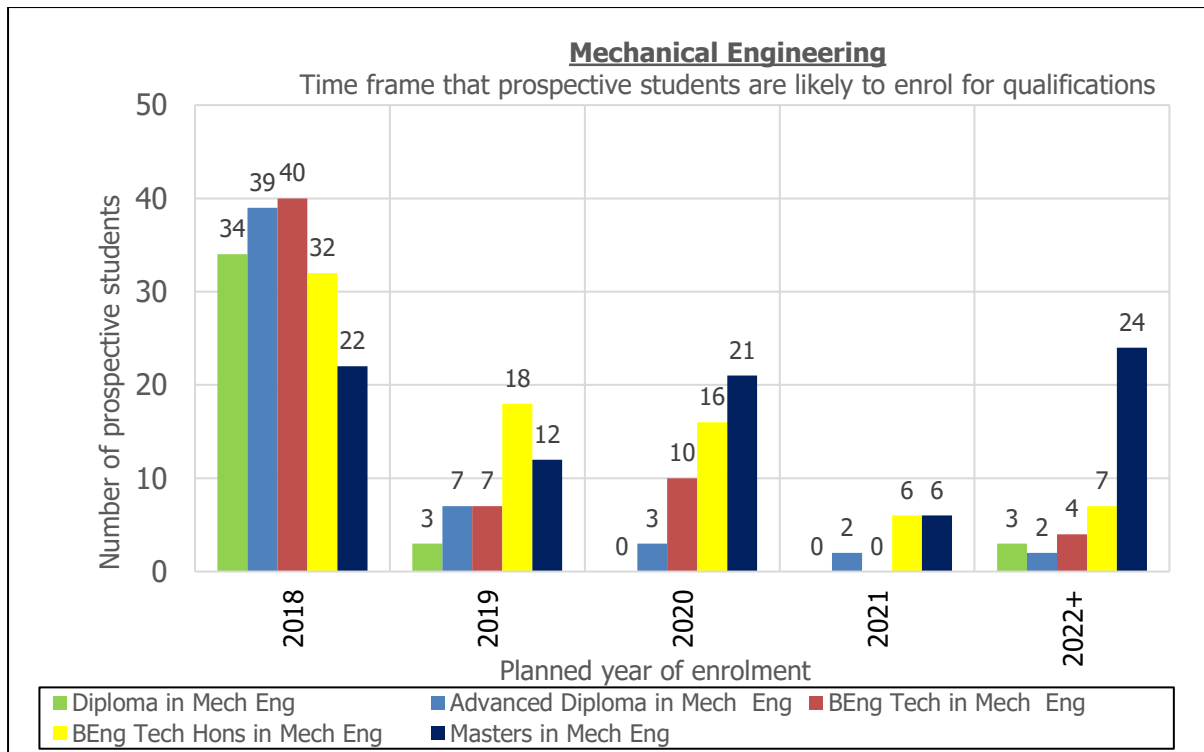
Figures 66 to 68 below reflect the results to the question posed to prospective engineering students as to when they are likely to enrol for the respective qualifications that WSU plans to offer. It reflects that there is an immediate interest to enrol all the engineering qualifications that WSU is considering. The results also show that the interest to enrol for post grad qualifications in engineering is sustained, with prospective students showing strong interest throughout the first five years, up to the year 2022 and beyond.



**FIGURE 66: Civil Engineering: Time frame that prospective students are likely to enrol for qualifications**



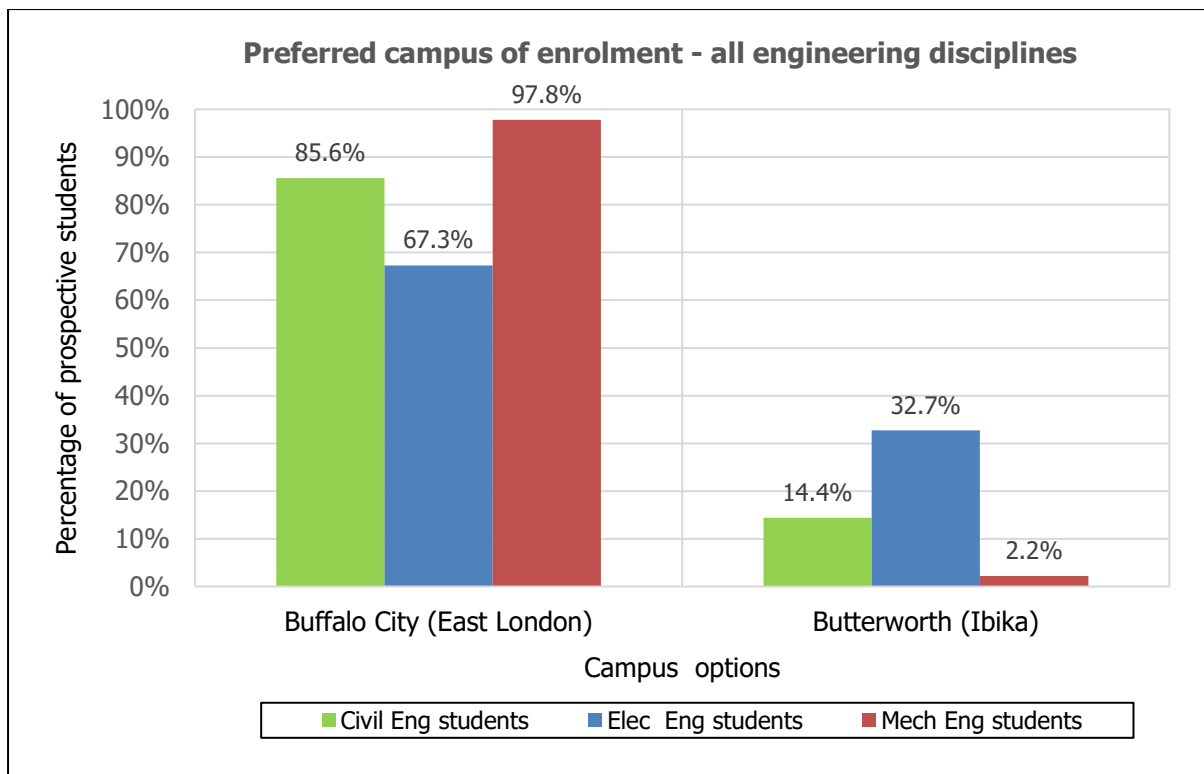
**FIGURE 67: Electrical Engineering: Time frame that prospective students are likely to enrol for qualifications**



**FIGURE 68: Mechanical Engineering: Time frame that prospective students are likely to enrol for qualifications**

#### Prospective students' preferred campus of tuition

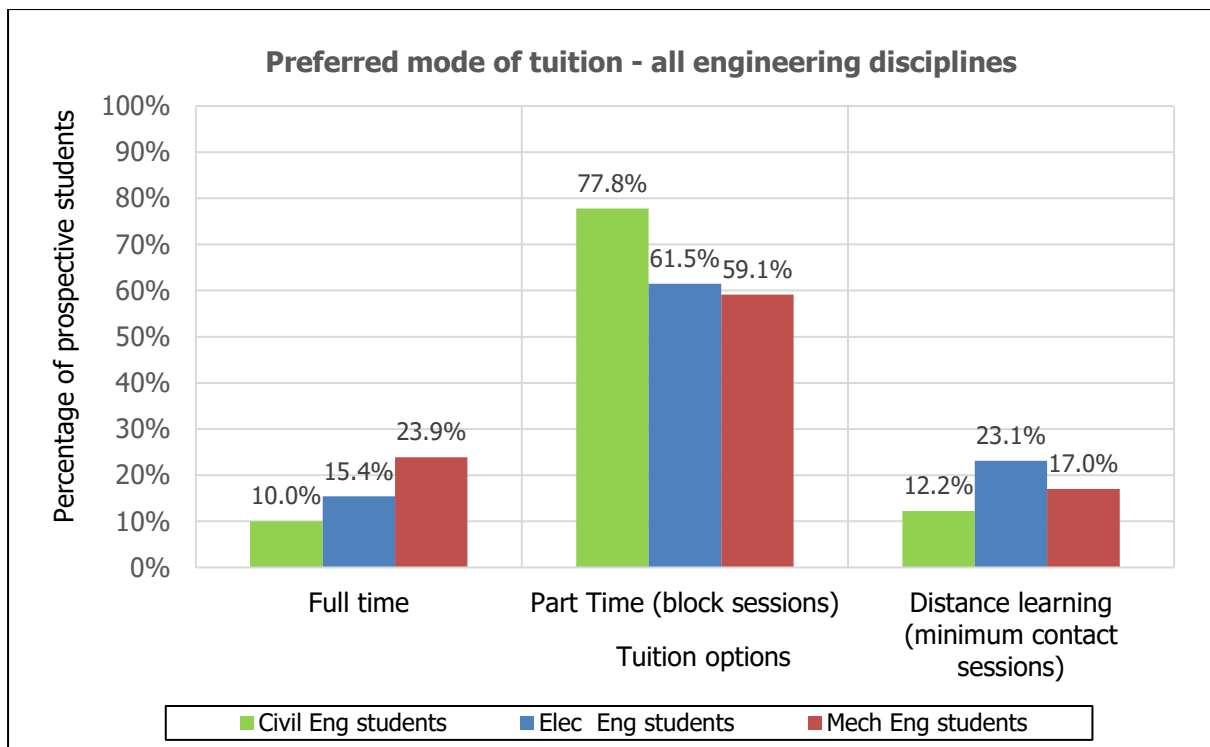
The responses received from prospective students across all engineering disciplines indicate that Buffalo City is the majority of students' preferred campus. The strongest interest shown for tuition to take place in Butterworth emanated from the responses of the Electrical Engineering student cohort. The reasons for this can possibly be attributed to the urban setting at Buffalo City that, as a result of a larger industry presence is home to more prospective students. It may not be feasible to offer all the programmes at both campuses, in which case choices will have to be made as to where (which campus) a programme can best be offered.



**FIGURE 69: Preferred campus of enrolment - all engineering disciplines**

#### Prospective students' preferred mode of tuition

Prospective engineering students, across all Engineering disciplines, expressed a preference for Part Time (block sessions) as their preferred mode of tuition. The interest among students for tuition to be through full time and distance learning modes was almost equal, but was well below preference for students to study through Part Time (block sessions). The limited interest for full time studies can possibly be attributed to many of the prospective students being in employment, which makes it difficult for them to be absent from the workplace for extended periods.



**FIGURE 70: Preferred mode of tuition - all engineering disciplines**

#### Interest from students for additional engineering qualification(s)

Prospective students were asked to indicate whether there are any other engineering qualifications, in addition to the generic programmes that WSU offer in Civil, Electrical and Mechanical Engineering. The following is a synopsis of the qualifications and specialised short courses, as was suggested by students.

#### Civil Engineering students

- Degrees in Urban and Structural Engineering
- Post graduate qualifications in Project Management
- Qualifications in Land Surveying
- Specialised short courses, e.g. AutoCAD, Project Management

#### Electrical Engineering students

- Qualifications in Mechatronics
- Qualifications in Industrial Engineering
- Post graduate qualifications and/or short courses in Project Management
- Specialised short courses, e.g. Control Systems

#### Mechanical Engineering students

- Qualifications in Mechatronics
- Qualifications in Industrial Engineering
- Qualifications in Quality Management
- Post graduate qualification in Project Management
- Specialised short courses, e.g. Safety, Project Management, Inventor and CAD

The suggestions made by students are broadly aligned with the needs expressed by employers. Most of the additional qualifications/specialisation stream/short courses, that students have expressed an interest in can be developed as parallel qualifications, or as



specialist streams, nested within the generic qualifications that WSU plans to offer in the disciplines of Civil, Electrical and Mechanical Engineering.

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## 6. REFERENCES

- Allahverdi, A, & Aldowaisan, T 2015. Assessment of student outcomes of the Industrial and Management Systems Engineering programme at Kuwait University. *Global Journal of Engineering Education*, 17(3): 103-112.
- Archer, T M 2008. Response rates to expect from web-based surveys and what to do about it. *Journal of Extension*, 46(3), 3RIB3.
- Ballim, Y, Mabizela, S and Mubangizi, JC, 2014. Professional bodies and quality assurance of higher education programmes in South Africa: Towards an appropriate framework. *South African Journal of Higher Education*, 28(4), 1140-1155.
- Basson, A, 2017. What should engineers be trained for in SA? *Proceedings*, 4<sup>th</sup> Biennial Conference of the South African Society of Engineering Education, Cape Town, pp 1-12.
- Besterfield-Sacre, M, Cox, M F, Borrego, M, Beddoes, K & Zhu, J 2014. Changing engineering education: Views of US faculty, chairs, and deans. *Journal of Engineering Education*, 103(2), 193-219.
- Biggs, J (2014). Constructive alignment in university teaching. *HERDSA Review of Higher Education*, 1(1), 5-22.
- Cape Higher Education Consortium 2013. *Pathways from university to work: A graduate destination survey of the 2010 cohort of graduates from the Western Cape Universities*. Cape Town: CHEC.
- Council for the Built Environment 2014. *Is there a gap between graduate competencies and expectations?* Available: <http://www.cbe.org.za/pages/publications/articles> [Accessed 2015, August 16].
- Council on Higher Education 2004. *Criteria for programme accreditation*. Higher Education Quality Committee. Pretoria. Council on Higher Education.
- Elrod, C C, Stanley, S M, Flachsbarth, B B, Hilgers, M G & Cudney, E A 2015. Assessing professional behavior perceptions between computing, engineering, and business students and hiring employers. *Issues in Information Systems*, 16(1).
- Engineering Council of South Africa 2010. *The Engineering Skills Pipeline*. Available: [www.ecsa.co.za/documents/News/241110\\_Engineering\\_Skills\\_Pipeline.pdf](http://www.ecsa.co.za/documents/News/241110_Engineering_Skills_Pipeline.pdf). [Accessed 2015, August 12].
- Engineering Council of South Africa 2013. *Policy for the Accreditation of Engineering Technology Programmes. Section 1*. Available: [https://www.ecsa.co.za/ECSADocuments/ECSA%20Documents/Documents/Accreditation\\_Universities\\_Technology\\_Section\\_1.pdf](https://www.ecsa.co.za/ECSADocuments/ECSA%20Documents/Documents/Accreditation_Universities_Technology_Section_1.pdf) [Accessed 2015, August 1].
- Engineering Council of South Africa 2014. *E-12-P: Revision 2: Programme Self-study Documentation Requirements for Accreditation Visits*. Available: <https://www.ecsa.co.za/education/EducationDocs/E-12-P.pdf> [Accessed 2015, August 1].
- Engineering Council of South Africa 2016. *Qualification Standard for Diploma in Engineering: NQF Level 6. Document E-02-PN Rev-3*. Available: <https://www.ecsa.co.za/education/EducationDocs/E-02-PN.pdf> [Accessed 2016, January 30].
- Gay, L R, Mills, G E & Airasian, P W 2011. *Educational research: Competencies for analysis and applications*. Boston: Pearson.
- Griesel, H & Parker, B 2009. *Graduate attributes: A baseline study on South African graduates from the perspective of employers*. Pretoria: Higher Education South Africa.
- Gwyn, M L & Gupta, R 2015. Co-op employer evaluation of the graduate attributes: a comparison of two approaches. *Proceedings*, Canadian Engineering Education Association, McMaster University, CEEA 15, Paper 034, pp 1-5.

- Hauschildt, U, Brown, H & Zungu, Z 2013. Competence measurement and development in TVET: Result of the first COMET test in South Africa. *Proceedings*, Apprenticeship in a Globalised World. Premises, Promises and Pitfalls. Reihe Bildung und Arbeitswelt. Münster. LIT, pp 177-180.
- Klein-Gardner, S S, & Walker, A 2011. Defining global competence for engineering students. *Proceedings*, ASEE Annual Conference & Exposition, Vancouver, British Columbia, pp 22.420.1 - 22.420.17
- Lawless, A 2007. *Numbers and needs in local government.*, Midrand: SAICE.South Africa.
- Lawless, A 2011. Training/development: Demand/supply of Technical Engineers within the Public Sector. *Proceedings*, CESA 2011 Conference and Exhibition, East London.
- Naicker, S 2016. Developing a Code of Best Practice for Civil Engineering Education at Tertiary Institutions. *Civil Engineering= Siviele Ingenieurswese*, 25(1), 9-12.
- Neilsen, A C 2000. *Employer satisfaction with graduate skills*. Commonwealth of Australia, Canberra.
- Ngetich, W K & Moll, C M 2013. An investigation of industry expectations of industrial engineering graduates: A case study of graduate development programmes in South African universities. *South African Journal of Industrial Engineering*, 24(3): 125-138.
- Nic, D & Rarr V 2013. *Oh Ordinal data, what do we do with you?* [online] Learn and Teach Statistics and Operations Research. Available: <https://learnandteachstatistics.wordpress.com/2013/07/08/ordinal/> [Accessed 27 Jan. 2017].
- Passow, H J 2012. Which ABET competencies do engineering graduates find most important in their work? *Journal of Engineering Education*, 101(1): 95-118.
- Peng, L, Zhang, S & Gu, J 2016. Evaluating the competency mismatch between Master of Engineering graduates and industry needs in China. *Studies in Higher Education*, 41(3): 445-461.
- Ridgman, T W & Liu, M 2014. Engineering Graduate Employability—an international comparison. *Proceedings*, SEFI Annual Conference, Birmingham, UK, paper ID 102.
- South Africa. Department of Higher Education and Training 2016. *List of occupations in high demand*. (Government Gazette 39604, Notice 34, 19 January 2016). Pretoria: Government Printer.
- South Africa. The Presidency 2010. *Joint Initiative on Priority Skills Acquisition Growing priority skills in South Africa Final report on JIPSA*. Pretoria: The Presidency.
- Singer, S R, Nielsen, N R & Schweingruber, H A 2012. *Discipline-based education research: Understanding and improving learning in undergraduate science and engineering*. National Academies Press.
- Taylor, N 2015. *The Production of high level science, engineering and technology skills: Role of the Dinaledi Project*. Pretoria: HSRC.
- Teichler, U & Höhle, E A 2013. *The work situation of the academic profession in Europe: Findings of a survey in twelve countries*. Springer.
- Vadivu, M C, Bala, M L & Sumathi, N 2016. Expectation Vs Performance—A Skill Gap Analysis Among Engineering Graduates. *Indian Journal of Applied Research*, 5(10).
- Virginia Tech (n.d.). *Measurement Scales in Social Science Research*. [online] Available: <http://simon.cs.vt.edu/SoSci/converted/Measurement/> [Accessed 2017, January 27].
- Walther, J & Radcliffe, D F 2007. The competence dilemma in engineering education: Moving beyond simple graduate attribute mapping. *Australasian Journal of Engineering Education*, 13(1), 41-51.
- Watermeyer, R & Pillay, M 2012. Strategies to address the skills shortage in the delivery and maintenance of infrastructure in South Africa: a civil engineering perspective: infrastructure delivery. *Civil Engineering= Siviele Ingenieurswese*, 20(5), 46-56.

## **7. Annexures:**

**A1.1: Employer Study: Information Sheet attached to questionnaire**

**A1.2: Employer Study: Information Sheet attached to questionnaire (merSETA stakeholders)**

**A1.3: Employer Study: Example of Questionnaire used (varied per sector)**

**A2.1: Student Demand Study: Information Sheet attached to questionnaire**

**A2.2: Student Demand Study: Example of Questionnaire used (discipline based)**

# **ANNEXURE A1.1**



## **Information Sheet: Survey: Views of employers/employer representatives as to the desirability/relevance and need for the respective HEQSF-aligned engineering qualifications**

Dear colleague

In terms of the Higher Education Qualification Sub-Framework (HEQSF) all universities are required to develop new qualifications and/or ensure that its existing engineering qualifications are re-aligned to meet HEQSF requirements. The attached online questionnaire forms part of a research study by Walter Sisulu University (WSU) to assess the desirability/relevance and need within industry for the respective HEQSF-aligned engineering qualifications that WSU is planning to offer. Abbreviated explanatory notes as to what the focus and minimum duration of the respective qualifications are provided in the questionnaire. The Engineering Council of South Africa (ECSA) website <https://www.ecsa.co.za/EcsaDocuments/sitepages/ecsa%20documents.aspx> provides further information and details as to the New Engineering Technology Qualification Standards in terms of programme design criteria, knowledge profile and graduate attributes associated with each qualification.

I request you to kindly assist WSU by answering the items as set out in the questionnaire. This will greatly assist the university in determining what engineering qualifications are most needed by the engineering sector that represents the employers of WSU engineering graduates.

While participation in the survey is entirely voluntary, I would really appreciate it if you can please find time to answer this questionnaire. Individual responses will remain anonymous, as the results will be published in aggregate form only. This survey is entirely web-based and the results are captured and processed electronically. Trials indicate that the survey takes no more than 10 minutes to complete. Please record your views by clicking on the "Begin Survey" button at the end of this message which will take you to the questionnaire.

It would be of great help if you can kindly complete the survey by (date) if at all possible. I thank you in advance for taking the time and effort to participate in this survey. If you have further questions then please contact me on my office number: 043 7094753, or my cell: 0834198518 or by e-mail: [fgerber@wsu.ac.za](mailto:fgerber@wsu.ac.za)

**Ferdie Gerber**, Pr Eng  
Project Manager: Academic Development Programme  
Walter Sisulu University

## **ANNEXURE A1.2**



### **Information Sheet: Survey: Views of employers/employer representatives as to the desirability/relevance and need for the respective HEQSF-aligned engineering qualifications**

Dear merSETA member,

In terms of the Higher Education Qualification Sub-Framework (HEQSF) all universities are required to develop new qualifications and/or ensure that its existing engineering qualifications are re-aligned to meet HEQSF requirements. merSETA is collaborating Walter Sisulu University (WSU) to enhance research activities, empower academic staff development and enrich and expand academic programme offerings within the field of engineering. The attached online questionnaire forms part of a research study by WSU to assess the desirability/relevance and need within industry for the respective HEQSF-aligned engineering qualifications that WSU is planning to offer. Abbreviated explanatory notes as to what the focus and minimum duration of the respective qualifications are provided in the questionnaire. The Engineering Council of South Africa (ECSA) website <https://www.ecsa.co.za/EcsaDocuments/sitepages/ecsa%20documents.aspx> provides further information and details as to the New Engineering Technology Qualification Standards in terms of programme design criteria, knowledge profile and graduate attributes associated with each qualification.

MerSETA members are kindly requested to assist WSU by answering the items as set out in the questionnaire. This will greatly assist the university in determining what engineering qualifications are most needed by the engineering sector that represents the employers of WSU engineering graduates.

Please note that participation in the survey is entirely voluntary, but we would really appreciate it if you can please find time to answer this questionnaire. Individual responses will remain anonymous, as the results will be published in aggregate form only. This survey is entirely web-based and the results are captured and processed electronically. Trials indicate that the survey takes no more than 10 minutes to complete. Please record your views by clicking on the "WebLink URL" button at the end of this message which will take you to the questionnaire.

It would be of great help if you can kindly complete the survey by 21<sup>st</sup> April 2017 if at all possible. I thank you in advance for taking the time and effort to participate in this survey. If you have further questions then please contact the merSETA regional office, or the WSU representative Mr F Gerber, Project Manager: Academic Development Programme on tel: 043 7094753, or cell: 0834198518 or by e-mail: [fgerber@wsu.ac.za](mailto:fgerber@wsu.ac.za)

# ANNEXURE A1.3

## VOLUNTARY CONSENT

### **COMPLETING THE QUESTIONNAIRE**

- a) Indicate your choice by checking (clicking) on the appropriate box.*
- b) When it comes to answering questions there are no right or wrong answers.*
- c) I thank you in advance for taking the time and effort to participate in this survey. If you have further questions then please contact me on my cell: 0834198518 or by e-mail: fgerber@wsu.ac.za*

**Ferdie Gerber, Pr Eng**  
**Project Manager: Academic Development Programme**  
**Walter Sisulu University**

\* 1. Have you received adequate information regarding the background, aim and objectives of this research as communicated through the information sheet provided and do you voluntarily consent to participate in this survey?

- ☐ Yes (allows you to continue)
- ☐ No (will terminate survey)

## PART A: DEMOGRAPHICS OF EMPLOYER REPRESENTATIVES

\* 2. Which of the following best describes the main focus area of your organisation?

- ☐ Construction/contracting
- ☐ Consulting
- ☐ Industry/manufacturing
- ☐ National/Provincial government
- ☐ District/Metropolitan/Local municipality
- ☐ Parastatal (wholly, or partly owned government entity)
- ☐ Other (please specify)

\* 3. What is the size of your organisation/company?

- ☐ Less than 5 employees
- ☐ 6 to 20 employees
- ☐ 21 to 50 employees
- ☐ 51 to 150 employees
- ☐ 151 employees and more

\* 4. Please indicate your highest academic qualification

- ☐ BEng/BSc(Eng) degree in engineering
- ☐ BTech engineering degree
- ☐ Engineering Diploma
- ☐ Other - please specify your highest qualification in the text box below (e.g. Bachelor's degree in Human Resource Management)



\* 5. Please indicate which best describes your current job designation.

- ☐ Owner/Director
- ☐ Senior Manager
- ☐ Section manager/Supervisor
- ☐ Human Resource Manager
- ☐ Other (please specify your job designation in the text box below)

\* 6. What is your gender?

- ☐ Male
- ☐ Female

\* 7. What is your age?

- ☐ 29 or younger
- ☐ 30 to 39
- ☐ 40 to 49
- ☐ 50 to 59
- ☐ 60 to 70
- ☐ 70 or older

\* 8. How many years of work experience do you have within the engineering sector?

- ☐ 9 years or less
- ☐ 10 to 19 years
- ☐ 20 to 29 years
- ☐ 30 to 39 years
- ☐ 40 years or more

Add any other relevant comment that you may have as to your work experience in text box below

## PART B3: WHICH QUALIFICATION TYPE(S) ARE MOST NEEDED? (Engineering)

### Explanatory note on Technology based engineering qualifications:

- **Diploma:** The curriculum for the Diploma is typically spread over 3 years (3 x 30-week full-time academic years). The primary purpose of this vocationally-oriented diploma is to develop focused knowledge and skills as well as experience in a work-related context.
- **Advanced Diploma:** This qualification typically follows a Diploma. The curriculum for the Advanced Diploma is spread over 1 year (1 x 30-week full-time academic year). This qualification is primarily industry oriented and have a strong professional or career focus. Holders of this qualification are normally prepared to enter a specific niche in the labour market. This qualification is at the same NQF level as the BEng Tech degree.
- **BEng Tech:** The curriculum for the Bachelors of Engineering Technology degree is typically spread over 3 years (3 x 30-week full-time academic years). This qualification is primarily industry oriented and have a strong professional or career focus. Holders of this qualification are normally prepared to enter a specific niche in the labour market. This qualification is at the same NQF level as the Advanced Diploma.
- **BEng Tech (Hons):** The Bachelors of Engineering Technology Honours degree has a curriculum that is typically spread over 1 year (1 x 30-week full-time academic year). This is a postgraduate qualification, characterised by the fact that it prepares students for industry and research. This qualification typically follows a Bachelor's Degree, Advanced Diploma and serves to consolidate and deepen the student's expertise in a particular discipline and to develop research capacity within that discipline.
- **Master's Degree:** The Master's degree qualification has two possible variants. It has a minimum duration period of 1 year (1 x 45-week full-time academic year). The primary purpose of a general Master's Degree is to educate and train researchers who can contribute to the development of knowledge at an advanced level. Master's Degree graduates in general must be able to reflect critically on theory and its application.

\* 9. Below is a list of HEQSF-aligned **Electrical Engineering** qualifications that WSU is planning/considering to offer. Does your organisation need graduates with these qualifications?

	Definitely don't need	Probably don't need	Undecided	Probably need	Definitely need
Diploma in Electrical Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Advanced Diploma in Electrical Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bachelor of Engineering Technology in Electrical Engineering (BEng Tech)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bachelor of Engineering Technology Honours in Electrical Engineering (BEng Tech Hons).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Masters of Engineering (MSc/MEng) in Electrical Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please add additional comments here if you so wish

\* 10. Below is a list of HEQSF-aligned **Mechanical Engineering** qualifications that WSU is planning/considering to offer. Does your organisation need graduates with these qualifications?

	Definitely don't need	Probably don't need	Undecided	Probably need	Definitely need
Diploma in Mechanical Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Advanced Diploma in Mechanical Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bachelor of Engineering Technology in Mechanical Engineering (BEng Tech)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bachelor of Engineering Technology Honours in Mechanical Engineering (BEng Tech Hons).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Masters of Engineering (MSc/MEng) in Mechanical Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please add additional comments here if you so wish

11. Apart from the Electrical and Mechanical qualifications listed in the preceding two questions, are there any **other engineering qualification(s)** needed in industry which WSU should consider offering (e.g. Diploma in Industrial Engineering)? If so, please use the text box below to specify such qualification(s).

## PART C: STRENGTHS AND WEAKNESSES OF GRADUATES FROM WSU

- \* 12. How many graduates from the WSU has your company employed within the last five years? Give an approximate number if you do not know the exact number, or enter 0 if you had none.

From WSU (approx. number)

- \* 13. On average, how would you rate the competency of **graduates from WSU** in the following areas? [use check boxes in last column if you are unable to respond to this question]

	Very low	Low	Neither high nor low	High	Very high	Unable to respond
Problem solving ability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to apply scientific and engineering knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engineering design ability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to conduct investigate well-defined problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to use of appropriate engineering methods, skills, tools & IT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Professional and technical communication ability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Show understanding for impact that engineering activities can have on society	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Individual and teamwork ability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Independent learning ability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Understanding and alignment with engineering professionalism	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Understanding of workplace practices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please add additional comments here if you so wish

## PART D: CRITERIA FOR RECRUITMENT OF GRADUATES

14. What are the most important **criteria that are used in the recruitment of newly qualified engineering graduates** in your organisation? Tick only the most important five, in order of importance. [ *you can skip this question if you are unable to respond to it*]

	Most important criteria	2nd most important criteria	3rd most important criteria	4th most important criteria	5th most important criteria
Academic results	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engineering-specific/Technical skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inter-personal skills (e.g. interaction with others and ability to work in a team)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Personal skills (e.g. initiative/self confidence/flexibility/self-management)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Communication skills (e.g. written/oral/presentation skills)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gender	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Race	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Having a valid driver's license	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University where graduated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

## PART E: RESPONSIVENESS OF ENGINEERING CURRICULUM TO EMPLOYER NEEDS

15. Are there any competency areas (needed in employment) that you think should be expanded on, or more comprehensively covered in the curriculum? In answering this question please indicate the qualification(s) where you would like to see such improvement(s).

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# **ANNEXURE A2.1**



## **Information Sheet: Survey: Assessing the desirability/relevance of the respective HEQSF-aligned engineering qualifications – views of prospective students**

Dear (student name)

In terms of the Higher Education Qualification Sub-Framework (HEQSF) all universities are required to develop new qualifications and/or ensure that its existing engineering qualifications are re-aligned to meet HEQSF requirements. The attached online questionnaire forms part of a research study by Walter Sisulu University (WSU) to assess the interest and need among prospective students within the engineering industry for WSU to offer the respective HEQSF-aligned engineering qualifications. Abbreviated explanatory notes as to the focus and minimum duration of the respective qualifications are provided in the questionnaire. If you wish to obtain further information as to the programme design criteria, knowledge profile and graduate attributes associated with each of the new qualifications then go to the Engineering Council of South Africa (ECSA) website <https://www.ecsa.co.za/EcsaDocuments/sitepages/ecsa%20documents.aspx> (section 7.3. New Engineering Technology Qualification Standards).

I request you to kindly assist WSU by answering the items as set out in the questionnaire. This will greatly assist the university in determining which engineering qualifications prospective students, graduates and those wishing to improve their qualifications are interested in.

While participation in the survey is entirely voluntary, I would really appreciate it if you can please find time to answer this questionnaire. Individual responses will remain anonymous, as the results will be published in aggregate form only. This survey is entirely web-based and the results are captured and processed electronically. Trials indicate that the survey takes no more than 10 minutes to complete. Please record your views by clicking on the "Begin Survey" button at the end of this message which will take you to the questionnaire.

It would be of great help if you can kindly complete the survey by (date) if at all possible. I thank you in advance for taking the time and effort to participate in this survey. If you have further questions then please contact me on my office number: 043 7094753, or my cell: 0834198518 or by e-mail: fgerber@wsu.ac.za

**Ferdie Gerber**, Pr Eng

Project Manager: Academic Development Programme, Walter Sisulu University

**I ask you to PLEASE click the button below to start the survey. Your opinion matters!**

**Ferdie Gerber**, Pr Eng

Project Manager: Academic Development Programme  
Walter Sisulu University

## VOLUNTARY CONSENT

**COMPLETING THE QUESTIONNAIRE**

- a) Indicate your choice by checking (clicking) on the appropriate box.*
- b) When it comes to answering questions there are no right or wrong answers.*
- c) I thank you in advance for taking the time and effort to participate in this survey. If you have further questions then please contact me on my cell: 0834198518 or by e-mail: fgerber@wsu.ac.za*

**Ferdie Gerber, Pr Eng**  
**Project Manager: Academic Development Programme**  
**Walter Sisulu University**

\* 1. Have you received adequate information regarding the background, aim and objectives of this research as communicated through the information sheet provided and do you voluntarily consent to participate in this survey?

- ☐ Yes (allows you to continue)
- ☐ No (will terminate survey)



## PART A: DEMOGRAPHICS OF PROSPECTIVE ELECTRICAL ENGINEERING STUDENTS

\* 2. What is your gender?

- ☐ Male
- ☐ Female

\* 3. What is your age?

- ☐ 19 or younger
- ☐ 20 to 25
- ☐ 26 to 29
- ☐ 30 to 35
- ☐ 36 to 39
- ☐ 40 or older

\* 4. Please indicate which of the following statements best describe your academic career path to date.

- ☐ Have not completed any Electrical Engineering qualification
- ☐ Studying towards National Diploma: Electrical Engineering
- ☐ Completed National Diploma: Electrical Engineering
- ☐ Completed National Diploma: Electrical Engineering and currently studying towards BTech Electrical Engineering degree
- ☐ Completed BTech Electrical Engineering degree
- ☐ Completed BTech Electrical Engineering degree and currently studying towards MTech degree
- ☐ Other (please use the text box below to specify the qualification and whether you have completed it or not)

\* 5. When did you complete your highest engineering qualification?

- ☐ 2010
- ☐ 2011
- ☐ 2012
- ☐ 2013
- ☐ 2014
- ☐ 2015
- ☐ 2016
- ☐ 2017
- ☐ Other (please use the text box below to specify the year when highest academic qualification was completed)

\* 6. At which university/campus did you graduate from when you completed your highest engineering qualification?

- ☐ WSU (Butterworth/Ibika)
- ☐ WSU (Buffalo City/East London)
- ☐ NMMU (Summerstrand)
- ☐ Other (please use the text box below to specify at which university you have obtained your highest qualification)

\* 7. Are you currently employed?

- ☐ Yes
- ☐ No

Should you wish to make any additional comments then insert it in the text box below

## PART A: DEMOGRAPHICS OF PROSPECTIVE ELECTRICAL ENGINEERING STUDENTS

\* 8. Please indicate which best describes your current job designation.

- ☐ I work as an intern
- ☐ I work as an engineering technician
- ☐ I work as an engineering technologist
- ☐ I work as a project manager
- ☐ I work as an engineer's representative on site
- ☐ I work as a supervisor/section head
- ☐ I work as a manager
- ☐ Other (please use the text box below to specify your current job designation )

\* 9. Which of the following best describes the main focus area of your organisation?

- ☐ Construction/contracting
- ☐ Consulting
- ☐ Industry/manufacturing
- ☐ National/Provincial government
- ☐ District/Metropolitan/Local municipality
- ☐ Parastatal (wholly, or partly owned government entity)
- ☐ Other (please use the text box below to specify the main focus area of your organisation )

**Explanatory note on Technology based engineering qualifications:**

- **Diploma**: The curriculum for the Diploma is typically spread over 3 years (3 x 30-week full-time academic years). The primary purpose of this vocationally-oriented diploma is to develop focused knowledge and skills as well as experience in a work-related context.
- **Advanced Diploma**: This qualification typically follows a Diploma. The curriculum for the Advanced Diploma is spread over 1 year (1 x 30-week full-time academic year). This qualification is primarily industry oriented and have a strong professional or career focus. Holders of this qualification are normally prepared to enter a specific niche in the labour market. This qualification is at the same NQF level as the BEng Tech degree.
- **BEng Tech**: The curriculum for the Bachelors of Engineering Technology degree is typically spread over 3 years (3 x 30-week full-time academic years). This qualification is primarily industry oriented and have a strong professional or career focus. Holders of this qualification are normally prepared to enter a specific niche in the labour market. This qualification is at the same NQF level as the Advanced Diploma.
- **BEng Tech (Hons)**: The Bachelors of Engineering Technology Honours degree has a curriculum that is typically spread over 1 year (1 x 30-week full-time academic year). This is a postgraduate qualification, characterised by the fact that it prepares students for industry and research. This qualification typically follows a Bachelor's Degree, Advanced Diploma and serves to consolidate and deepen the student's expertise in a particular discipline and to develop research capacity within that discipline.
- **Master's Degree**: The Master's degree qualification has two possible variants. It has a minimum duration period of 1 year (1 x 45-week full-time academic year). The primary purpose of a general Master's Degree is to educate and train researchers who can contribute to the development of knowledge at an advanced level. Master's Degree graduates in general must be able to reflect critically on theory and its application.

\* 10. Below is a list of HEQSF-aligned Electrical Engineering qualifications that WSU is planning/considering to offer. Should you qualify, are you interested in enrolling for any of these qualifications at WSU?

	Definitely not interested	Probably not interested	Possibly, but uncertain	Probably interested	Definitely interested
Diploma in Electrical Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Advanced Diploma in Electrical Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bachelor of Engineering Technology in Electrical Engineering (BEng Tech)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bachelor of Engineering Technology Honours in Electrical Engineering (BEng Tech Hons).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Masters of Engineering (MSc/MEng) in Electrical Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Use the text box below to add any comments that you may have

## PART C: COMMENCEMENT OF STUDIES

- \* 11. You have indicated an interest in the following qualifications. Should you qualify, when are you likely to enroll for these qualifications that WSU plans to offer?

	2018	2019	2020	2021	2022 and beyond
Diploma in Electrical Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Advanced Diploma in Electrical Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bachelor of Engineering Technology in Electrical Engineering (BEng Tech)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bachelor of Engineering Technology Honours in Electrical Engineering (BEng Tech Hons).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Masters of Engineering (MSc/MEng) in Electrical Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. What is your preferred mode of study for the qualifications that you are interested in?

Full time	Part Time (block sessions)	Distance learning (with minimum contact sessions)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Use the text box below to add any comments that you may have

- \* 13. Which is your preferred campus to attend face to face/contact sessions (for the qualifications that you are interested in)?

Buffalo City (East London)	Butterworth (Ibika)
<input type="radio"/>	<input type="radio"/>

Use the text box below to add any comments that you may have

#### PART D: INTEREST IN OTHER ENGINEERING QUALIFICATIONS (EXCEPT THOSE LISTED)

14. Are there any other engineering qualifications that you would like WSU to offer? If so, use the text box below to indicate the qualification(s) which you would like to see that WSU offer in the future.

## PART E: FINAL COMMENTS & FUTURE PARTICIPATION

15. If you have any final comments as to this survey, or any matter relating to it then please add such comments in the text box below.

\* 16. Are you willing to participate in follow up group discussions that may result from this survey research?

- ☐ I am willing to participate in possible follow up group discussions
- ☐ No thanks, I do not wish to participate in possible follow up group discussions

Use the text box below to add any comments that you may have