PEESA III
Personalized Engineering Education in South Africa

Co-funded by the Erasmus+ Programme of the European Union

PEESA III
Gender Equality

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UNIWERSYTET SZCZECIŃSKI
WYDZIAŁ EKONOMII FINANSÓW I ZARZĄDZANIA

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I. Gender equality – background

South Africa is facing at the moment shortage of engineers (PEESA I and II)

Women make up approximately 50% of the population in South Africa, yet less that 10% in some branches of engineering are involved

Therefore there is a need to provide analysis and evaluate tools to promote geneder issues in capacity building in South Africa

Source: Part E. Project characteristic and relevance, PEESA III Detailed Project Description.

Project objective: promotion of gender equality in engineering education in South Africa among students and academic staff

I. Gender equality – background

Many countries as well as companies, institutions and higher education sector in South Africa are still struggling with gender inequalities (Loots and Walker, 2015).

Societies that increase women's access to employment and narrow differences between men and women in economic opportunities increase the pace of economic development, provide greater macroeconomic stability, increse productivity and reduce poverty.

Tertiary education constitute a crucial factor of economic growth and social progress, driving research and innovation that fosters positive economic and social change. There is also the widespread recognition that tertiary education is main player of gender equality in the family and society (Dandan, Marquez, 2017).

Some authors point out that leaders in academic science are still poorly educated about the nature and impact of barriers to full participation of women in science around the world. This lack of awareness and education results in failures to fully utilise the human capital and limits technological advancements (Coe, Wiley, Bekker, 2019).

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II. Student's survey - objectives

The PEESA III project members are seeking to understand the reasons why women and men have chosen to study engineering. They also try to develop recommendations for policymakers on how to encourage females (and males) success in Engineering and related disciplines. The expected result of the project is to present which tools and solutions are conducive to increase the number of women choosing engineering studies, to identify determinants of enrolment rate, and also to determine factors that increase the employability of engineering graduates.

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II. Student's survey - limitations

- Due to non-representative and unbalanced data (female/men and universities) conclusions can be drawn only within the sample
- Long time to obtain ethical clearances
- Some incomprehensible and incorrect answers – this problem was solved during the second surveying process

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II. Student's survey - development and conducting

The whole process of student's surveying was realised in the following steps:

1. Analysis of gender equality at PEESA III partner universities in South Africa based on received materials and reports
2. Preparation of first version of questionnaire, consultations and first improvement of survey based on feedback and comments of SA partners
3. Next and last modification (improvement) of survey: structure, questions, and design development
4. Initialising the procedure of ethical clearance required by ethical committees at all partner universities in South Africa
5. Development of the on-line survey questionnaire in Microsoft Forms
6. Survey conducting
7. Preparation of database, data analysis and report elaboration

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II. Student's survey - questionnaire

https://forms.office.com/Pages/ResponsePage.aspx?id=1i2Jr2NFVUScBaOYpD8jYgwyGhEIQrhIrCNATDX9ngBUM1ZWQ0wyVlpHNUVYNEdTVzFEMzQ3OFlLNy4u

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II. Student's survey – chosen results

Sample structure

- 708 complete answers (275 made by women – 38.84%)
- The vast majority of students who responded were up to and including 25 years of age, representing 83.47% of all respondents
- Among the types of parental education, "Secondary school" for mothers (304) and "Elementary/Primary school" for fathers (225) dominated. The most numerous group were students whose parents had these levels of education (148). Only for 22 students alone, both parents had a university degree
- Most student's answers were received from undergraduates (571, 80.65%), 1st year of the study (433, 61.16%), those who graduated public schools (623, 87.99%) and were living in a town/city (urban area) before studying (424, 59.89%)

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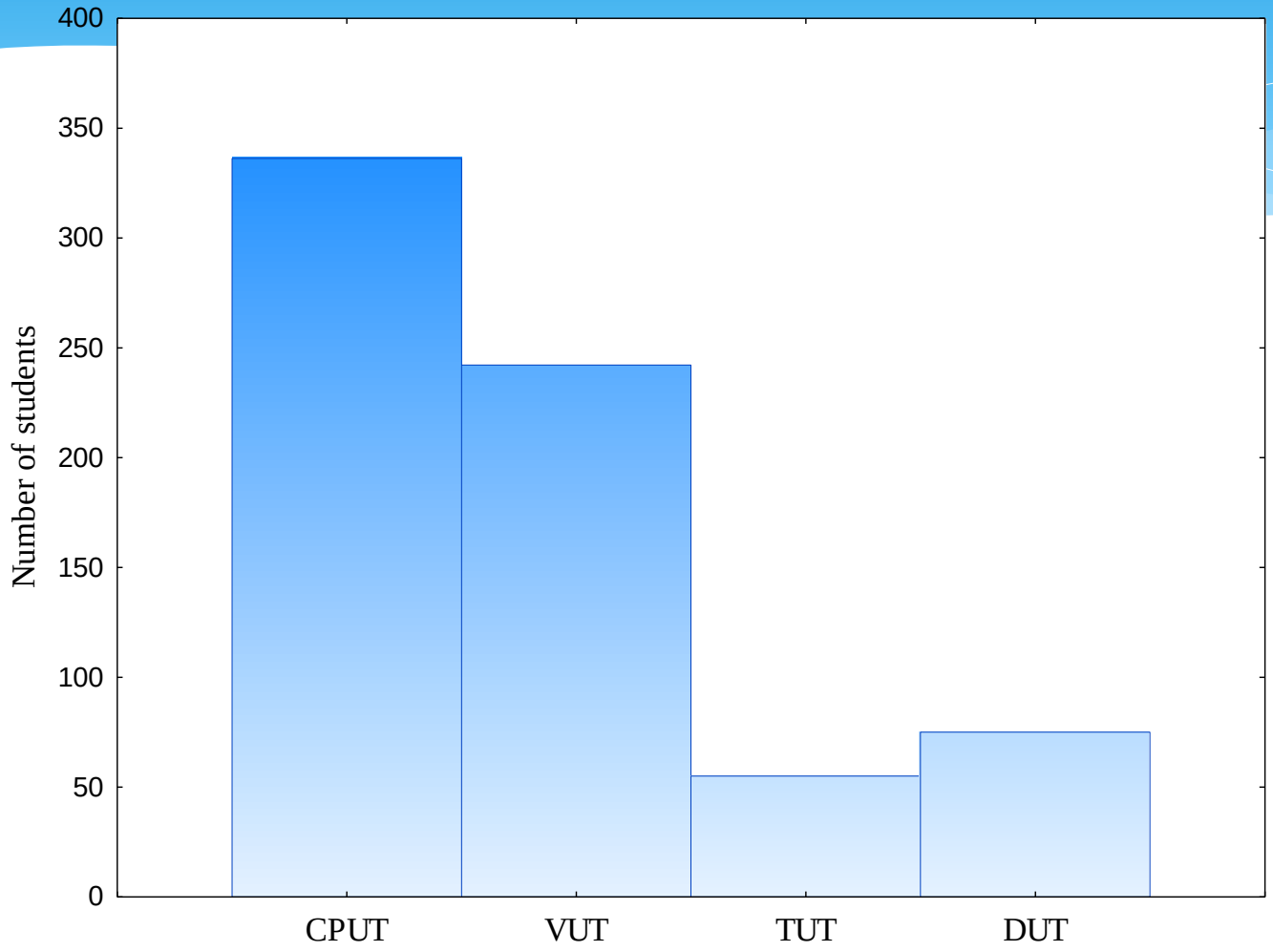

Fig. 1. Sample structure according to the name of the South African partner

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Table 1. Sample structure according to Sex and Study field

Sex	Construction	Chemical	Civil	Electrical	Industrial	Mechanical	Other
Males	36	22	53	109	35	102	76
	5.74%	**3.51%**	**8.45%**	**17.38%**	**5.58%**	**16.27%**	**10,73%**
Females	24	43	31	54	38	40	45
	3.83%	**6.86%**	**4.94%**	**8.61%**	**6.06%**	**6.38%**	**6,36%**
All Groups	60	65	84	163	73	142	121
	9.57%	**10.37%**	**13.40%**	**26.00%**	**11.64%**	**22.65%**	**6,37%**

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Table 2. Contingency table for Sex/Different treatment in grading system

	Different treatment in grading system (1 – not at all, 5 – to a large degree)					
	Gender	1	2	3	4	5
Count	Males	321	25	41	22	16
Total Percent		46.25%	3.60%	5.91%	3.17%	2.31%
Row Percent		**75.53%**	**5.88%**	**9.65%**	**5.18%**	**3.76%**
Count	Females	196	27	27	11	8
Total Percent		28.24%	3.89%	3.89%	1.59%	1.15%
Row Percent		**72.86%**	**10.04%**	**10.04%**	**4.09%**	**2.97%**

More than 80% of students do not observe any different treatment related to grading system due to their gender.

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Fig. 2. Sample part of the database and calculation workspace

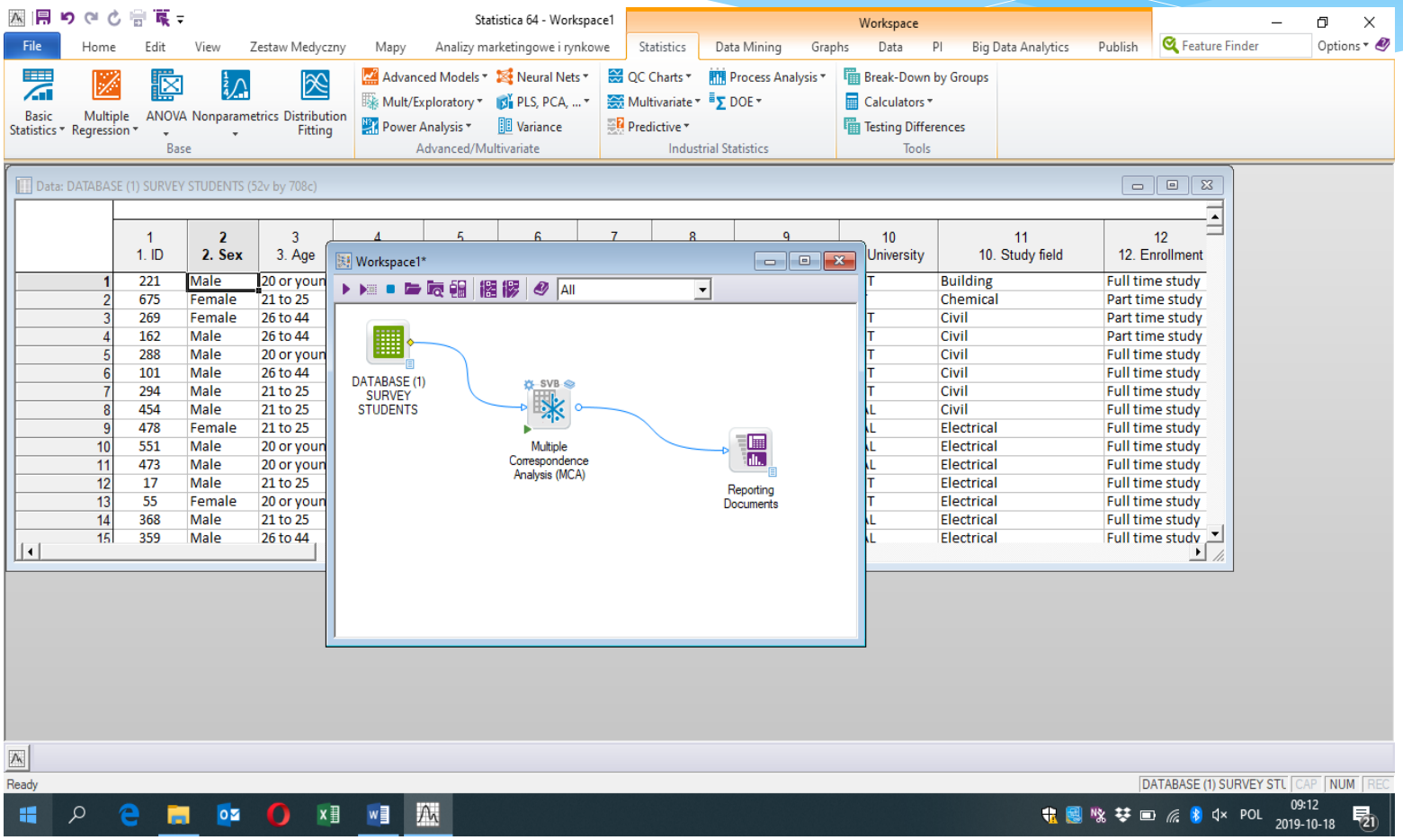

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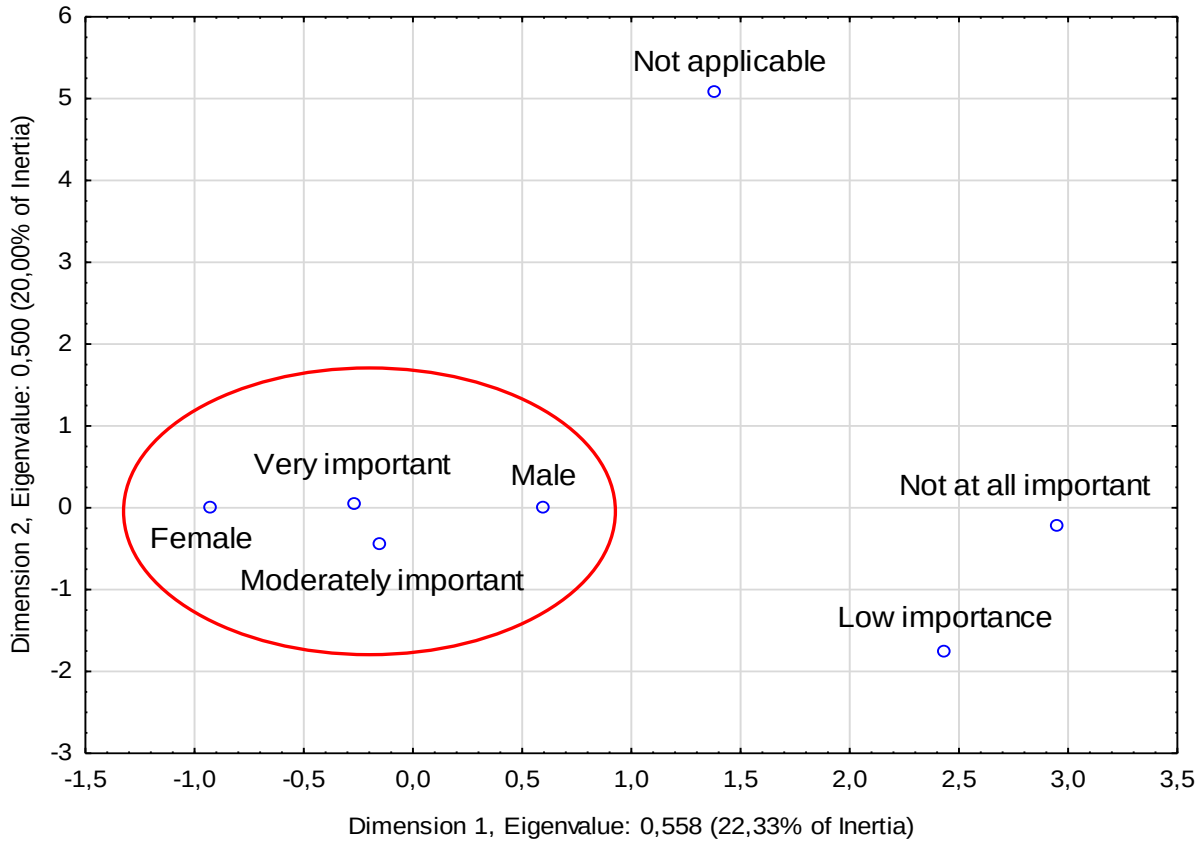
Fig. 3. The relationship between gender and the factor "Better job prospects"



Better job prospects after graduation are really an important factor of enrolment to engineering studies, both for men and women.

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Table 3. The meaning of particular determinant of engineering study enrolment

Factor	„Moderately important" and "Very important" answers (%) – in brackets percentage share among women
12.1. Family and relatives influence	54.32 (56.55)
12.2. Friends' influence	20.64 (14.23)
12.3. Schoolmates' influence	23.72 (18.35)
12.4. Having an engineer as a family member increase knowledge/interest in eng.	49.34 (45.32)
12.5. Teachers' influence	46.85 (44.94)
12.6. Discussions and workshops with schools and career guidance teachers	64.71 (67.04)
12.7. Your own ability/skills	**93.70 (93.26)**
12.8. Your interest/passion	**94.73 (93.63)**
12.9. Better job prospects after graduation	**90.19 (94.38)**
12.10. Future possibilities (earnings, social status)	**82.43 (82.77)**

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II. Student survey - conclusions

- Almost all kinds of study are dominated by males (apart from Chemical and Industrial)
- More than 80% students do not observe any different treatment related to grading system due to their gender
- For both male and female students the opinion of family and relatives was important when they decided about the studying subject/area
- Having an engineer in the family was important in terms of choosing the type of study only for men and these students who were living in the village/rural area

II. Student survey - conclusions

- Better job prospects after graduation have a large influence on the enrolment decision in case of engineering studies, both for men and women
- Graduates of public schools think that better job prospects is an important advantage after they finish engineering study, while for private school graduates such factor has no meaning at all
- Own ability/skills, own interest/passion, better job prospects after graduation, accommodation access and university reputation were the most important enrolment factors for future engineering students
- The most popular/effective tools used within the promotional and recruitment process were social media and you-tube videos and pre-study workshops in the secondary school.
- The most important difficulties that can result in higher drop-out rates indicated by respondents were the financial aspects and problems with bursary and accommodation.

III. Staff survey - background

The development of higher education institutions depends not only on the level of funding, but also on the effectiveness of the system itself. The latter is conditioned, among other things, by the relations prevailing among staff and the system of values which guides them.

"Increasing women's participation in S&T will not be successful without restructuring institutions and mainstreaming gender analysis into knowledge production" (Schiebinger, 2008).

Recent results point out an increase in the number of women leaving academia in order to take up careers in other science and technology-related professions, which provide not only new career paths, but also more favourable working conditions (*Meta-analysis of gender and science …*, 2012).

III. Staff survey - background

Frances (2017) highlighted that in the period 1987-2011 the share of women employed in universities in the US increased from 30 to 50%. This advance in employment have not been accompanied with gains in their salaries and in access to funding in comparison to faculty men. A higher percentage of women than men were employed at lower-paying colleges and universities and a few women were moving into executive positions. These tendencies were also confirmed by Huang (2017) and for Chinese universities by Zhong and Guo (2017) as well as for Italian and Swiss academia (Goastellec, Vaira, 2017).

III. Staff survey - background

Also in the European higher education sector female academics form a disadvantaged group since they are underrepresented in senior academic positions, and tend to be more involved in teaching than in research or leadership than their male counterparts, which seems to inhibit career progression of female academics (Leišytė, Hosch-Dayican, 2017). Goastellec and Vaira (2017) found additionally that females academic career possibilities are strongly dependent on the scientific discipline and that the gender salary gap increases over job seniority.

III. Staff survey - background

Some authors point out that leaders and practitioners in academic science are still unaware of and poorly educated about the nature and impact of barriers to full participation of women in science around the world. This lack of awareness and education results in failures to fully utilize the human capital and limits technological advancements (Coe, Wiley, Bekker, 2019).

While policy action is needed for raising gender awareness and removing institutional constraints and biases, empirical research is required in order to provide a sound basis for policy making. The systematic collection of personal and career data is of utmost importance for monitoring progress towards both family and career balance and gender equality in scientific institutions (*Meta-analysis of gender and science …*, 2012).

III. Staff survey - objectives

Main goal of the survey was recognising if:

- there exists different treatment related to gender, ethnicity or race among staff,
- academic workers are aware of gender equality policy at their university,
- academic staff is satisfied with its decision regarding teaching/conducting research at engineering studies.

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III. Staff survey - questionnaire

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III. Staff survey – chosen results

73 full responses were analysed

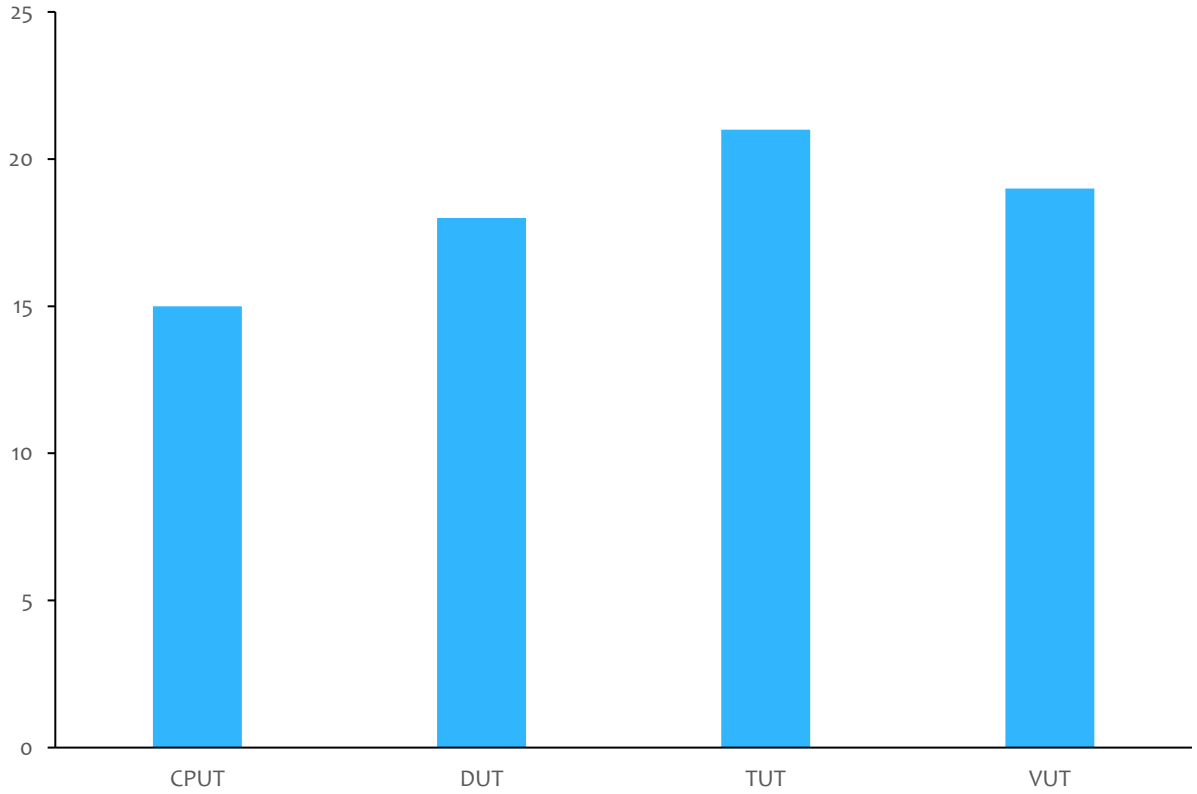

Fig. 4. Sample structure according to the university

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The vast majority of staff members who responded were 46 or older, representing 52.05% of all respondents. Almost all respondents are full-time employed.

The dominant share of staff members ethnicity was African (41.10%), males (73.97%), with lecturer position (69.86%) and characterized by the work seniority at the university level from 11 to 20 years.

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Table 4. Sample structure according to *Gender* and awareness of gender equality policy in the university

	Gender	Yes	No	I don't know	Total
Count	Males	40	2	12	54
Row Percent		74.07	3.70	22.22	100.00
Count	Females	12	2	5	19
Row Percent		63.16	10.53	26.32	100.00
Count	All Groups	52	4	17	73
Column Percent		71.23	5.48	23.29	100.00

It is somewhat surprising that men are more aware of the implementation of gender equality policies in the university. It is worth noting that the general level of knowledge of this type of policy among academic staff is quite high.

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Fig. 5. The relationship between length of service at the university and different treatment related to assessment system of work

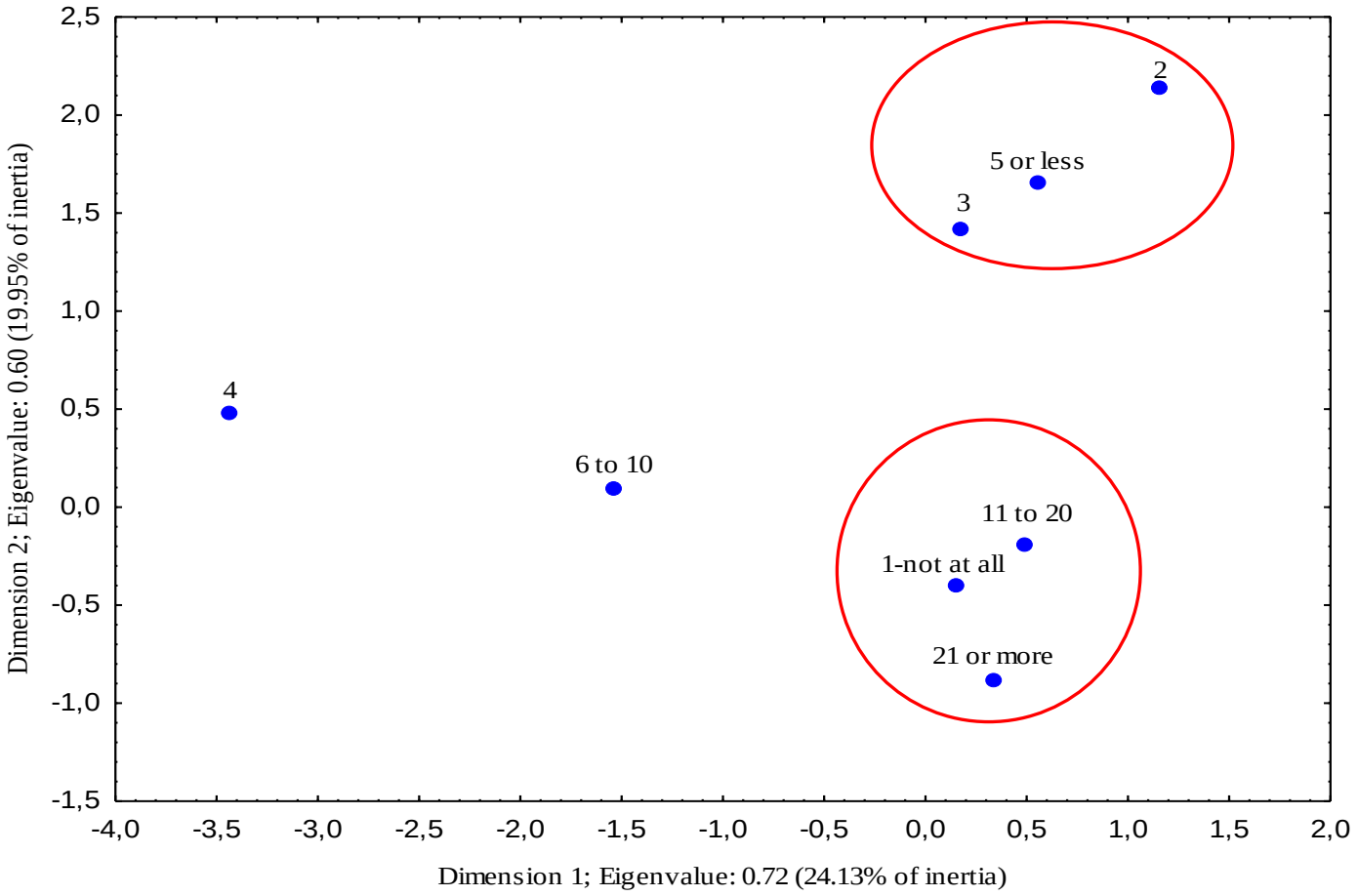
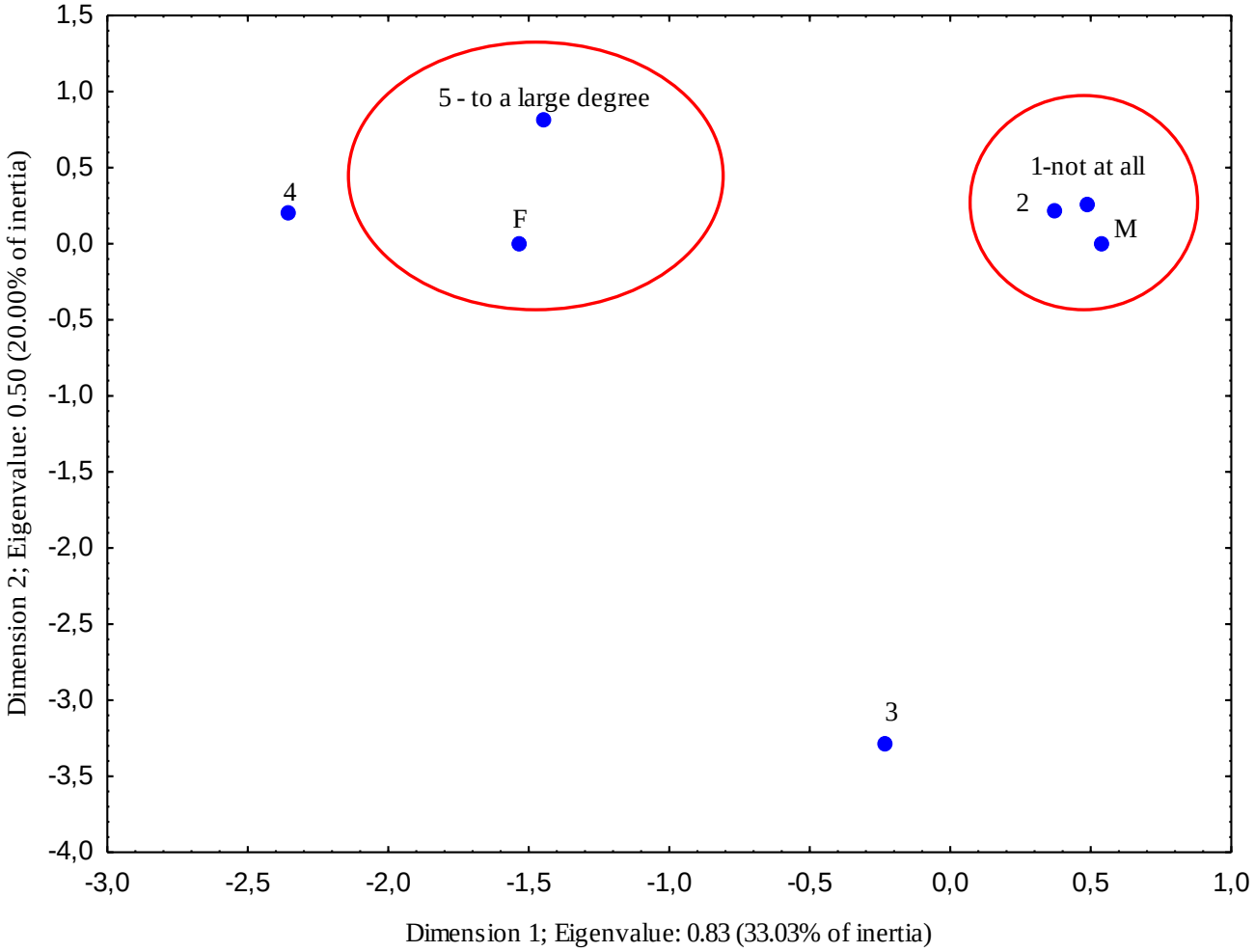


Fig. 6. The relationship between gender and different treatment related to wage



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III. Staff survey – chosen conclusions

- Female respondents reported discrimination in some work-related areas
- A similar situation occurred in the case of young academics
- African staff members expressed different treatment related to assessment system of work and the existence of “glass ceiling”, but this conclusion should be treated with some caution due to the sample bias – this ethnicity represented more than 40% of the total sample

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Thank you for your attention

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