WOMEN SCIENTISTS IN GENDER ORIENTED RESEARCH

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Abstract: The aim of the article is to present and analyze the results of the questionnaire research performed in Poland between November of 2006 and February of 2007 as well as to discuss their meaning for product design and manufacturing management. The project aimed at clarifying the process of how the women scientists are engaged in technological and R&D response to the needs of women end-users. The study examined economic and socio-cultural factors that influence gender-specific end-user interaction with women researchers by comparing and analyzing gender equality in R&D in the case of agricultural implementations for rural applications.

Keywords: gender-specific, end-user, R&D, GDP, product development process, Lisbon strategy.

1 Introduction

The article focuses on the issues of the general condition of scientific research in Poland with a special attention paid to the situation of Polish female scientists. Quantitative research was performed in the Polish Patent Office in Warsaw on the patents that involved women as well as questionnaire research among women in Poland in order to verify whether particular research and development institutes take into consideration the needs and requirements of the product final users. First and foremost, the answer to the following question was sought: „How are women scientists engaged in technological R&D responses to the needs of women end-users? The questionnaire distinguished several phases of product development and the questions concerned each of the phases. Therefore the discussed research might contribute to the improvement of R&D projects' management and/or manufacturing of products at different stages from the testing phase, through the product usability development to the stage of final shape of the product.

The following part of this chapter presents the structure of the article. It consists of 11 chapters. After the introductory chapter the scientific research expenditure in Poland analysis is presented (Chapter 2), with a special attention paid to agricultural sciences, due to the fact that most of the research presented in the article is based on the achievements of scientists from this area of science.

Third chapter presents the Innovative Economy Operational Program 2007 – 2013, elaborated by the government in order to improve the innovativeness of Polish enterprises.

Fourth chapter focuses on the approach and plans of enterprises in the difficult times of global economic crisis.

Fifth chapter describes the situation of women in Poland with the consideration of the employment factor and awarded scientific titles.

Sixth chapter presents the author's research results on the participation of women in the creation of innovative products that were awarded with a patent in Poland.

Following chapters include the description of the questionnaire research: the origin and genesis of the research is presented in chapter seven, short characterization of the research is presented in chapter eight, detailed research results are presented in chapter nine, summary and discussion on the results influence on the improvement of management is collected in chapter ten.

Eleventh chapter consists of the literature sources for the article.

Next chapter is characterizing the difficult situation of Polish scientists, based on the data from the GUS - Central Statistical Office.

2 Science and technology in Poland

The impact of the science and technology development on the state of economy and quality of life of the society is recognized in Poland, similarly to most other developed and developing countries. However, the turbulent history of Poland, geo-political situation

as well as corruption, nepotism, increasing level of unemployment and many other causes contribute to the common lack of financial resources to finance science and technology adequately to the needs and potential possibilities.

Table 1 presents the resource division on research and development activities.

Research described below concerns mainly the agricultural sciences, therefore in order to compare with the totality of financial expenditures on R&D activities (see Table 1) the Table 2 the employment and expenditures from this area are presented.

Data collected in the Table 2 indicates that more or less 1/10 of the total research and development activities expenditures are given to Agricultural Sciences. Values from Table 1 will be clearer when presented in relation to the gross domestic product (see Table 3).

Data from Table 3 indicate that approximately 0.6% of GDP is given to scientific research in Poland, whereas e.g. Japan this ratio is equal to 3,3%, it is even greater in Finland and Sweden has the biggest value of this ratio – almost 4% among 31 other highly developed countries [4]. This leads to a conclusion that science is heavily underfinanced in Poland.

Great expectations are given to European Union. One of the directions of the Lisbon strategy, approved by the European Council in 2000, which Poland – and other EU countries – should realize, is the knowledge based economy. Successive governments in Poland declare considerable financial support for scientific research in modern areas of knowledge, especially the ones concerning innovation. It is possible due to a considerable financing provided by EU for Poland in the period of 2007-2013 for telecommunication and IT projects.

Table 1. Gross domestic expenditures on research and development activities
(source: self elaboration on the basis of [7])

SPECIFICATION	1995	2000	2005	2006
	grand total in million PLN			
TOTAL	2132,8	4796,1	5574,6	5892,8
Scientific and R-D units	1276,1	2449,6	2617,6	2839,1
Science support units	2,8	13,8	25,8	33,6
Development units	292,9	791,6	1150,1	1171,4
Higher education institutions	561,0	1512,4	1760,3	1826,9
Other units	---	28,7	20,8	21,8

Table 2. Employment and gross domestic expenditures on research and development activities in agricultural sciences
(source: self elaboration on the basis of [7])

SPECIFICATION	1995	2000	2005	2006
Agricultural sciences	Expenditures in million PLN (in current prices)			
	245,7	439,4	474,8	532,1
	Employment (in full-time equivalents)			
	9257	8213	6494	6609

Table 3. Main research and development activities indicators
(source: self elaboration on the basis of [7])

SPECIFICATION	1995	2000	2005	2006
Gross domestic expenditures on research and development activity (current prices):				
ratio to gross domestic product in %	0,63	0,64	0,57	0,56
per capita in PLN	55	125	146	155
Employment in R-D activities per 1000 economically active persons	4,9	4,6	4,4	4,3
of which researchers	2,9	3,2	3,6	3,5

3 Innovative Economy Operational Program

Special Innovative Economy Operational Program for 2007-2013, which support investments in innovative ventures, was elaborated, in order to improve the innovation level of Polish enterprises. Priority includes projects from enterprises including implementation of self or purchased new technologies. Additional support for enterprises investing in R&D activity includes financing of expert advisory and consulting as well as investments necessary to undertake R&D activities that include preparation of enterprises to gain the status of research and development centers.

Special support will be given to manufacturing and servicing enterprises for new investments with high innovation potential. In such case supported projects must include the implementation of modern technological solutions used worldwide not more that 3 years back. Activities will support new investments and advisory and training projects necessary for their realization.

All enterprises can be the beneficiaries of the activities, including large enterprises (at least 250 employed people). Due to the special treatment of the SME enterprises sector it was assumed that 75% of the resources will be allocated into investment activities with high potential in this sector.

Investments projects that use modern technological solutions in manufacturing and services, which lead to the creation of new or considerably improved products or services, will be supported.

Moreover, as part of the investments, new organizational solutions that lead to the increase of productivity and effectiveness (e.g. marketing, logistics, distribution, IT and management systems) will be supported as well as purchasing of required material, legal and immaterial assets necessary for organizational changes [3].

Our specialists are appreciated worldwide, especially the IT specialists, which led to the visit of Bill Gates (founder of Microsoft) and his plans to establish IT center in Poland.

4 Approach of enterprises in the time of global economical crisis

Poland noted considerable economical development in recent years. It was forecasted that such pace of development will continue in the following decade. However the global economical crisis emerged also in Poland, what let to the slowdown of the development and forced necessary savings in all resorts. This can lead to the increase of unemployment rate and decrease of expenditures - among others - for scientific research. Unemployment rate is currently rising. According to the Ministry of Labor it grew to 11,2% in March 2009 with relation to 10,9% in February of 2009.

Research of Polish Chamber of Commerce performed in February of 2009 performed on the sample of 160 large, medium and small enterprises indicated that every fifth enterprise is willing to dismiss employees. At the same time 87% of enterprises share an opinion that currently we are witnessing the beginning of the crisis and are expecting the situation to be worse. Research results are collected in the Fig. 1.

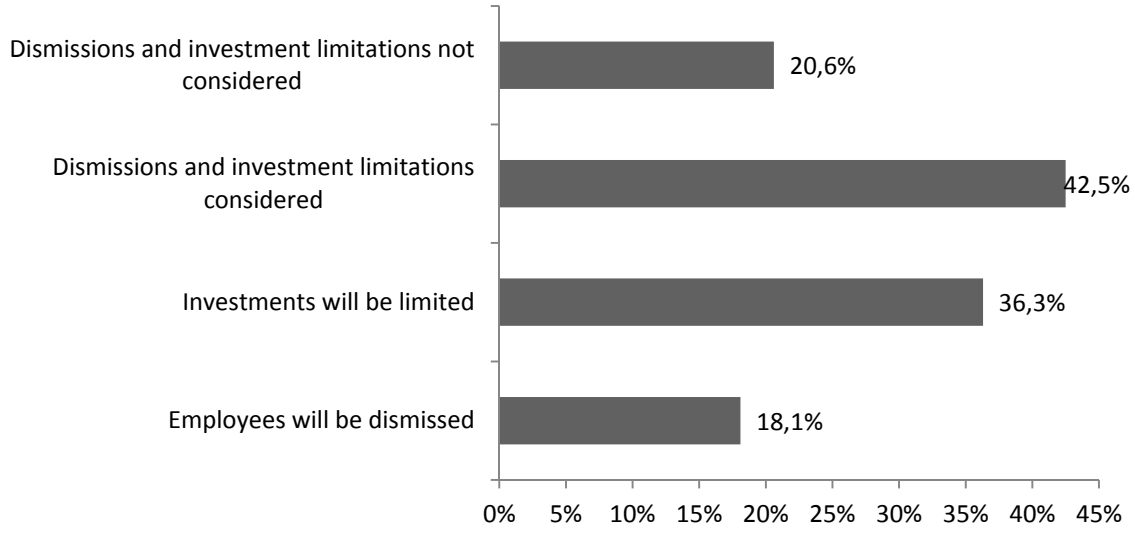

Figure 1. Enterprise questionnaire
(source: self elaboration on the basis of Chamber of Commerce research results)

Nevertheless one can assume an optimistic approach towards this issue. Poland is one of relatively large countries – it takes ninth place in Europe according to its size and eight place according to population (38,6 million). Polish people do not have to extol but also there is no need for complexes because of its culture, history or present activities. It is a member of many important international financial, economical and military organizations such as the World Bank, European Union and in March of 2009 the 10th anniversary of NATO participation was celebrated. Therefore it is reasonable to assume that Poland will overcome the current crisis.

5 Social and economic role of women in Poland

Global social structure is dominated by men and women are playing a secondary role in it. During the seventies in the United States the concept of the "glass ceiling" was created, which meant an invisible barrier that separated women from reaching the highest career positions. "Glass ceiling" is a symbol of the visibility of the possible promotion with the simultaneous impossibility to attain it [9]. Another definition which is describing the mechanisms of women's' discrimination is the concept of the sticky floor, which relates to low-status jobs with no possibility of promotion – people performing such types of work are attached to the lowest level [9]. Such job positions include civil servants, secretaries or dressmakers – jobs usually performed by women.

Generally the issue of employment of women is not very positive. Table 4 collects the employment level in recent years in Poland. The ratio is calculated as the relation of employed people, 15 or over in given employment group, to the total number of people in the population.

According to the statistics over 50% of the population in Poland are women. Over 31,4 million people are able to work, whereas there are 1,6 million women more than men[1]. These proportions are changing unfavorably for women when the employment gender-ratio is taken into consideration (Table 4); therefore unemployment is more painful for women than men.

Data from the last periods is also not favorable for women, indifferent from the region of Poland they originate in. Here is an example of two regions distant form each other[2]. Małopolskie province in the February of 2009 had the domination of women in the group of unemployed – 54,4% (approx. 62 thousand). Slightly better indicator was noted in the opolskie province: 53,5% of unemployed were women and in the kujawsko-pomorskie in 2008 59,8% (approx. 65 thousand) of unemployed were women.

[1] Data from Main Statistical Office for the IV quarter of 2007 according to [4].

[2] Source: drogowskaz@agora.pl.

Table 4. Employment ratio during 2005 -2007
(*source: self elaboration on the basis of Main Statistical Office data [4])*

	2005	2006	2007	
	Average during the year			IV quarter
Men	52,4%	54,1%	56,4%	57,4%
Women	38,6%	39,6%	41,5%	42,3%

Table 5. Number of titles of professor granted
(source: self elaboration on the basis of [7])

SPECIFICATION	1995	2000	2005	2006
TOTAL	367	470	503	397
of which women	61	111	136	108
in the field of agricultural sciences	45	56	68	70

On the other hand, significant increase of the role of women in the economic, political and social life is being observed. Awareness of women about the job market situation and politics is increasing and many women organizations are created – even a political party of women was created – due to the fact that women are educated as good as men and they aim to get equal job positions and salaries as men.

The fact that Polish women are more enterprising than women in other EU countries is optimistic. This is indicated by the number of women who start their own companies. Poland is one of the top countries in EU in this matter[3]. Polish women are not afraid to take risk and they start their own businesses - small service oriented but also large like the Polonia Theater (Krystyna Janda) or the Institute of Cosmetics (dr Irena Eris).

Table 5 collects information about the number of scientific titles awarded to women in general and in the field of agricultural sciences (due to the character of described research). Data indicates that considerably lower number of women was awarded the professor title than men. In relation to the number of scientific titles in the field of agricultural sciences the biggest number of titles was awarded in 2006.

6 Participation of women in the creation of inventions for that apply for patent

Polish women are not only involved in performance of simple jobs like services but also many educated women are managers and participants of research and development activities that increase the innovation level of enterprises. Results of their work are usually a source for patent applications. Patent office does not prepare statistics on the participation of women in patent applications. Main Statistical Office also does not provide such information. That is why the author of this paper performed hard work in the main Patent Office in Warsaw, where the names of all female patent creators and co-creators accepted in Poland during 2001 - 2004 were listed [11]. Female patent project managers were of the highest interest for the author. Unfortunately patent applications do not have the information about the patent project manager.

The order of listed names in a patent application was entirely up to the project team. There are some project teams with a single female in the top of the name list and others with several women in the list in random order. Statistical calculations do not include recent years, even though patent applications with female participants are filed in every year. However the time to evaluate the patent application lasts usually from 5 to 7 years. Even some applications are present that are not yet evaluated, even though the application was

[3] Chudzicka J., Wybrane aspekty globalizacji przedsiębiorstw, [in] Wybrane aspekty Zarządzania Wiedzą w Przedsiębiorstwach Unii Europejskiej, (ed. Krupa T.), Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją, Opole 2006, p. 77.

provided in 90ties (usually cases that have the legal aspects not clear). Presented data collection shows data concerning published patents and reveals all women creators and co-creators. Therefore this information shows the number of Polish women who created or participated in the creation of patents, but does not indicate how many of the women single creators and managers of patent projects are. In order to check who the patent project leader was one would have to contact each and every team, what seems practically impossible.

Table 6 collects all the patents applications accepted by the Polish Patent Office 2001-2004, which included women as participants.

One of the difficulties in gaining this data is that the Patent Office dies not provide information about the gender of the applicants. For example it is hard to evaluate whether Idris is a male or female name. Such problem was encountered three times in the analyzed data. Table 7 collects the number of patents with the unspecified gender of the applicant.

For example Tables 8 and 9 present data about applied inventions and granted patents as well as the information about the utility model applications (without specified gender of the applicants) based on the data from the Main Statistical Office.

However, when comparing data from Tables 6 and 7 with Table 8, one can see that in 2004 the number of women participating in granted patents is the highest, what leads to a conclusion that Poland has more female inventors every year.

Table 6. Number of granted patents with female participants
(source: self elaboration)

	Year			
	2001	2002	2003	2004
number of patents, in which women participated	302	316	256	419

Table 7. Number of patents with the unspecified gender of the creator/co-creator
(source: self elaboration)

	Year		
	2001	2002	2004
number of patents with the unspecified gender of the applicant	1	2	5

Table 8. Domestic inventions and utility models in 2000-2004
(source: self elaboration on the basis of the data provided by the Main Statistics Office [7])

Year	2000	2001	2002	2003	2004
Patent applications	2404	2202	2313	2268	2381
Patents granted	939	851	834	613	778
Utility model applications	1274	1057	865	732	648
Rights of protection granted	680	484	558	666	894

Table 9. Domestic inventions and utility models in 2005-2007
(source: self elaboration on the basis of the data provided by the Main Statistics Office [4])

Year	2005	2006	2007
Patent applications	2028	2157	2392
Patents granted	1054	1122	1575
Utility model applications	600	625	604
Rights of protection granted	829	869	605

Data in Table 9, in comparison with the data from previous years (Table 8), indicate that the ratio between patent applications and granted patents has increased - over half of the applications were granted with a patent.

Information in Tables 8 and 9 indicates that that the number of rights protection granted in 2004-2007 is higher than the number of applications. The most probable cause is the delay in granting these rights, therefore some of the right protections can relate to cases originating before the year 2004.

One of the main issues that the inventors fight with is the transfer of scientific inventions into business practice. Therefore there are many active initiatives to improve this situation. One of such examples can be a conference organized in 2007 by the Enterprising Poland foundation and Independent Students Union from Warsaw School of Economics "Innovators – the program of transferring the science into business practice". The main topic of the conference was to determine how to allow and effective and profitable transfer of knowledge into practice beneficial for the enterprises and the society.

Following part of the article questionnaire research results, which was performed among women scientists in Poland from November of 2006 and February of 2007, are presented.

7 Background

In January 2006, the project *Women Scientists in Gender-Specific Technological R&D – How do Women Scientists in Technological R&D Respond to the Needs of Women End-Users? (WOSISTER)* was launched with support from the European Commission. The project aimed at clarifying the process of how women scientists engaged in technological R&D respond to the needs of women end-users.

The study examined economic and socio-cultural factors that influence gender-specific end-user interaction with women researchers by comparing and analyzing gender equality in R&D in the cases of two technologies – agricultural implements for rural application and teleservices - and in two transition economies - Poland and China [2].

As part of this project, questionnaire research was performed among women scientists in Poland, November of 2006 and February of 2007, mainly from the fields of Agricultural Sciences and Telecommunications; as well as few scientists from different areas of knowledge. Author's research concerned specialists form the field of Agricultural Sciences. Listed project includes results for both Agricultural Sciences and Telecommunications, although this paper focuses in detailed results and their analysis in different scopes as well as the conclusions of the author based in the interviews with women agricultural scientists and ladies who, despite working in institutions connected with agriculture, indicated their specialization as „other".

Selection of the respondents for the designed questionnaire was not an easy task. Information displayed in the Polish scientific websites, which seemed to be the best solution for this type of research was usually incomplete, outdated and included information only about scientists with the Ph.D. title at least. It was extremely difficult and time consuming to search for information about companies who employ women scientists and get some contact information hoping that the selected respondents will be kind enough to answer the questionnaire. Some of the responses did not include filled in questionnaires. Sometimes the responses were a tough lesson of humility, due to the fact that some of the answers included unpleasant comments. In one case a respondent did not like one expression in the questionnaire, even though it did nit influence the understanding and results of the research.

On the other hand there was a respondent who was enthusiastic about the research and provided all necessary answers.

Some of the respondents required some proof and identification for the questionnaire what indicates that the women were not willing to provide answers to an anonymous interviewer. It was one of the reasons for a strong engagement in the collection of the responses by the author.

Most of the questionnaires were delivered personally by the author to the respondents located in Warsaw. In some of the institutions employees were not allowed to fill in the questionnaire due to the policy of confidentiality. Fortunately such cases were not common. Most respondents were not keen on filling in the questionnaire so receiving the answers required much engagement, encouragement and persuasion. Moreover the author tried to thank every respondent e.g. via e-mail.

Despite the hard and time consuming work, the author managed to collect a relatively high number, in the limited field of the research, of 100 responses with questionnaires.

The following chapter describes shortly the questionnaire research.

8 Characteristics of the questionnaire research

The survey has been run on the sample of 82 women researchers working primarily on the fields of Agricultural Technologies.

Research was performed at universities, research and development institutes and agricultural companies in Poland.

The purpose of this questionnaire was to carry out a quantitative analysis of how, and at what stage of the R&D process, interaction between end-users and researchers take place. In other words, how are customer preferences integrated into the product development process?

The questionnaire mainly consisted of multiple choice simple questions. There were also provided possibilities for comments to each question, in case somebody wished to clarify his position. However, not many of the respondents provided comments in written form but rather in the form of remarks in discussion.

9 Results of a questionnaire survey

9.1 Sample characteristics

Before starting to analyze the results of the merit part of our survey one has to look at the structure of our sample from the point of view of characteristics of respondents.

One of the questions required to estimate the age group. Fig. 2 presents the quantitative result and the percentage of each age group[4].

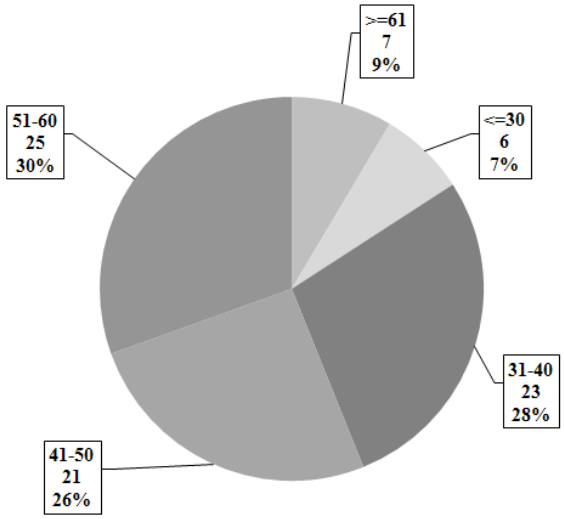

Figure 2. Number of respondents in particular age groups (presented in numbers and percentage)

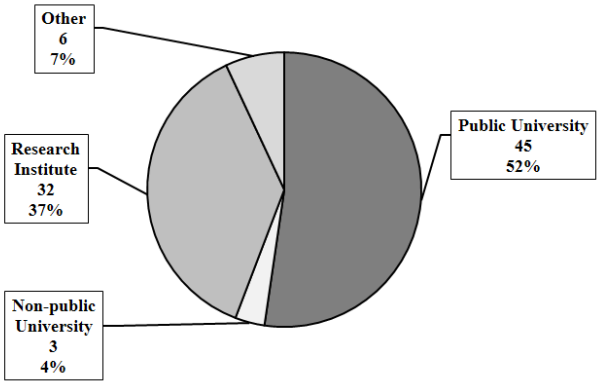

Figure 3. Type of employer (number and percentage of people employed in particular institutions)

Results in the Fig. 2 indicate that the majority of the respondents were qualified in three age groups. Percentage in all of these groups was similar. Relative-

[4] All figures and tables in the chapter 9 are author's elaborations.

ly small group were young women (under thirty years of age) and women over 60.

Most of our questionnaired women worked either in Public Universities or in Research Institutes (see Fig. 3) and it seems to more or less mirror the actual structure of employment of researchers in Poland.

Questionnaire respondents were also asked to indicate their scientific title. Fig. 4 presents the number of people with the title of M.Sc., B.Sc. and Ph.D. It the last case also people with additional titles and degrees are taken into consideration e.g. professor title or the post doctoral degree. Results are presented in percentage and quantitative.

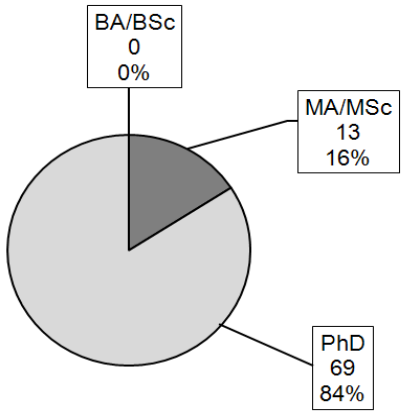

Figure 4. Scientific degree of questionnaired women (in percentage and quantitative)

People who had high influence on the created upcoming projects/products were of special interest. Therefore the author had asked whether there were any people, currently or in the past managing projects, among the respondents. Results are presented in percentage and quantitative in the Fig. 5.

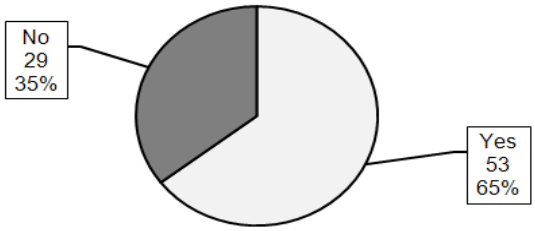

Figure 5. Project leaders (in percentage and quantitative)

It is easy to see that the majority of respondents have a Ph.D. degree and 2/3 of them had experience with project management. If particular values from the Fig. 2, 3, 4 and 5 are compared, one can conclude that the typical features of the respondents were: age between 31 and 60 years and scientific degree of Ph.D. (wit a relatively large group of professors), place of employment – public university or research and development institute, experience in managing at least one project.

With all the factors considered it is possible to state that our questionnaired women where competent enough to treat their answers as reliable.

9.2 General integration of user's perspectives at institutions

At first we look at the institutions our respondents work for. For the purpose of this study, we have divided the process of developing and bringing a product to the market into three broad phases:

- the research phase (the discovery of new knowledge),
- the product development phase (developing the technical functionality of the product),
- the design phase (modeling, shaping and re-designing the product).

Questionnaire concerned the activities of the respondents in particular phases of product development. The question was as follows: In the work at your institute/department, do you integrate user preferences by consulting with or receiving any kind of feed-back from prospective end-users, either directly or through other types of market research studies:

- in the research phase? (answers in percentage and quantitative are presented in the Fig. 6),
- in the product development phase? (answers in percentage and quantitative are presented in the Fig. 7),

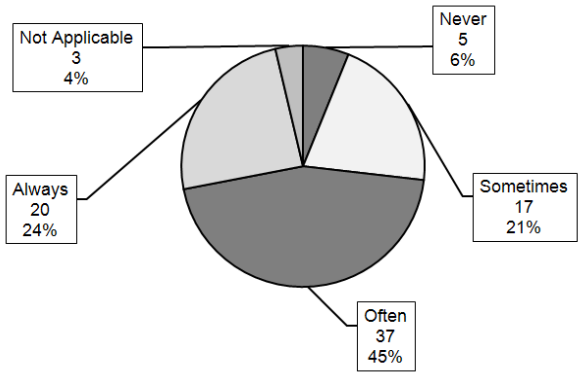

Figure 6. Integrating user preferences in the research phase

- in the design phase? (answers in percentage and quantitative are presented in the Fig. 8).

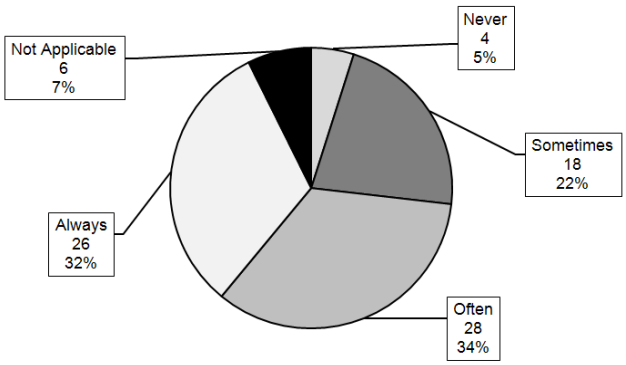

Figure 7. Integrating user preferences in the product development phase

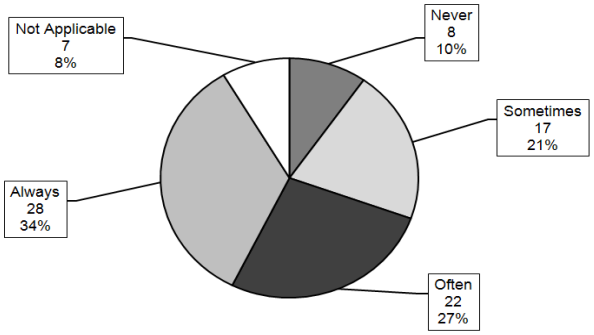

Figure 8. Integrating user preferences in the product design phase

It seems that most of our respondents at least try to incorporate the end-users preferences into the agenda of their research. In all phases of product development the answers "often" or "always" were in the scope of 60 to almost 70 percent (see Fig. 6, 7 and 8).

Almost 70% of respondents declare that preferences are often or even always observed even during the initial phase of the work on the product – the research phase; a little bit less during the product development phase and the least of all (but not a few – about 60%) during the design phase. This may be explained by the fact that large number of our respondents seem to work in institutions where mainly the initial research is performed (universities).

9.3 Distinguishing male/female preferences in the interaction with end-users

Unfortunately, from the point of view of the main subject of our research, the institutions our respondents work for are not very often distinguishing preferences of males and females when interacting with end users and then, consequently, when working on their products.

Answers to the question: Does your institute / department distinguish between male and female preferences in the interaction with end-users (e.g. in end-user consultations by focus groups or/and demand surveys)? are presented in the Fig. 9.

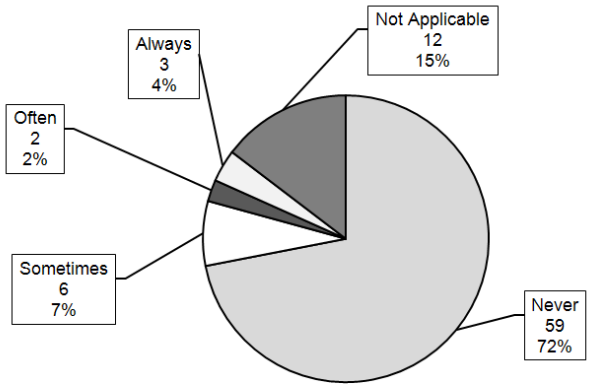

Figure 9. Distinguishing between gender preferences when interacting with end-users

As much as 72% of institutions never take into account gender differences, 7% take it into account at least sometimes, 15% of respondents reckon this question is not applicable for their institutions and only 6% of institutions take it into account often or always (see Fig. 9).

Respondents who have not answered „never" in the previous question were asked the following question: Have these end-user consultations indicated differences in end-user preferences with respect to gender, i.e. do you get significantly different results from men and women?

According to the expectations of the author this question was answered by 23 respondents (sum of answers other than "never" - see Fig. 9), of which only in 6 cases the respondents claim that consultations with end users indicated for differences in preferences between women and men. No such differences were discovered in the rest of cases. Result in percentage is presented in the Fig. 10.

Answers to the following question were expected from respondents who have provided positive answer to the previous question – it concerned 6 respondents.

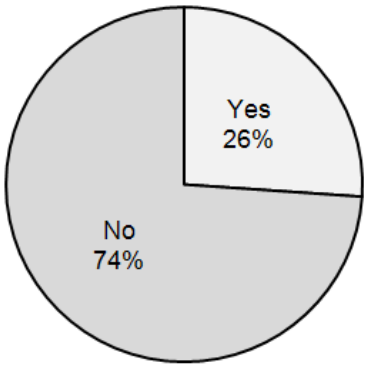

Figure 10. Differences in male/female preferences of the end products

Special attention was paid to the fact, whether differences in male/female preferences of the end products were spotted, what have been the practical consequences, if any, for the R&D and design process?

This question allowed multiple answers, that is why the number of answers could be greater than six – it was necessary to indicate the gender at which the products were aimed.

Collected answers are presented in the Table 10. Of 8 answers, there was 1 case of resulting products targeted primarily on men, in 2 cases the results of consultations resulted in products directed primarily for women, in the rest 5 cases the resulting products were targeted at both sexes.

Table 10. Products aimed at particular gender and gender neutral

	Number of answers
Product(s) aimed primarily at women	2
Product(s) aimed primarily at men	1
Product(s) aimed at both sexes (=)	5

In the answer for the question: If products aimed specifically at women or men were developed, at which phase(es) were they made gender-specific? multiple selections were also possible what affected the results collected in Table 11.

Table 11. Phases of aiming products at specific gender

	Number of answers
During the research phase	3
During the product development phase	1
During the design phase	2

The respondent, who has filled in all three options in the answer for the previous (Table 10), has indicated the most relevant research phase in the last question – the earliest phase. Other respondent, who has selected only one answer in the previous question (Table 10), selected only the option: "product(s) aimed primarily at women", answering the last question as the design phase, what suggests that such product aimed at women will be created or is already created. It can be a ray of hope for the ladies.

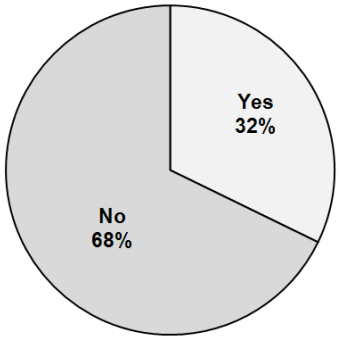

Figure 11. Meaning of consultations with end-users

Next question concerns respondents who have answered "never" in the question: Does your institution distinguish male and female preferences during the contacts with end-users? – there 59 answers to this question (results are presented in Fig. 9). It was meant to check whether, despite of negative answer, a researcher think consultations with end-users could have had any practical consequences for the development of the product(s). This question had 19 positive answers and 40 negative answers. Answers are presented in the Fig. 11. Therefore every third woman believes that consultancy with an end-user would have influence on the type of created product.

The following part of the paper presents the personal experience with gender-specific projects of question-

naired women, their participation and/or interest in gender oriented technological R&D.

9.4 Personal experience with gender-specific projects

This part of the questionnaire was aimed at personal experience of women – scientists with gender-specific projects. The following question was asked: In your experience, approximately how many of all product development projects at your institute/department have been gender-specific (i.e. aimed at either women or men)? Respondents were to determine the relevant, in their opinion, level. Reached results are presented in Fig. 12.

Apart from the values presented in the Fig.12 there were a small number of other answers that are collected in the Table 12.

Only 68 of 82 respondents decided to answer the set of questions concerning the total share of gender-specific projects in their institutes. Of that 42 respondents (almost 2/3) declared that none of projects implemented by their institute has ever been gender-specific (see Fig. 12). Only 13 of respondents (somewhat less than 16%) claimed that 50% or more of projects in their institutes had been gender-specific.

Table 12. Other answers in the question about gender-specific products/projects

	Number of answers
Not applicable	1
Information not available	1
Lack of an answer	12

Those who declared existence of gender specific projects in their institutes have also been asked how many of them had been targeted at females. Out of 61 respondents more than a half (38) could not remember any women-oriented project and only in 8 cases (13%) the share of such projects in total number of gender-specific projects has been not less than 50% (see Fig. 13).

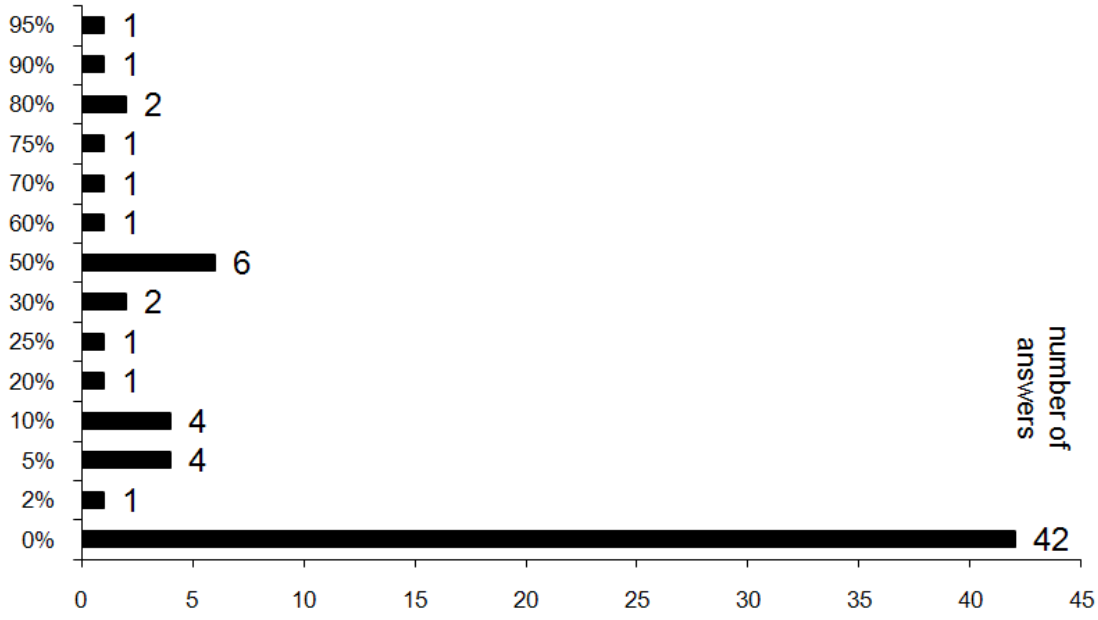

Figure 12. Percentage of gender-specific projects and the number of answers

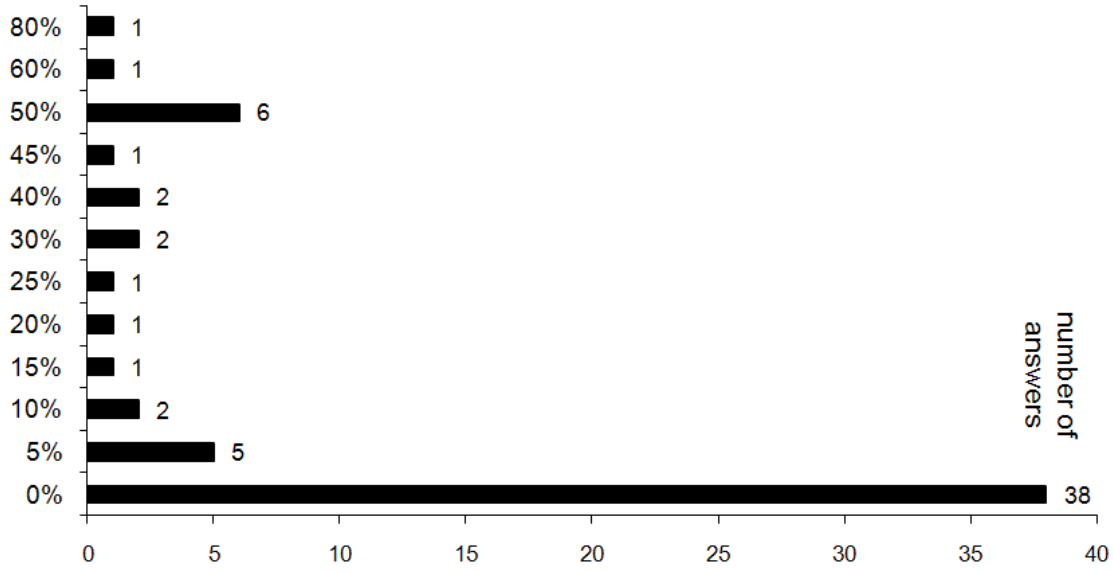

Figure 13. Percentage of projects aimed specifically at women and the number of answers

Similarly to previous questions some of the respondents provided non-standard answers that are collected in the Table 13.

Table 13. Other answers in the question about products/projects aimed at women

	Number of answers
Not applicable	3
Information not available	2
Lack of an answer	16

Including the nonstandard answers it is possible to claim that not 13% but approximately 10% of respondents indicated that at least 50% share of female oriented products in total number of gender-specific projects. Such information is certainly not comforting for women.

The focus of the author was also on the fact whether the respondent showed interest and initiative towards projects/products aimed at specific gender. The question was: Have you ever personally proposed to management (or equivalent) a product development project aimed at a specific gender? Answers included several variants of answers according to the number of projects. Reached results are presented in Table 14.

Table 14. Number of initiatives of the respondents

	Number of answers	
	Aimed at women	Aimed at men
No	75	
Yes, 1 project	3	0
Yes 2-5 projects	1	1
Yes >5 projects	0	0
	Other answers	
Not applicable	1	
Lack of an answer	1	

Large majority of our respondents have never proposed to their management any gender-oriented projects – 75 (almost 94%) out of 80 of those who decided to answer this question. Additionally one person reckoned this question as “not applicable”.

It means that only 5 persons (6% of all who answered) have ever proposed any gender-oriented project(s). Out of that: 3 have proposed one project (aimed at women) and 2 persons proposed 2 - 5 projects (aimed at women or at men). No one has ever proposed more than 5 projects. In case of this question the proportions are in favor of women.

Table 15. The acceptance rate of proposed projects (W – Women, M – Men, Resp. - Respondent)

	Resp. 1		Resp. 2		Resp. 3		Resp. 4		Resp. 5	
Projects primarily aimed at:	W	M	W	M	W	M	W	M	W	M
0 (all turned down)										
25%	+									
50%									+	+
75%		+								
100% (all accepted)			+		+		+			

The following question: "What has been the acceptance rate of your proposed projects (i.e. what percentage of the projects was approved by management to be initiated)?" was aimed at respondents who showed initiative in gender-specific project application. Multiple variants selection was possible in this question. Reached results are presented in Table 15.

Information in Table 15 concern 5 people, who have responded positively on the previous question, whereas there was more than 5 submitted projects. Table 15 presents the acceptance level for these projects – forwarding the projects to realization.

Gender oriented projects submitted by our respondents have mostly been accepted by decision making bodies (see Table 15). In 3 out of 5 cases all the proposed projects directed at females have been accepted for implementation. In case of male oriented projects the acceptance rate was 50% in 1 case and 75% also in 1 case.

One can conclude that although in general gender oriented project were relatively rarely proposed by our interviewees, but as soon as they were submitted most of them have been accepted for implementation by managements of related institutions.

Obviously, taking any conclusions one has to remember that we operate on very small samples here, so the resulting potential mistakes are huge.

Next question deals with personal participation of the respondent in the gender-related technological project. The question was: "Have you ever personally participated in a technological R&D project aimed at a specific gender?" – the emphasis was put on the word "participated". Results in percentage and numbers are presented in the Fig. 14.

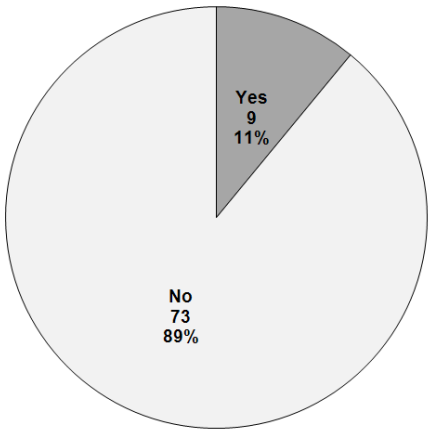

Figure 14. Participation in a technological R&D project aimed at a specific gender

Vast majority of our interviewees have never participated personally in any gender oriented project. Only 11% of those who answered the related question (9 of 82) have ever done so. On the other hand however these projects seem to have been relatively successful (see Table 16).

Taking into consideration the answers for particular acceptance levels (Table 16), Fig. 15 presents the percentage of projects resulted in a marketable gender specific product.

For 15 cases for both male and female oriented projects over 2/3 were at the acceptance level of at least 50% (see Table 16 and Fig. 15).

Table 16. The acceptance rate of proposed projects (W – Women, M – Men, Resp. - Respondent)

	Resp. 1		Resp. 2		Resp. 3		Resp. 4		Resp. 5		Resp. 6		Resp. 7		Resp. 8		Resp. 9	
Projects aimed at:	W	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M
0 (all failed)											+							
25%								+	+						+		+	
50%	+					+							+	+				
75%					+		+			+								+
100% (all successful)			+	+														

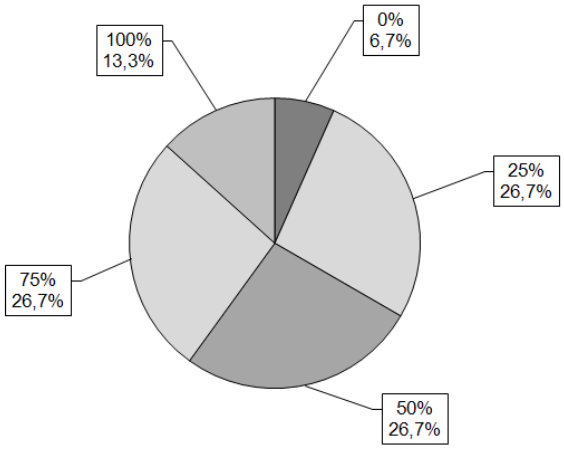

Figure 15. The acceptance rate of projects resulted in a marketable product

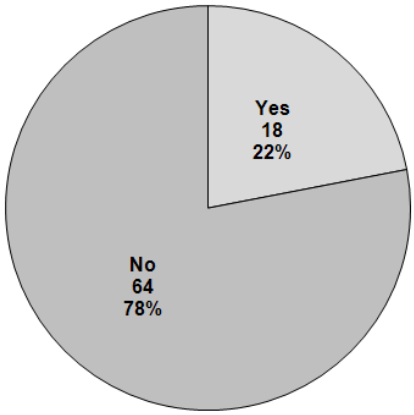

Figure 16. The share of respondents ever thinking about proposing a gender oriented project in their field of research.

The last question in our survey concerned the willingness of women researchers to propose a gender oriented project in their field of research (Fig. 16).

Out of total 82 respondents who decided to answer the related question 18 (almost 22%) of them has ever thought about suggesting any gender oriented project in their field of research (see Fig. 16). This is not a bad result and a good forecast for the future, because the current state in particular institutions, in terms of gender oriented projects/products, is much worse (what was indicated by the answers to previous questions).

In the next chapter summary of the research results and their analysis, in different scopes as well as their meaning for production management, will be presented. Moreover, the characterization of similar research performed among telecommunication scientists in Poland and China will be briefly presented.

10 Research result summary

Thus far I have reviewed the general results of our survey. They indicate for general relative scarcity of gender oriented research and general lack of interest in such kind of research among the surveyed women researchers. On the other hand, it seems that projects that actually had been proposed in most of cases have been accepted by the management of related institutions. It seems also that projects that have actually been implemented have rather been successful.

In this section I would like to look how the participation experiences and the level of interest of our researchers in gender oriented projects depends on their (i.e. researchers') selected characteristics. Hence I present our main results divided into three dimensions:

the field our researcher work on, type of the employer and the age group.

10.1 Field of research

The beginning of this chapter mentioned that the research was a part of bigger research that involved not only agricultural sciences. In general we have differentiated between 3 groups of respondents according to the field of their research: working in telecommunication sector, agricultural technologies and other sector. Majority of the questionnaires came from scientists from the field of agriculture.

In order to briefly compare the results from particular sectors it would turn out that the general level of interest in end-users preferences was the lowest in telecommunication sector with the average frequency of consultations at all stages of the work on the product development was only slightly higher than "sometimes". The research seems to be most often consulted with the end-users in agricultural technologies sector – the average indicator for this sector was rather high, meaning that end-users are predominantly "often" consulted. For other sectors, treated as the comparator group from the point of view of our research, the average indicator was between "sometimes" and "often".

In telecommunication sector one observed also the highest number of "not applicable" answers at all analyzed stages of product creation [10]:

- 15% in research phase (with the second highest incidence of 5% for "other fields"),
- 38% in product development phase (with the second highest incidence of 11% for "other fields"),
- 15% in product design phase (with the second highest incidence of 11% for "other fields").

The rest of results of our survey broken by fields of research lead us to even more acute observations (see Table 17). It seems that gender specific projects are neither existing nor interesting in telecommunication sector. Obviously one can claim that such severe results are a consequence of very small number of observation we managed to gather for that particular sector. But one can also suspect that high refusal rate we encountered during our survey for this sector is a consequence of actual scarcity of gender dimension in this field of research.

The situation seems to be more optimistic from the point of view of our research in case of those working on agricultural technologies. It seems that there exists some interest in gender specific projects in this sector and mostly it is at least not smaller than in "other fields" treated here as a comparative group.

10.2 Type of Employer

Interesting results can also be obtained dividing our analysis according to the type of employer. Most of our respondents work either for Public Universities (53%) or Research Institutes (37%) and these will be the main objects of our comparisons. Some work also for Other Institutions (7%), only 3% of them work for Private Universities (see Fig. 3). It is important to mention that part of the respondents had more than one job position; therefore Table 18 includes the workplace which was listed as first (main). Selected results of survey divided by type of employer (institution) are collected in Table 18.

It seems natural that on average user preferences are most often taken into account by research institutes, since creating of new products is the main objective of their research (Table 18). The answers for all stages of product creation were mostly "always" and a little bit less answers were "often", meaning that on average user preferences were monitored more than often. The answers for public universities were mostly "often" and a little bit less answers were "sometimes" and more or less 16% respondents indicated "always", so on average user preferences were monitored near "often" options for all stages of product creation.

It seems also that research institutes more frequently differentiate between gender preferences than public universities do (see Table 18 row 2). On the other hand however those working in public universities much more frequently admit that consultation on gender preferences could result in practical consequences for products developed (see Table 18 row 3).

Gender specific projects are much more frequent in public universities than in research institutes (see Table 18 rows 4 and 5) which, taking into account the result concerning differentiating between gender preferences, comes as a small surprise. On the other hand however researchers working for the latter have much wider personal experience of working in gender specific projects (see Table 18 row 6).

Table 17. Selected results of survey broken by field of research questionnaired women are engaged in
(source: column 3 - the author's calculations based on survey results; column 4 - [10])

1	2	3	4
		Agricultural technologies and other fields (without telecommunication)	Telecommunication
Distinguishing between male and female preferences.	Percent of affirmative answers.	13%	0%
Do you think that consultation on gender preferences could lead to any practical consequences for your research?		32%	0%
Average percent of gender specific projects in respondent's institution.		15%	0%
Has ever proposed to management a gender specific project?	Percent of affirmative answers	6%	0%
Has ever personally participated in any gender specific project?		11%	0%
Has ever thought about proposing a gender specific project?		22%	0%

Table 18. Selected results of survey broken by type of employer (institution) our respondents work for
(source: the author's calculations based on survey results)

		Research Institute	Public University
Distinguishing between male and female preferences.	Percent of affirmative answers	15,6%	11,1%
Do you think that consultation on gender preferences could lead to any practical consequences for your research?		15,6%	26,7%
Average percent of gender specific projects in a respondent's institution.		8,3%	16,9%
Has ever proposed to management a gender specific project?	Percent of affirmative answers	3,1%	6,7%
Has ever personally participated in any gender specific project?		6,3%	2,2%
Has ever thought about proposing a gender specific project?		21,9%	17,8%

Table 19. The views of women researchers on gender oriented research depending on age of respondents
(source: the author's calculations based on survey results)

Age group:	Percent of affirmative answers	<=30	31-40	41-50	51-60	>=61
Do you think that consultation on gender preferences could lead to any practical consequences for your research?		17%	39%	19%	20%	0%
Has ever proposed to management a gender specific project?		17%	4%	14%	0%	0%
Has ever personally participated in any gender specific project?		17%	0%	14%	8%	0%
Has ever thought about proposing a gender specific project?		17%	26%	33%	16%	0%

The share of those who do not have personal experience in gender specific projects but still ever thought to suggest such a project is quite big in both kinds of institutions, but bigger in research institutes (see Table 18 row 7).

These results seem to suggest than in more product and client oriented institutions such as research institutes where gender specific issues are more frequently taken into account when working on new products the incidence of gender oriented projects is lower than in more theory focused public universities. The level of interest in gender specific projects among the women researcher is however higher in more practically oriented research institutes.

10.3 Age

The attitude of women researchers towards gender oriented research also varies with age.

Results indicate (see Table 19), that, in all deliberated aspects, the youngest age group (<=30 years) the interest in gender oriented projects is the same and equals 17%. However, in this case the sample is too small (6 respondents) to treat this result as a common view.

The highest interest in gender oriented projects, in all aspects included in Table 19, was shown by respondents from the 41-50 age group. Little bit worse results were observed in the 31-40 age group, although this group supports the end-user consultancy the most. In the age group of 51-60 the interest in gender oriented research drops to 0%, what is presented in the Table 19. Such result indicates that these respondents were never offered any gender related project. This leads to a conclusion that such research and projects were of small importance in the early years of the respondents from this age group.

The worst situation takes place in the age group over 60 years of age. None of female researchers above the age of 60 has ever either proposed or personally participated in any gender oriented project. They have never thought about such a project and they do not think that any consultations on gender specific issues could results in any practical consequences for R&D work they are engaged in (see Table 19). This confirms the earlier assumptions about the lack of interest in gender oriented research in previous years.

10.4 General conclusions

In general one can conclude that although the institutes our interviewees work for tend to monitor the end-user preferences during their R&D activities, they very rarely distinguish between male and female preferences. The situation is especially severe in telecommunication sector where none of our respondents declared it.

In 8 of 11 cases recorded consultations on gender preferences have lead to development of gender oriented products, but only in 2 of them the product developed was directed primarily to women, in 1 case the product was directed primarily to men and in the remaining 5 cases products for both sexes were developed.

Almost 2/3 our respondents could not remember of any gender oriented project that had ever been implemented by their institute, although the total share of such projects is not negligible (15%). The projects implemented by the institutes our respondents work for are also rather rarely directed primarily at women (12% of total number of gender oriented projects on average).

As far as personal experience with gender oriented project of the women researchers we spoke to it is rather limited. Vast majority of them neither have ever proposed gender oriented project to their managements nor have ever participated in such project. One has to admit however that both the acceptance rate for proposed projects and success rate for implemented projects seem to be reasonably high.

The level of personal interest of women researcher interviewed in gender specific project can not be considered as high either.

In general, those working in telecommunication sector are completely uninterested in running any gender oriented research on their filed. The situation in agricultural sector, on the other hand, seems to be comparatively well.

It seems that although those working in product oriented research institutes are more experienced in running gender oriented research, the more theory oriented researchers working for public universities are also inclined to do it.

General level of interest in gender oriented research tends to fall with increasing age of researchers.

The author hopes that the research will encourage both the scientists and the management, from the companies employing our respondents, to have a habit of consulting the product end-users and develop more gender-oriented products and services.

The research was a part of a bigger research in Poland, China and Nordic countries. The research shows that, theoretically, men and women, who have even established a political party to protect their rights, in Poland have equal rights – the situation in China is much different.

We should remember that China is a huge country with large differences between regions and provinces. But in general, the female roles propagated in the advertisement culture are usually connected with girl friends, wives and mothers, highlighting their importance in the family and relatives, rather than their roles as professional scientists, precious for the state and society. Although, with economic development the educational level of women workers increases, still it is not high. Statistical data of 2004 year show that only 6,59% women workers have received the education of college or above (source [6]).

Low position in social hierarchy of Chinese women can be confirmed by the experience of the interviewers. Often the interviewers were not allowed in households when the man was not present. Interviewers were informed that nobody was home, even though few women were present. Women were not eager to provide answers when men were not present. In such circumstances it is difficult to expect gender-oriented research from Chinese scientists.

10.5 Meaning of the research in management sciences

The strategic objective of described research was to boost gender equality in technological R&D through promoting increased participation of women in such work. The study aimed at developing a better understanding of the gender issues in scientific research, both from the aspect of scientist as well as of end-user. Through analyzing the influence of gender roles, sociocultural contexts and stereotypes the study should improve the status of women in technological R&D.

Research included the whole Poland in its scope what contributed to the rise of awareness of the needs and expectations of end-users of products. The respondents were often in managerial positions what allowed them to take decisions and change the approach towards the designing or manufacturing of products and services.

One can wonder *to what extent is technology gender-neutral?* There definitely are products that are used both by men and women but can have different appearance and functions. Such example can be a mobile phone which would probably suit women better having a small mirror installed instead of e.g. computer games. It could have a nice shape and color what is not very important for male users. In agriculture some tools could be smaller and lighter as well as nicely designed to encourage female users to purchase. Men prefer to have multiple functions and plain colors e.g. in electronic equipment. Decedents should formulate some kind of consultancy with the end users and include their needs in some or all design and production phases. Sometimes it would require major technological

changes but take into consideration the market saturation it can be profitable in long term perspective.

Research was aimed at woman scientists in order to stimulate the participation of women in science and technological development and hoping that they would better understand the needs of other women. Even though currently the gender issue in scientific research in institutions was not relevant the research can change this situation – many respondents made such statement.

The research was performed also to draw attention to the small participation of women in public services management [8]. Such management includes such social and economical areas as: public health, public finance, infrastructure, public safety, education and culture. The single cases e.g. the president of Warsaw Hanna Gronkiewicz-Waltz or the selection of Katarzyna Chałasińska-Macukow for the president of Warsaw University, are not satisfactory. Drive towards equal rights for men and women as well as elimination of the „glass ceilings" is necessary e.g. through promoting women to top positions. Until now in Poland there was no case of a female parliament speaker or president. Unfortunately, „where policy is set, decisions are made and a culture is developed, women are lacking, making senior teams mono-dimensional and so impacting upon their ability to create strategies that meet their customers' needs" [1].

One can assume that monitoring of situation of women, handicapped people and ethnic minorities will lead to the „equal opportunities in employment" policy. In Poland this concept is relatively new and little known. In relates not only to women: "Equal employment opportunity policies are human resource management measures taken by companies, aimed at preventing discrimination and promoting equality in the workplace" [1]. However, the main objective of this concept is to counteract women's discrimination on the labor market by increasing employers' knowledge and interest in managing gender equality within companies' environment.

There are cases of enterprises that promote women in order to make the employment and promotion possibilities equal for both sexes. One of the examples can be the Avon Cosmetics Poland, which employs 72% of women and only 28% of men and the managerial positions are held by 68% of women and 32% of men [1]. Moreover, Avon organizes many events in order to improve the situation of women e.g. „The Entrepreneurial Woman" competition or „Great Campaign for Life", aiming to raise awareness and knowledge about breast cancer.

Described research will contribute to the increase of interaction between women scientists and end-users and technology providers will be encouraged to develop technical applications geared specifically towards women end-users.

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