Male vs. Female Perception of Problems Highlighted for Solving and Innovating

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ABSTRACT

Problem driven approach with customer engagement is argued to be one of the principal strategies of innovation opportunity identification. This paper analyzes the findings of a two-year-long research project conducted in Riga Technical University with the data collection from different countries of Europe, Asia and America (n=1050) to explore whether there are principal differences in the perception of innovation opportunities by males and females. The qualitative content analysis of the respondents' texts revealed three groups of problems shared by males and females: 1) universal problems which are perceived similarly by both genders, 2) problems, which are perceived more by males, and 3) problems, which are perceived more by females. So, innovation opportunity identification is gender related.

Keywords: innovation opportunities; problem driven innovation; gender-conditioned perception

1. INTRODUCTION

Some scholars argue that gender stereotypes are underlying cultural beliefs that can be presented as natural or inevitable [1]. Either normatively or stereotypically differences in behaviors, attitudes and interests are associated with one or the other gender [2]. Ample research has been conducted on exploring gender related differences which in several cases gave confirmative results. Male-female differences have been revealed related also to their visions and perceptions, like: risk-taking perceptions [3]; personal values [4]; perception of ethical behavior [5]; etc. While the temptation is high to link these differences to mainly cultural norms, some other findings of research reveal brain hemispheric functional differences in males and females [6]. So, male-female vision and perception differences might be caused both by social and biological factors.

Therefore, if in open economy and open innovation the costumers play multiple roles in different stages of a new product and service development as: experience creator; innovator; co-ideator; co-evaluator; co-tester; co-designer, etc. [7], it becomes important to research differences, similarities, and commonalities of the gender-related vision and perception of problems and their solutions as sources for innovation opportunities.

The paper answers the research question:

What are male vs. female specific differences in problems perceived by them for solving and generating innovative products / services?

2. GENDER CONDITIONED MALE VS. FEMALE DIFFERENCES

The long running historical male hegemonic culture has formed man-dominant archetypes and stereotypes not only in the context of perceiving the two genders by each other, their roles, status, rights, responsibilities and opportunities in the society, but also their way of seeing the world, perceiving challenges and acting for overcoming them. Because of traditional gender constraints, females and males perceive and are perceived differently in working with each other [8], and there are certain cultural expectations to see males in high positions where maleness is the norm [9, 10]. It could not be argued that there are differences between males and females, but it should not be synonymous with the belief that women are inferior to men [11, 10, 12]. Ample studies have shown that in many leading positions females have all the qualities needed and competences for being there and are valued more positively than males though at the same time it is mentioned as a negative aspect that females still do not resemble males [9, 11, 12]. It is a common practice that employers are not willing to pay female workers as much as male workers for the same type of work they perform [13]. Having the same higher education and managerial status at work, women can earn less than men, but at the same time, they can perceive their careers to be successful [14]. This phenomenon can be explained from the evolutionary perspective as the role of women has not been to earn the living for the family or make career; therefore, even facing such gender-conditioned discrimination, they may feel satisfied with their achievements.

Very often females' achievements are underestimated compared to males' advancement because of less earning possibilities for them. Research has shown that among the self-employed, female earnings decrease with marriage, family size, and hours of housework, while male earnings are positively associated with the same variables [15]. In

addition, women's career advancement is compromised due to childbirth and care which makes a long pause in her career growth [10]. So, while women have to take care of children and cope with the housework, they create all base for men and provide them with freedom to go out of home walls into the society and concentrate their attention on earning possibilities even if their work schedule is not family friendly.

The research has shown that female business owners in a local community can succeed mainly as social venture founders but they may face backlash when they do commercialize [16]. Along with this social pressure and perceived behavioral control decrease female business students' intention to become entrepreneurs [10].

It shows that we live in the world of clear-cut gender-stereotyped vision of life and people acting there. More of it, research has revealed, that even gender-neutral objects like animals are perceived through gender schema and gender polarization lenses [17].

A great deal of research has shown that:
- males and females perceive people in different ways [11];
- having similar levels of knowledge and awareness about different environmental risks, women are less willing to take risks than men [18, 3];
- there are principal differences in the views of males and females on what they consider to be ethical and unethical (for example, concealing one's errors was perceived unethical more by females than males) [5];
- males and females have different personal values which are manifested through their managerial styles [4]; etc.

The question 'Why is it so?' has been under research for centuries also by scientists representing such fields as psychology, neurology, biology, etc. There was even a hypothesis which proposed that because women's brains were, on average, five ounces lighter than men's, women must be less intelligent [19]. This hypothesis was rejected finally in 2015 when MRIs of more than 1400 brains were examined to find that there are not sex differences in human brain; a typical brain is a "mosaic", combining some features common both in males and females' brains. Thus, brains cannot be categorized by sex [19].

Nevertheless, it is argued that cognitive abilities can be sex- specific:
- "Females evidence higher verbal ability, many language related skills, such as length and grammatical correctness of their talk, correct pronunciation, fewer speech errors, verbal memory. Therefore, in female-female competition and relational aggression is expressed through language, such as gossip or spreading rumors.
- Males excel in virtually every domain of visuospatial ability by wide margins, for example, spatial rotation tests, map reading, memory for routes, learning the geometric relations among landscape and abilities needed for a hunter" [20].

Thus, social and cultural influences play a huge role in the development of gender-related skills, characteristics, and

dispositions which have biological origins and have developed through longitudinal evolutionary processes while males and females have had to fulfill definite roles and perform specific duties in the society.

However, the world is changing dynamically and the gap between the genders is gradually decreasing. This process can be tracked also through the comparative analysis of the results of two prominent worldwide surveys on the cultural dimensions conducted by Geert Hofstede between 1967 and 1973 and Global Leadership and Organizational Behavior Effectiveness Research Program (GLOBE) headed by Robert House in the mid-1990. If Hofstede's research resulted in five cultural dimensions: individualism - collectivism, uncertainty avoidance, power distance, masculinity-femininity, long-term orientation [21], the findings of the GLOBE research conducted about two decades later collecting data from over 17,000 middle managers in over 950 organizations in 62 countries, revealed four more cultural dimensions including gender egalitarianism - degree of gender role equality [22]. This speaks of the transformation of thinking in different societies worldwide within 20 years after Hofstede's research. If gender egalitarianism is one of the criteria which can be used to characterize a culture and compare cultures with each other today, it means, the world has started to pay more attention to the topic of minimization of the gap between the rights and opportunities for men and women.

Women are becoming more self-confident and getting more involved in innovation and sciences which can be witnessed by their patents registered. According to the statistics of the World Intellectual Property Organization (WIPO), there is an upward trend in women participation in international patenting - the share of women in total listed inventors almost doubled from 9.5% in 1995 to 15% in 2015. Although women are less likely to file their inventions without the opposite gender than men [23]. According to WIPO analysis, participation rates for the five technological fields with the highest women participation are: biotechnology; pharmaceuticals; organic fine chemistry; analysis of biological materials; and food chemistry. From the opposite end, women participation rates for the five technological fields with the lowest women participation are: mechanical elements; transport; machine tools; engines, pumps, turbines; and civil engineering [23]. This is a serious evidence that shows that innovation fields are also gender conditioned.

In the light of the foregoing, this research focuses on the exploration of whether there are principal gender conditioned differences also in the perception of problems which could be solved innovatively to create new products and services. which and their innovation opportunities, and if yes, what these differences are like. The concept of innovation opportunity is closely linked to the identification of the right problems which are worth investing intellectual, financial, human and other resources [24] and elaboration of concepts of new useful product / service ideas [25]. Therefore, the main research strategy here was to collect topical problems which contain

innovation potential and conduct male vs. female comparative analysis of these problems highlighting commonalities and differences.

3. THE COURSE OF THE RESEARCH AND THE FINDINGS

The research was conducted in the study years of 2017-2019 with the participation of Riga Technical University (RTU) Latvian and International Master's students within the study course "Modern research methods: theory and practice".

Table 1

The categories developed
related to the problems highlighted

No	Meta-category & categories	Frequency
1.	**Science & Technology**: Science and technologies (n=165), Engineering (n=142), Information technologies (n=124), Gadgets (n=70), Smart technologies (n=34)	535
2.	**Life organization:** Life organization in the society (n=309), Communication (n=31), Issues of people with special needs (n=13), Entertainment (n=6)	359
3.	**Healthcare & Medicine:** Healthcare (n=140), Hygiene (n=70), Nutrition (n=55), Medicine (n=52), Cleanliness (n=15), Ergonomy (n=5)	337
4.	**Household & Products:** Household (n=181), Clothes & shoes (n=67), Low quality products (n=45), Car-care (n=23)	316
5.	**Ecology & Environment**: Ecology (n=92), Environment (n=58), Usage of plastic (n=43), Waste of resources (n=26), Recycling (n=22)	241
6.	**Economy & Business**: Business organization (n=94), Economy (n=80), Job opportunity (n=12), Attitude to employees (n=11), Unemployment (n=7), Poverty (n=6)	210
7.	**Social justice & Public norms**: Public norms (n=101), Safety (n=50), Inequality (n=11)	162
8.	**Education & Children up-bring**: Education (n=88), Children up-bringing (n=49)	137
9.	**Municipal governance**: Transport (n=75), Infrastructure (n=43), Municipal government (n=8)	126
10.	**Self-management**: Self-organization (n=80), Social media addiction (n=11)	91

The respondents (n=1050) were from: India (n=395), Latvia (n=364), Sri Lanka (n=58), Azerbaijan (n=47), Pakistan (n=45), Canada (n=14), USA (n=11), China (n=11), Russia (n=10), Finland (n=9) and other countries (n=86). The difference between the numbers of male (n=550) and female (n=485) respondents makes only 6% with 2% of respondents who did not indicate their gender (n=15).

The qualitative content analysis of the respondents' answers to the question "What problems do you consider to be worth solving for creating new values for commercialization?" resulted in 40 categories which were further reorganized into 10 meta-categories which show the domains to which these problems are related (see Table 1).

It was decided to include in a meta-category even those categories which have small frequencies if their essence complements and makes the meaning of the meta-category more whole. For example, despite its small frequency, 'Ergonomy' (n=5) is considered as a category and included in the meta-category 'Healthcare & Medicine' as along with 'Healthcare' (n=140), 'Hygiene' (n=70), 'Nutrition' (n=55), 'Medicine' (n=52) and 'Cleanliness' (n=15), ergonomy is recognized as a crucial factor impacting health in today's society. In addition, problems related to ergonomy have high innovation potential.

The sum of the frequencies of all the meta-categories (see Table 1) makes 2514 which obviously exceeds the number of respondents (n=1050). This is explained by the multidimensionality of the problems shared. It can be illustrated with the examples given below.

- The problem of creating a twenty-four-hour self-service machine for getting the opportunity to buy over-the-counter medicine when needed (mentioned by a male respondent from Latvia) is related to 'Engineering', 'Business organization', 'Medicine', and 'Life organization in the society'. Therefore, all these four categories were assigned to this problem.
- Another problem shared by a female respondent from India was related to uncomfortable situations for ladies when they get into the local trains and buses during rush hours. This problem was assigned two categories – 'Transport' and 'Life organization in the society' as she offered to provide special diagrams for organizing male and female flows, entrances and exits at the doors of the local transport.
- A female respondent from the USA wrote about the topicality of creating smart plates, bowls, and cups to keep track of what we eat, and drink and the calories consumed on a daily and monthly basis. This problem was assigned categories which logically correspond to its essence – 'Nutrition', 'Smart technologies', 'Gadgets', and 'Self-organization'.
- Or a housewife writing from Sri-Lanka says that she often cuts her fingers while cutting vegetables. As she must deal with vegetables every day, for her it is important to have "a steel open-ring-design finger protector suitable for most fingers" which, in her opinion, could be a good solution. That is why this

problem was assigned three codes – 'Healthcare', 'Household' and 'Gadgets'.

Of course, there were also problems which correspond explicitly to only one category, like the problem shared by a male respondent from Canada. The problem was about cellphone connectivity which we lose in such areas as basements, hilly areas, moving trains, highways, etc. As he offered to create electronic portable radars/antennas for catching cellular signals from towers and transmitting the signal to mobiles, the problem was assigned the category 'Gadgets'.

After the qualitative content analysis, the categories were reorganised into three groups, categories whose frequencies:

1. Differ less than 10% in female vs. male demographic groups;
2. Are explicitly bigger for the group of females compared to the group of males;
3. Are explicitly bigger for the group of males compared to the group of females.

The results are shown in Tables 2-4.

Table 2

Categories with close frequencies in
female vs. male demographic groups

Category	Female	Male	Δ, abs (male - female)
Environment	50.00%	50.00%	0.00%
Self-organization	50.00%	48.75%	1.25%
Nutrition	49.09%	50.91%	1.82%
Gadgets	52.86%	47.14%	5.72%
Life organization in society	46.28%	52.10%	5.82%
Smart technologies	50.00%	44.12%	5.88%
Public norms	45.54%	52.48%	6.94%
People with special needs	46.15%	53.85%	7.7%
Business organization	45.74%	54.26%	8.52%
Healthcare	45.71%	54.29%	8.58%
Low quality of products	44.44%	53.33%	8.89%
Inequality	45.45%	54.55%	9.10%
Social media addiction	45.45%	54.55%	9.10%
Attitude to employees	45.45%	54.55%	9.10%
Education	54.55%	45.45%	9.10%
Usage of plastic	44.19%	53.49%	9.30%
Communication	54.84%	45.16%	9.68%

The aim of creating Table 2 is to pick out those categories related to which the differences of male vs. female perception of problems for innovation are not explicit. The smaller the difference (Δ), the closer the perception of problems related to these categories by male and female respondents. The frequencies of these categories mainly vary around 50% for both groups of respondents which can

be explained by the globalized world and the decreasing gaps between the topics of worries similarly important and pertinent to both females and males. The environmental problems related to overuse of plastic; different organization-related challenges at the levels of: an individual, the entire society and businesses including the legislative and regulatory norms; guarantee of equal rights and opportunities for different groups of citizens; the quality of education, products, nutrition and healthcare; the attempt to solve a number of problems creating different gadgets using smart technologies – these are the characteristics of the modern life and the contemporary world. Thus, related to these categories there are not significant differences in the perception of problems shared by female and male respondents for solving and generating innovative products.

Table 3

Categories whose frequencies are bigger for the female
group compared with the male group

Category	Female	Male	Δ, (female - male)
Beauty & Cosmetics	77.27%	22.73%	54.54%
Clothes & Shoes	65.67%	32.84%	32.83%
Children up-bringing	63.83%	36.17%	27.66%
Hygiene	60.00%	38.57%	21.43%
Ergonomy	60.00%	40.00%	20.00%
Household	57.46%	38.67%	18.79%

Table 3 was created to identify the categories whose frequencies are explicitly bigger for the group of females compared with the group of males (see Δ in column 4) to identify the problems which women are more inclined to perceive compared to men. The bigger the difference (Δ), the more frequently the problems related to these categories are perceived by the female vs. the male respondents. These categories are aligned with the expectations as they demonstrate once again that people perceive more frequently those problems which they regularly come across and deal with; these are women in particular whose role traditionally has been linked to the household, taking care of children, clothes, shoes and different accessories, providing hygienic conditions at home combined with comfort and ergonomy. In addition, beauty and cosmetics related problem have always been more topical for women than for men.

The categories whose frequencies are explicitly bigger for the group of males compared with the group of females (see Δ in column 4 of Table 4) to identify the scope of the problems which are perceived by men more frequently than by women. The bigger the difference (Δ), the more frequently the problems related to these categories are perceived by the male vs. the female respondents.

Table 4

Categories whose frequencies are bigger for the male group compared with the female group

Category	Female	Male	Δ, (male - female)
Car-care	4.35%	95.65%	91.30%
Waste of resources	23.08%	76.92%	53.84%
Municipal government	25.00%	75.00%	50.00%
Recycling	27.27%	72.73%	45.46%
Job opportunity	33.33%	66.67%	33.34%
Transport	36.00%	62.67%	26.67%
Infrastructure	39.53%	60.47%	20.94%
Engineering	40.14%	56.34%	16.20%
Information technologies	41.13%	57.26%	16.13%
Medicine	42.31%	55.77%	13.46%
Safety	44.00%	56.00%	12.00%
Economy	43.75%	55.00%	11.25%
Ecology	44.57%	55.43%	10.86%

These categories are associated with problems which:
- have traditionally been within men's responsibility, like car-care; the respondents suggested problems of equipping cars with special tools for safe night drive; mini machines for making and holding coffee in the car, facilities for repairing of scratched and damaged surfaces of cars, etc.;
- come out of home and family specific scopes of problems expanding larger into different areas of public life; from the evolutionary perspective it is absolutely understandable as men have always been those members of family who used to go out and find jobs, rule the society, promote economic development, make inventions and scientific discoveries for solving acute problems.

Of course, nowadays, owing to the decrease of the gap between opportunities for both genders to get education and realize their potential in multiple ways, the gap between the problems perceived also shrinks away, although certain differences underpinned by socio-cultural and gender conditioned dissimilarities still remain. As innovation opportunity identification is closely linked to the problems highlighted, also the gender conditioned vision of innovation opportunities tends to equalize.

4. CONCLUSIONS

The male and female respondents perceived similarly frequently problems related to: environment, self-organization, nutrition, gadgets, life organization in society, smart technologies, public norms, people with special needs, business organization, healthcare, low quality of products, inequality, social media addiction, attitude to employees, education, usage of plastic, communication (the absolute value of the difference between category frequencies of male and female groups Δ < 10%, see Table 2). These are universal problems concerning each one regardless of the gender; so, these findings keep up with the understanding of what problems surround modern people and occupy their minds.

The female respondents are more inclined compared to male respondents to perceive problems related to beauty and cosmetics, clothes and shoes, children up-bringing, hygiene, household, ergonomy (the difference between category frequencies of female and male groups Δ > 10%, see Table 3). Such results could be expected as these categories are closely linked more to women's everyday life and activity scope rather than of men. The sequence of these six categories organized in the decreasing order of their frequencies seem rather curious as it is not clear whether for the female respondents the beauty, cosmetics, clothes, and shoes are of higher priority than children up-bringing. This can be explained by the fact that the data were collected by Master's students who, most likely, sent the questionnaire mainly to their friends who could be of their age and who might not have children themselves. As a result, problems related to beauty, cosmetics, clothes, and shoes were mentioned more frequently. Further research with the involvement of women of older age might cause changes in this order.

The male respondents are more tended compared to female respondents to perceive problems related to car-care, waste of resources, municipal government, recycling, job opportunity, transport, infrastructure, engineering, information technologies, medicine, safety, economy, ecology (the difference between category frequencies of male and female groups Δ > 10%, see Table 4); most of these problems are traditionally linked to maleness.

These gender-conditioned differences were obvious also in the comparison of the technological fields of invention registered by female and male inventors [23]. It is assumed that the scope of the problems could differ from this one to some extent if the problems were collected in the period of the Covid-19 pandemic due to the current pressing issues related to safety, healthcare, psycho-emotional state created by mass media, etc.

Thus, in the context of highlighting problems for solving and generating innovative products / services it can be concluded that there are universal problems which are perceived by males and females similarly, but there are also problems perceived by them differently owing to their gender-conditioned peculiarities. Consequently, perception of innovation opportunities is gender conditioned.

5. ACKNOWLEDGEMENT

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