

Annex 2: Methodological note on the Gender variable's treatment

Introduction

In developing the questionnaire, we decided to overcome the binary vision of gender usually applied in quantitative research. Both at theoretical and linguistic level, the concepts of “gender” and “sex” are often conflated (Lindqvist, Sendén and Renström, 2021). The conflation of the two terms, in fact, can generate at least two potential problems: 1) risk of measurement errors due to the inability of a dichotomous variable to capture diversity in gender identities (Frohard-Dourlent et al., 2017), 2) discrimination of the respondents who do not identify themselves either as a male or a female (or man or woman) (Nowakowski, Sumerau and Mathers, 2016).

To overcome the employment of gender binary categorization in quantitative analyses, several strategies have been elaborated and discussed in the literature. In their comprehensive work, Lindqvist, Sendén and Renström, (2021) outline three ways to account for the non-binary nature of the gender dimension. All of them, however, have their pros and cons that need to be considered and evaluated considering the aim of the survey one is developing

The first strategy is to add a third category, either “transgender”, “non-binary”, or “other”. The advantage of adding one of these categories is to give a choice to all those individuals that do not identify as one of the two classic gender categories. But each of the three proposed categories presents its limitations. The “transgender” option assumes that people with transgender experiences will identify as such, but transgender individuals can also identify as women or men (Ansara and Hegarty, 2014). The “non-binary” option has the advantage of recognizing that gender is not binary, but it also implies that gender has fixed categories (Richards et al., 2016). The “other” option has the advantage of being open to many different meanings, but naming “other” a group of

individuals is a form of “othering” and can reinforce and reproduce subordination and discrimination (Johnson et al., 2004).

The second strategy is to maximize the number of categories by including many different possible categories. This strategy has the advantage of providing the respondent with a large set of choices. But due to the increasingly large set of terms that individuals can use to identify themselves, it is impossible to provide a full and exhaustive list of terms (Magliozi, Saperstein and Westbrook, 2016), thus risking falling back into reductionism (Westbrook & Saperstein, 2015).

The third strategy is to provide a free text response to the gender question. This has the undeniable advantage of providing the respondents with the maximum possible flexibility in terms of self-identification, but it can lead to more missing data and ridiculing responses (Lindqvist, Sendén and Renström, 2021).

According to Lindqvist, Sendén and Renström, (2021), the best option is represented by the utilization of a free text response. Indeed, they points out that in a data collection not specifically aimed at reaching individuals with trans experiences and/or non-binary identities, other response categories than woman and man might not have enough participants to be included in the analyses.

Our data collection was not aimed at reaching individuals with trans experiences and/or non-binary identities (our reference universe is represented by individuals who do research in the fields related to energy transition), still, we wanted to account for the non-binary nature of gender and possibly to perform meaningful analysis on that. For these reasons, we decided to give respondents the possibility of answer the gender question by choosing among: Female, Male, Non-Binary/Other, I prefer not to answer. We acknowledge the validity of the critics to this strategy, but due to the nature of our research, we considered it the best compromise between using a dichotomous

categorization, and accounting for the non-binary nature of gender while increasing the chances of collecting enough data to allow us to perform meaningful statistical analyses.

Unfortunately, even using the term non-binary as an umbrella term did not help in collecting sufficient data to allow an analysis that overcomes the binary understanding of gender. Out of 356 individuals in our sample, only 3 individuals identify themselves as “non-binary”, while 11 individuals preferred not to answer to the gender question.

When possible, researchers recommend not excluding participants with non-binary gender identities from the analysis, and code gender as a three-case variable (Magliozzi et al., 2016; (Ansara and Hegarty, 2014). However, as suggested by Fraser (2018) when the sample size is small and there is not enough statistical power to differentiate the sub-groups within a third gender category, one should include descriptive statistics in a table to acknowledge all participants, regardless of their gender identity.

Due to the very low number of non-binary responses received (representing the 0.8% of the sample), we decided to perform our analyses with a binary gender variable (Female, Male). “Non-binary” responses were firstly recoded into the “I prefer not to answer” category, generating the new variable Gender_2. “I prefer not to answer” category was used in the descriptive statistics analysis to show the distribution of the Gender_2 variable. For the averages’ calculations used in the cluster analysis, instead, we used the binary variable Gender_N where both “Non-binary” and “I prefer not to answer” responses were dropped, leaving only “Female” and “Male”.

Analysis

Notwithstanding, following Fraser’s suggestion, we report here a description of the

“Non-binary” and “I prefer not to answer” individuals, and a brief comparison with the Female plus Male sample used in the main analysis, on the sociodemographic and organization variables. Table 1 reports the summary statistics for all the variables for the three groups.

Table 1. Summary statistics for the groups of respondents “I prefer not to answer”, “Non-binary/Other”, and “Female + Male”

<i>Variable group</i>	<i>Gender</i>	<i>I prefer not to answer</i>				<i>Non-binary/Other</i>				<i>Female + Male</i>			
	<i>Statistics</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Demographic	Age	47.7	9.0	31	63	31.0	12.2	23	45	46.8	11.1	22	72
	Education	4.9	0.3	4	5	3.0	1.7	2	5	4.6	0.8	1	5
	Seniority	2.6	0.7	1	3	2.0	1.0	1	3	2.6	0.7	1	3
Care responsibility	Care_child_6	0.1	0.3	0	1	0.0	0.0	0	0	0.2	0.4	0	1
	Care_child_7_17	0.1	0.3	0	1	0.3	0.6	0	1	0.3	0.5	0	1
	Care_elderly	0.2	0.4	0	1	0.0	0.0	0	0	0.1	0.3	0	1
	Care_disability	0.1	0.3	0	1	0.0	0.0	0	0	0.1	0.2	0	1
	Care_none	0.3	0.5	0	1	0.7	0.6	0	1	0.4	0.5	0	1
Type of contract	A temporary employment agency contract	0.0	0.0	0	0	0.0	0.0	0	0	0.0	0.1	0	1
	Apprenticeship or other training scheme	0.1	0.3	0	1	0.7	0.6	0	1	0.0	0.2	0	1
	Fixed term	0.4	0.5	0	1	0.0	0.0	0	0	0.2	0.4	0	1
	Permanent	0.5	0.5	0	1	0.3	0.6	0	1	0.8	0.4	0	1
	NA	0.0	0.0	0	0	0.0	0.0	0	0	0.0	0.2	0	1
Research profile	Director / Board member	0.0	0.0	0	0	0.0	0.0	0	0	0.1	0.2	0	1
	Other	0.0	0.0	0	0	0.3	0.6	0	1	0.0	0.2	0	1
	Research assistant	0.0	0.0	0	0	0.0	0.0	0	0	0.0	0.2	0	1
	Researcher or Technologist	0.8	0.4	0	1	0.0	0.0	0	0	0.7	0.5	0	1
	Team Manager, Supervisor	0.2	0.4	0	1	0.3	0.6	0	1	0.2	0.4	0	1
	Technician	0.0	0.0	0	0	0.3	0.6	0	1	0.0	0.2	0	1
Energy sector	Energy_sector	0.7	0.5	0	1	0.3	0.6	0	1	0.6	0.5	0	1
Type of employer	Private company or corporation	0.0	0.0	0	0	0.7	0.6	0	1	0.0	0.2	0	1
	Public/private academic or research organization	1.0	0.0	1	1	0.3	0.6	0	1	0.9	0.3	0	1
	Self-employed, independent Researcher/Technician for academic/research organization	0.0	0.0	0	0	0.0	0.0	0	0	0.0	0.1	0	1
	Self-employed,	0.0	0.0	0	0	0.0	0.0	0	0	0.0	0.1	0	1

	Independent Researcher/Technician for business												
Organization size	Organization size	3.4	1.0	1	4	3.3	0.6	3	4	3.2	1.0	1	4
WRQoL	WRQoL goals	4.4	0.9	2	5	4.0	0.0	4	4	4.1	1.0	1	5
	WRQoL influence	4.0	1.3	1	5	3.7	0.6	3	4	4.0	1.0	1	5
	WRQoL abilities	3.9	1.5	1	5	4.3	0.6	4	5	4.2	0.9	1	5
	WRQoL flexibility	4.3	1.0	2	5	4.0	1.0	3	5	4.3	0.9	1	5
	WRQoL working hours	4.2	1.1	2	5	3.7	1.5	2	5	4.1	1.0	1	5
	WRQoL pressure	4.2	0.6	3	5	3.7	1.2	3	5	3.5	1.1	1	5
	WRQoL knowledge ment	3.5	1.0	1	5	3.7	0.6	3	4	3.7	0.9	1	5
	WRQoL skill development	3.5	1.3	1	5	3.7	1.5	2	5	3.7	1.1	1	5
	WRQoL decision involvement	3.0	1.5	1	5	3.7	0.6	3	4	3.7	1.1	1	5
	WRQoL needs met	2.7	1.2	1	5	3.3	0.6	3	4	3.4	1.1	1	5
	WRQoL safe environment	3.2	1.5	1	5	3.3	1.2	2	4	4.0	1.1	1	5
	WRQoL career opportunity	2.1	1.1	1	4	4.0	1.0	3	5	3.3	1.2	1	5
PSGBI	Discrimination biases	2.1	1.2	1	4	3.7	1.5	2	5	2.6	1.2	1	5
	Discrimination verbal prevarication	2.1	1.2	1	4	3.3	1.2	2	4	2.6	1.3	1	5
	Discrimination respect	2.3	1.5	1	5	3.7	0.6	3	4	2.6	1.3	1	5
	Discrimination ambitiousness	2.8	1.4	1	5	3.0	1.4	2	4	2.9	1.2	1	5
	Discrimination subordination	2.8	1.3	1	4	3.0	1.0	2	4	2.8	1.3	1	5
	Discrimination treat women	1.9	0.8	1	3	2.0	1.0	1	3	2.3	1.1	1	5
	Discrimination support male	1.9	0.9	1	3	2.5	0.7	2	3	2.7	1.2	1	5
	Discrimination meeting	1.7	0.9	1	3	3.0	1.0	2	4	2.1	1.0	1	5
	Discrimination bias acknowledge m.	2.3	1.5	1	5	3.7	1.5	2	5	2.5	1.2	1	5
	Discrimination feedbacks	3.4	1.0	1	5	3.0	1.0	2	4	3.7	0.8	1	5
	Discrimination collegial	3.5	1.2	1	5	4.0	1.0	3	5	3.8	1.0	1	5
	Discrimination relationship	4.1	0.5	3	5	4.3	0.6	4	5	4.3	0.7	1	5
	Discrimination ideas	3.7	0.6	3	5	4.3	0.6	4	5	3.9	0.9	1	5
	Discrimination support people	3.8	0.6	3	5	4.0	1.0	3	5	3.8	0.9	1	5
	Discrimination feel valued	2.6	1.3	1	5	3.0	1.0	2	4	3.1	1.1	1	5
	Discrimination mentoring informal	3.3	1.3	1	5	3.7	1.2	3	5	3.4	1.0	1	5
	Discrimination mentoring formal	2.8	1.3	1	5	3.0	2.0	1	5	2.7	1.2	1	5
	Discrimination mentoring senior	2.3	1.4	1	5	2.7	1.5	1	4	2.6	1.3	1	5

	Discrimination attuned	3.7	1.4	1	5	2.3	0.6	2	3	3.4	1.1	1	5
	Discrimination support balance	3.3	1.2	2	5	3.3	0.6	3	4	3.6	1.1	1	5
	Discrimination policy equity	3.8	1.4	1	5	3.3	0.6	3	4	3.7	1.0	1	5
PJETKP	Policy diversity	3.2	1.2	1	5	4.3	0.6	4	5	3.8	1.0	1	5
	Policy culture	3.0	1.4	1	5	4.7	0.6	4	5	3.7	1.1	1	5
	Policy favoring groups	3.1	1.7	1	5	4.0	0.0	4	4	3.6	1.1	1	5
	Policy society representation	4.4	1.0	2	5	4.0	1.0	3	5	4.1	0.9	1	5
	Policy male domination	3.2	1.2	1	5	4.3	0.6	4	5	3.5	1.0	1	5
	Policy minorities	2.8	1.5	1	5	4.7	0.6	4	5	3.6	1.0	1	5
WDC	Organization managing backgrounds	3.1	1.3	1	5	2.3	1.5	1	4	3.6	1.1	1	5
	Organization accepted backgrounds	4.0	0.8	3	5	3.3	0.6	3	4	3.7	1.0	1	5
	Organization hiring practices	3.4	1.4	1	5	4.5	0.7	4	5	3.8	1.0	1	5
	Organization retain diversity	3.1	1.5	1	5	2.0	1.7	1	4	3.4	1.1	1	5

Source: Authors' elaboration. Note: Samples size for "I prefer not to answer", "Non-binary/Other", and "Female + Male" are respectively 14, 4, and 320-356.

Data show that, on average, individuals in our sample who self-identify as non-binary or other tend to be younger, with fewer years of education, and consequently hold more junior roles compared to females and males. Interestingly, individuals who prefer not to answer the gender question tend to be older and more educated than females and males.

Compared to those who preferred not to answer and to females and males, non-binary/other respondents are less likely to have caregiving responsibilities. In line with their relatively older average age, individuals who preferred not to answer appear to have fewer caregiving responsibilities for children but more for elderly individuals compared to females and males.

Regarding contract types, non-binary/other respondents are more likely to be in an apprenticeship or other training schemes, which aligns with their younger average age.

The sample sizes for individuals who preferred not to answer and those who self-identify as non-binary or other are too small to achieve statistical significance. As a result, they could not be included in the factor analysis or the cluster analysis conducted for females and males. However, to represent these groups, we calculated the average of averages (Table 2) for their responses across the different items that comprise each construct extracted in the principal analysis.

Table 2. Summary statistics for the groups of respondents “I prefer not to answer”, “Non-binary/Other”, and “Female + Male”

Extracted factor in the main analysis with female and male	Construct	I prefer not to answer	Non-binary / Other	Female + Male
WRQoL_F1	Empowerment and Goal Clarity in the Workplace	4.09	4.00	4.14
WRQoL_F2	Workplace Support and Professional Development Opportunities	2.99	3.61	3.64
WRQoL_F3	Work-Life balance and Flexibility	4.23	3.83	4.17
Discrimination_F1	Perceptions of Gender-Based Inequality	2.22	3.09	2.58
Discrimination_F2	Perceived Workplace Support and collegiality	3.52	3.78	3.77
Discrimination_F3	Mentorship and Professional Guidance	2.81	3.11	2.91
Discrimination_F4	Support and Work-Life Balance	3.58	3.00	2.91
Policy_F1	Policy Advocacy for Inclusivity in the Energy Sector	3.31	4.33	3.72
Organization_F1	Commitment to Diversity and Inclusion	3.40	3.04	3.61

Source: Authors' elaboration.

Overall, the data show relatively homogeneous results among the three groups. In particular, small differences of less than 0.5 points are observed for WRQoL_F1, WRQoL_F3, Discrimination_F2, and Discrimination_F3. Larger differences, exceeding 0.5 points, are present in the other constructs.

Individuals who preferred not to answer the gender question perceive receiving less workplace support and fewer development opportunities (WRQoL_F2) compared to the other groups. Non-binary/other respondents appear to perceive relatively higher levels of gender-based inequalities (Discrimination_F1) compared to females and males, as well as individuals who preferred not to answer.

Another notable difference is seen in support and work-life balance (Discrimination_F4): individuals who preferred not to answer the gender question report higher support from their employers than non-binary/other respondents and females/males. Finally, non-binary/other respondents, more than females/males and individuals who preferred not to answer, express agreement with the need for policies to make the energy sector more open to all (Policy_F1). Conversely, they perceive their employers as being less committed to creating and fostering an equitable and inclusive workplace than the other groups (Organization_F1).

Conclusions

Due to the very limited number of observations for Non-binary/Other respondents, and those who preferred not to answer to the gender question, this brief analysis cannot be used to derive any statistically significant results.

Moreover, this goes beyond the objective, which is to present these few data points so that they do not disappear into the "black hole" of data cleaning, and at least acknowledge their collection and existence.

However, presenting these data and the brief analysis we conducted allows us to reflect on overcoming the binary understanding of gender as a variable in quantitative studies that are not directly focused on studying gender identities.

In line with the literature cited in the introduction, we believe it is important to include gender as a non-binary variable in quantitative studies. If nothing else, this

enables individuals who do not identify with a binary gender categorization to answer the question without feeling excluded or discriminated against. Naturally, acknowledging the differences within the non-binary category—differences that also exist within male and female categories—if the number of respondents identifying as non-binary were sufficient, it would certainly be possible to derive interesting quantitative results.

And here lies the problem. In most cases, based on our experience, respondents identifying as non-binary always represent a very small proportion of the collected samples. Since any statistical analysis relies on the law of large numbers, with such small samples, it is not possible to infer or derive any generalizable relationships between this category and any other variable. Consequently, in the vast majority of cases, researchers are forced to eliminate these observations to avoid disrupting the analyses they are conducting.

However, we also agree with the cited literature regarding the need not to simply erase these data and the individuals behind them. We believe it is important to transparently present all collected data, even when they do not allow for statistically significant analyses.

For this reason, we think it is important and necessary to continue using gender as a non-binary variable in quantitative studies, while also reflecting on the best way to operationalize this variable.

For our part, we contribute to this discussion with reflections stemming from our experiences in this survey design and data collection, as well as from the brief analysis we presented here.

The fact that individuals who preferred not to answer the gender question were found to be older and in more senior roles compared to the population of males and

females (and even compared to non-binary/other individuals) raises the question of whether some of these individuals might not identify with a binary gender categorization but also do not identify with the "Non-binary/Other" label or do not feel comfortable defining themselves in that way.

If this is the case, the choice of using "Non-binary/Other" as a third category may have influenced the number of observations collected. In our case, this would not have had a significant impact, as even if all those who did not respond to the gender question identified as "Non-binary/Other," we would still have had an insufficient number of observations. However, this could be relevant for the design of future surveys.

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