

Subjective and Objective Quality of Work in Social Cooperatives

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The present work offers a description of the quality of work in the social cooperatives by means of a multivariate statistical technique, the Non Linear Principal Components Analysis (NL-PCA, Gifi, 1990). NL-PCA has been applied to the real data referring to 4.134 workers employed in the 320 social cooperatives sampled in the survey on the Italian social cooperatives ICSI²⁰⁰⁷ (Carpita, 2007). We distinguish objective from subjective aspects of quality of work. The former aspects essentially refer to the contract and the economic and non economic benefits offered by the cooperative to its workers. The subjective characteristics of quality of work are related to the perceptions and attitudes of workers and regard aspects like job satisfaction, distributive and procedural fairness, loyalty towards the organization, work effort and satisfaction with life. The paper investigates by a data analysis approach, the relationships between the quality of work and some worker and cooperative characteristics.

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1. Introduction

The paper aims at assessing the level of the quality of work in the social cooperatives, in relation with some worker and cooperative characteristics. The focus is on the so-called *internal* customer, that is the worker, because the quality of work plays an important role in defining the quality of the cooperative (and, more generally, of the social enterprise). Following the *Social Relationship Value Management* framework (SRVM; Carpita & Poli, 2007), extending the theory of RVM (Payne & Holt, 2001, Payne *et al.*, 2000 e 2001) to the nonprofit sector, the quality of the social cooperative depends on the quality of goods and services offered to every subject involved in the cooperative's activity: not only end users, but also workers, sponsors and the community where the cooperative acts. The relations among the different subjects concerned and the incentives offered to the workers are fundamental to define the quality of work and, definitely, the quality of the cooperative.

In this framework, the paper aims at studying the relationships between, on one hand, objective and subjective variables of quality of work and, on the other hand, some worker (gender, age, education, membership) and cooperative (geographic area, type –A or B– and dimension, in terms of number of workers employed) characteristics. Figures 1 and 2 represent the frequency distributions of the variables defining worker and cooperative profiles referred to the 4.134 paid workers of the ICSI²⁰⁰⁷.

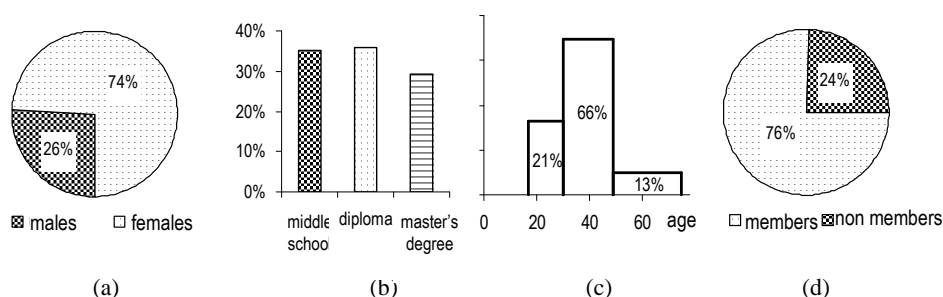


Figure 1 - Workers by (a) gender, (b) education, (c) age e (d) membership

Females represent the majority (74%) of the workers employed in the sampled Italian social cooperatives; a good proportion of the considered workers has a high level of education (65% have a degree higher than the “diploma”) and is relatively young (the mean age is 38 years, 87% of the workers are less than 50 years old and more than one fifth are less than 30). Moreover,

76% are members of the cooperative (for a detailed description of the socio-demographic profile of the ICSI²⁰⁰⁷ workers, see Manisera, 2007). Figure 2 shows that 40% of workers are employed in the North-West of Italy, the cooperatives of North-East and Centre employ a similar percentage of workers (22%) and 16% work in cooperatives in the South of Italy. More than three quarters work in A type cooperatives; 43% in large cooperatives (with at least 50 workers), 32% in medium cooperatives (16-49 workers) and 25% in small cooperatives (with a maximum of 15 workers).

We distinguish *objective* from *subjective* aspects of quality of work. The former aspects essentially refer to the contract and the economic and non economic benefits offered by the cooperative to its workers. The subjective characteristics of quality of work are related to the perceptions and attitudes of the workers and regard aspects like job satisfaction, distributive and procedural fairness, loyalty towards the organization, effort in working and happiness (satisfaction with life).

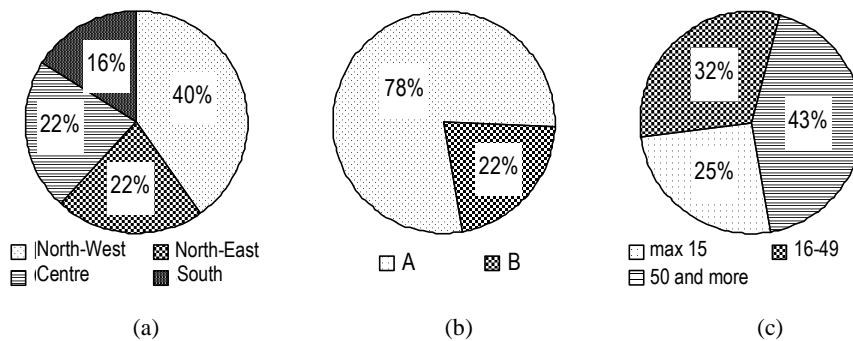


Figure 2 - Workers by (a) geographical area, (b) type, and (d) dimension (no. of workers) of the cooperative where they work

The distinction between objective and subjective characteristics comes from the idea that quality of work, especially in the nonprofit sector, is composed by important objective aspects, such as pay, social security protection and benefits as well as by other dimensions, depending on the workers' subjective perceptions and related to the non monetary incentives offered to the workers. The need to consider all these factors has led to the development in the recent economic literature of a number of concepts referred to subjective aspects of quality of work, such as procedural and distributive fairness, leader-member exchange, effort, task complexity, job satisfaction, commitment. For a brief review, see Carpita & Manisera (2006).

Tables 1 and 2 respectively display the objective and the subjective variables of quality of work used in the paper. The corresponding graphical representations are in Figures A1 and A2 reported in the Appendix.

Table 1 - *Objective* variables of quality of work

Question	Response categories
YEAR. When did you start to work in this cooperative as a paid worker?	{1=before 1990; 2=1991-95; 3=1996-2000; 4=2001-2007}
ACTIVITY. In which activity area do you work?	{1=Supply of services; 2=Area other than supply of services; 3=multi-area, including supply of services; 4= multi-area, not including supply of services}
CONTRACT. What is your current contract?	{1=permanent job; 2=temporary job as employee; 3=temporary job as consulting}
FULLPART. Do you work full-time or part-time?	{1=full-time; 2=part-time by choice; 3=part-time by constraint }
OVERTIME. Do you work overtime?	{1=yes; 2=no}
PAY. How much is your base pay (per hour)?	{1=very low; 2=low; 3=high; 4=very high}
BENEFIT1. Do you receive any fringe benefits?	{1=yes, monetary benefits; 2=yes, both monetary and non monetary benefits; 3= non monetary benefits; 4=no}
BENEFIT2. Does the cooperative allow your professional growth?	{1=yes, especially by training courses; 2=yes, by motivating forces other than training courses (for example, help by the superiors); 3=no}
BENEFIT3. Did you take part to training courses in the past three years?	{1=no; 2=yes, I paid for them; 3=yes, both the cooperative and me paid for them; 4=yes, and the cooperative paid for them}

Table 2 - *Subjective* variables of quality of work

Question	Response scale
D_FAIRNESS. Is your pay fair?	from 1 (much less than fair) to 7 (much more than fair) with definition of the central category 4 (fair)
P_FAIRNESS. The cooperative properly behaves towards me	from 1 (strongly disagree) a 7 (strongly agree)
IMP_REL. How much important are the interpersonal relationships in making your work pleasant?	da 1 (not important) a 7 (very important)
EFFORT. What is your level of work effort?	da 1 (very low) a 7 (high)
INV. How much often does the cooperative involve you into its <i>mission</i> , in order to recognize your work and motivate you?	{1=never; 2=occasionally; 3=sometimes; 4=often; 5=always}
LOYALTY. What do you think to do in the future, with regard to your job in this cooperative?	{1=to stay as long as possible, because satisfied with the work and the workplace; 2= to stay as long as possible, because there is no choice; 3=to stay, but not for long; 4=to quit as soon as possible}
PS. How satisfied are you with your pay?	from 1 (very dissatisfied) a 7 (very satisfied) with definition of the central category 4 (neither unsatisfied nor satisfied)
JS. How satisfied are you with your job?	
LS. How satisfied are you with your life?	

2. Method

The relation between the variables of quality of work and the worker and cooperative characteristics has been studied by applying the Non Linear Principal Components Analysis (NL-PCA; Gifi, 1990; Meulman, Van der Kooij & Heiser, 2004) to the real data referring to 4.134 workers employed in the 320 social cooperatives sampled in the survey on the Italian social cooperatives ICSI²⁰⁰⁷ (Carpita, 2007).

NL-PCA is a descriptive multivariate statistical technique. It simultaneously reduces the dimensionality of the data and transforms categorical variables into quantitative ones, by means of optimal scaling. It is the nonlinear version of the standard or linear Principal Components Analysis (PCA; Jolliffe, 2002; Zani, 2000, vol. II). Like PCA, NL-PCA aims at representing the original data matrix in a low-dimensional space (thus replacing the original number of original variables with a lower number of composite variables) resulting in minimal loss of information. Unlike PCA, conceived to deal with quantitative variables, NL-PCA allows the transformation of categorical variables, by assigning numerical values (category quantifications) to the original categories by optimal scaling, or alternatively, optimal scoring or optimal quantification. The scaling is optimal in the sense that the quantified variables are optimal with respect to the objective of standard PCA (minimum loss of information).

Let consider n subjects (or objects) on which m categorical (ordinal or nominal) variables are measured. The original categories of the categorical variables are in the vectors $\mathbf{c}_j' = (1, 2, \dots, k_j)$, $j = 1, 2, \dots, m$. \mathbf{H} is the $n \times m$ data matrix; the j -th column \mathbf{h}_j of \mathbf{H} contains the scores of the n subjects on the j -th variable. \mathbf{G}_j is the $n \times k_j$ indicator matrix such that $\mathbf{h}_j = \mathbf{G}_j \mathbf{c}_j$ (Gifi, 1990). The dimensionality reduction is achieved by an orthogonal projection from \mathcal{R}_m to \mathcal{R}_p , with $p \ll m$. Mathematically, the optimal scaling (that gives the smallest loss of information) is achieved by the minimization of the least squares loss function:

$$\sigma = \sum_j Sq(\mathbf{X} - \mathbf{q}_j \mathbf{a}_j') = \sum_j Sq(\mathbf{X} - \mathbf{G}_j \mathbf{y}_j \mathbf{a}_j')$$

where $Sq(\cdot)$ indicates the sum of the squared elements of a matrix or a vector, \mathbf{X} is $n \times p$ matrix of the object scores, containing the scores of the n subjects on the p components of \mathcal{R}_p ; \mathbf{q}_j is the $n \times 1$ vector of the quantifications assigned to the j -th original variable; \mathbf{y}_j is the $k_j \times 1$ vector of the quantifications of the categories \mathbf{c}_j ; \mathbf{a}_j is the $p \times 1$ vector of component loadings of the j -th variable.

The loss function σ is minimized by an iterative algorithm (*Alternating Least Squares*; ALS) that cyclically updates one of the three sets of parameters \mathbf{X} , \mathbf{a}_j and \mathbf{y}_j . It is a restricted optimization, because orthonormalization restrictions are imposed in order to avoid trivial solutions (Gifi, 1990).

The amount of information existing in the original variables and kept in the transformed variables depends on the type of transformation (scaling level) used to quantify the variables. The *nominal* scaling level is used to keep in the transformed variables only the grouping of subjects in the original categories; to keep the grouping as well as the ordering of the original categories, the *ordinal* scaling level must be chosen. It imposes order restrictions on the unrestricted nominal quantifications and it uses monotone non decreasing functions (for example, Kruskal, 1964a-b; Barlow *et al.*, 1972). Both nominal and ordinal transformations can be obtained by means of *spline* functions (Ramsay, 1988; Gallo & Lombardo, 2001; Lombardo, 2004), which require the estimation of fewer parameters and give transformations showing smoother curves. Finally, with a *numerical* scaling level, the quantified variables maintain the original information of grouping, ordering and equal distance among categories. NL-PCA is required when dealing with categorical variables; nevertheless, it can be useful in the presence of quantitative variables, when nonlinear relationships among variables are supposed.

One of the objectives of NL-PCA is to construct composite indicators summarizing different aspects of a latent concept measured by a number of items in a questionnaire (Carpita & Manisera, 2006). Another important goal is to graphically represent the analysed variables as well as the relations among variables and between variables and subjects. Following the *vector* model (Meulman *et al.* 2004), variables are represented by vectors in the low-dimensional space and each subject by a point in the same space (Figure 5a). Subjects can also be represented by the *centroids* of a grouping variables. For example, in Figure 5a subjects are represented both by points and by five centroids, corresponding to the categories A, B, C, D, E of an hypothetical grouping variable. Note that centroids simultaneously represent groups of subjects and categories of a variable (*centroid model*). When all variables are represented according to the centroid model (in the Gifi terminology, all variables are quantified by a multiple nominal scaling level), a multiple correspondence analysis is performed (Benzécri, 1973; 1992; Gifi, 1990; Nishisato, 1980).

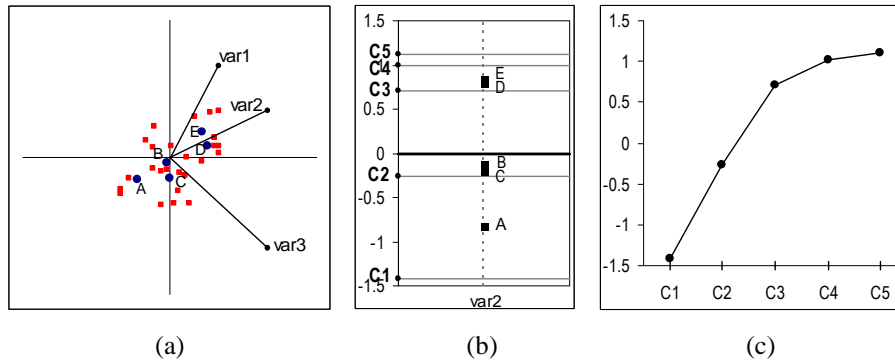


Figure 5 - (a) Representation in \mathcal{R}_2 of subjects (points \blacksquare), three variables (vectors), and centroids (points A,B,C,D,E); (b) projection of centroids onto “var2” e (c) *transformation plot* of “var2”

The projection of each point onto the vector representing one variable allows to interpret the relation between subjects and variables. In this way, it is easy to understand the relation among subjects (or groups of subjects) and each single variable and to identify similarities and differences in the behaviour of subjects, with reference to the considered variable.

The graphical representation is assured when the arrival space \mathcal{R}_p has two or three dimensions. However, it is also possible to graphically display the relations between variables and (grouped) subjects when $p > 3$. It is also possible when $p = m$ and hence there is no loss of information: the total amount of variability in the original variables is maintained in the final solution. This is feasible by representing each variable by a vertical line and each group of subjects by a point (resulting from the projection of the corresponding centroid onto the vector corresponding to the variable). In the example shown in Figure 5b, the five centroids A, B, C, D, E described in Figure 5a are projected onto “var2”: subjects of groups D and E show a similar behaviour, *on average*, with reference to “var2”, and so is for groups B and C, while the subjects of group A, *on average*, differ from the other groups.

The very interesting aspect of this unusual application of NL-PCA is that the dimensionality of the original data is not reduced: the final solution keeps $p = m$ dimensions, where m is the number of original variables in analysis. NL-PCA is thus used only to quantify the variables with the advantage to maintain, in the new representation of data, the whole information (variability) existing in the original variables.

To better understand the graph of projected centroids, it is useful to give the vector representing the variable a meaning, related to the original catego-

ries. This is easy by the so-called transformation plot, which displays the category quantifications versus the original categories and illustrates the nonlinear transformation used to quantify the original categorical variable (Figure 5c refers to “var2”). The quantifications read on the transformation plot can be used to assign a meaning to the values of the vertical axis of the graph of the projected centroids (Figure 5b). This makes it possible to appreciate differences and similarities among groups, but also to interpret the position of groups on the basis of the original categories by measuring the (metric) distance among centroids and among centroids and original categories of the variable. In the example in Figure 5c, groups D and E are in the middle between categories C3 and C4 of “var2”; groups B-C and group A are fairly close to C2, though the distance from C2 is longer with reference to group A than B-C.

Because quantified variables are standardized (they have zero mean and unit variance), the value corresponding to zero on the vertical axis of the graph of projected centroids represents the mean quantification. This helps the interpretation of the results: on one hand, it shows the position of the subject mean, with respect to the original categories (for example, Figure 5b suggests that subjects are, on average, between categories C2 and C3, although much closer to C2). On the other hand, one can identify the position of groups not only with reference to each other, but also with respect to the subject mean. In Figure 5b, groups A, B and C are below the mean, unlike D and E that are above the mean.

Obviously, the size of each group has effects on the closeness of centroids to the mean quantification; moreover, it should be noted that the marginal frequencies of the analysed variables have effect on the optimal quantifications and, consequently, to the NL-PCA solution. Finally, the NL-PCA is a multivariate technique, taking into account all the analysed variables and their relationships. If the objective is to study how one further variable (or more than one) relates to the analysed variables, in order to be sure that that variable does not influence the solution it should be inserted in the analysis as a supplementary (or passive) variable. Its quantifications are computed in a second moment, once the algorithm minimizing the loss function σ has converged. In the application proposed in this paper, the variables of quality of work are active in the analysis, while the variables describing workers and cooperatives are treated passively.

3. Results

We applied NL-PCA to the data regarding 4.134 workers employed in 320 cooperatives sampled in the ICSI²⁰⁰⁷. Objective and subjective variables of quality of work have been separately considered, thus two separate NL-PCA solutions were obtained. Both of them were completed by using the variables describing the characteristics of workers and of cooperatives as supplementary variables, quantified by multiple scaling level.

Both NL-PCA analyses were conducted by setting $p=m=9$; as a consequence, both final solutions kept the total amount of information existing in the original variables: the amount of variability accounted for in both solutions equals 100%.

Results are described by means of the graphs of projected centroids (Figure from A5 to A22 in the Appendix); the comments generated by reading such graphs are true *on average*: the position of every centroid corresponds to the mean of the positions occupied by the subjects belonging to the category represented by that centroid. The interpretation of those graphs is helped by the transformation plots, reported in Figures A3 and A4 in the Appendix.

By the evaluation of the graph of projected centroids, each variable of quality of work is examined in relation to the worker and cooperative profiles. This unavoidably penalizes the study of the relations among variables. However, we think that the exam of such relations could be more adequately achieved by considering other variables, for example the ones originated by multi-item questions present in the ICSI²⁰⁰⁷ questionnaires, and by using more appropriate statistical methods and models.

Results show some peculiar behaviours of worker and cooperative profiles, in relation to quality of work. They can be summarized in the following way.

Differences between males and females are negligible; minor discrepancies refer to the contract: on average, females choose part-time more often than males and receive a lower pay per hour. This has effect on a higher level of distributive fairness perceived by males. Women, with respect to men, give more importance to interpersonal relationships at work, put more effort on their working activity and feel to be less involved in the mission of the cooperative. With respect to men, women are less satisfied with both their job and their life in general.

Workers with different levels of education are different with reference to the year of hiring (graduate workers have more recently been hired); The higher the degree is, the higher the level of instability of the labour contract is, the higher the pay is and more possibilities of formative growth are offered by the cooperative. There is a direct relation between the level of education and the involvement in the mission of the cooperative, while the relation is re-

versed with the fairness (with reference to both the pay and, less strongly, to the behaviour towards the single worker); finally, workers with higher level of education are less satisfied with pay and job in general, but more satisfied with their lives.

Younger workers started to work in the cooperative more recently than older ones. Contracts regarding younger workers are less stable, count lower wages (the highest pay is given to workers in the middle class of age, that is 31-49 years); there exist a direct relation between the age of workers and fairness, satisfaction with pay and job in general; workers aged from 31 to 49 years work with more effort than other ones; workers over 50 years old are more involved in the mission than the younger ones.

Members of the cooperative have been hired before than non members, have a more stable contract and receive more support to attend training courses; they state to put more effort on doing their work and to be more involved in the mission of the cooperative; however, non members are more satisfied with the life in general.

The cooperative characteristics play a role in defining some differences among the quality of work existing and perceived by workers. Going from the North Italy, to the Centre and then to the South, the contracts are more and more unstable. Full-time contracts are predominant in the North East cooperatives, while the part-time jobs prevail in the South, where less people work overtime. Workers employed in the Northern cooperatives receive wages above the mean, whilst the wages of people working in the Centre and South of Italy are below the mean. The cooperatives located in the North-East offer training courses to its employed more than other areas' cooperatives, while workers of the Southern cooperatives pay for their training. With reference to the subjective variables of quality of work, people working in the cooperatives sited in the South of Italy have a peculiar behaviour, although the differences with the workers of the other areas are sometimes unimportant: they perceive more fairness, are more involved in the mission, are more satisfied with the pay and the job and less satisfied with the life in general.

With respect to B type cooperatives, A type cooperatives employ workers with less stable contracts and rather higher wages and give more financial support to their workers for training courses. Moreover, workers in A type cooperatives feel less fairness, judge interpersonal relationships more important and put more effort on their working activity; they are less satisfied with the pay and generally more satisfied with their life.

There exist a direct relation between the cooperative dimension (in terms of number of workers) and the stability of the contracts and between the cooperative dimension and its possibility to finance training; workers in larger cooperatives feel a lower level of distributive fairness, put more effort on their

work, feel to be less involved in the mission, are less satisfied with pay and more satisfied with life.

The application of NL-PCA, in the unusual way shown, allowed to characterize different worker profiles with reference to both existing and perceived quality of work. The graphical representations used were easy to interpret; some conclusions deduced from those graphs can be confirmed by simple distributions of the variables of quality of work, conditioned by gender, age, membership, and so on. The surplus value of the proposed application is related to the possibility to compute mean values and metric distance evaluating differences among groups and between groups and quantified categories of the original variables of quality of work.

Often the differences appear very small, and this is particularly true when the categories of the variables (onto the centroids of worker and cooperative profiles are projected) receive optimal quantifications very close each other. The study of the groups defined by crossing all characteristics of worker and cooperative could give interesting results, but we focused the attention on the groups of workers defined by the categories of single variables to simplify the analysis and the interpretation of results, to deal with a reasonable number of groups and groups with an acceptable size, in terms of number of workers. Moreover, we tried to consider combinations of characteristics of workers and cooperatives by performing a cluster analysis (Kaufman & Rousseeuw, 2005), but the output do not add very useful information to the NL-PCA results.

Concluding, although the analysis showed some differences among workers with different profile and employed in cooperatives with different characteristics, we can state that paid workers of ICSI²⁰⁰⁷ are substantially homogeneous with regard to the quality of work, both existing and perceived. This seems to be a reasonable result, considering that the survey investigated a very peculiar organizational form (the social cooperative), operating in a particular economic sector.

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Appendix

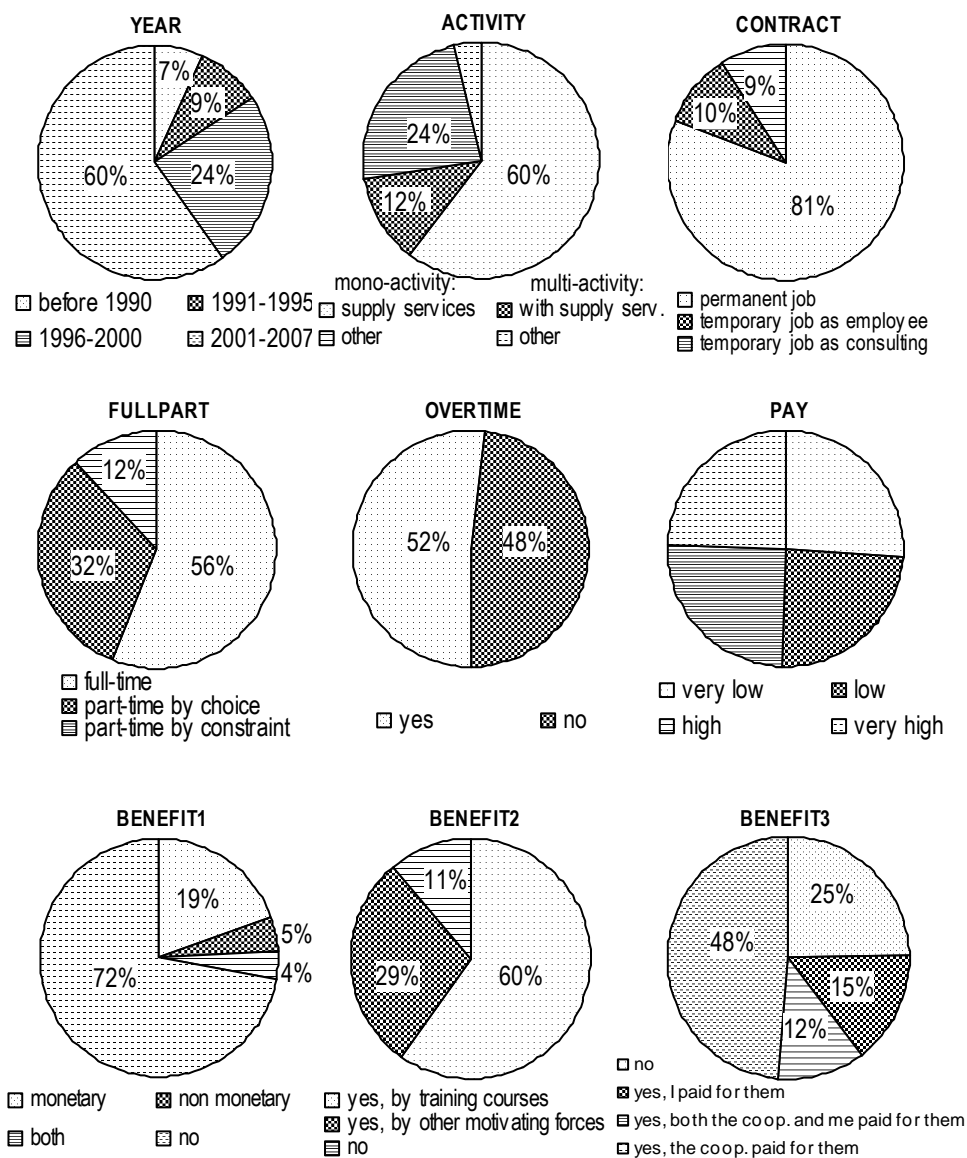


Figure A1 - Frequency distributions of *objective* variables of quality of work

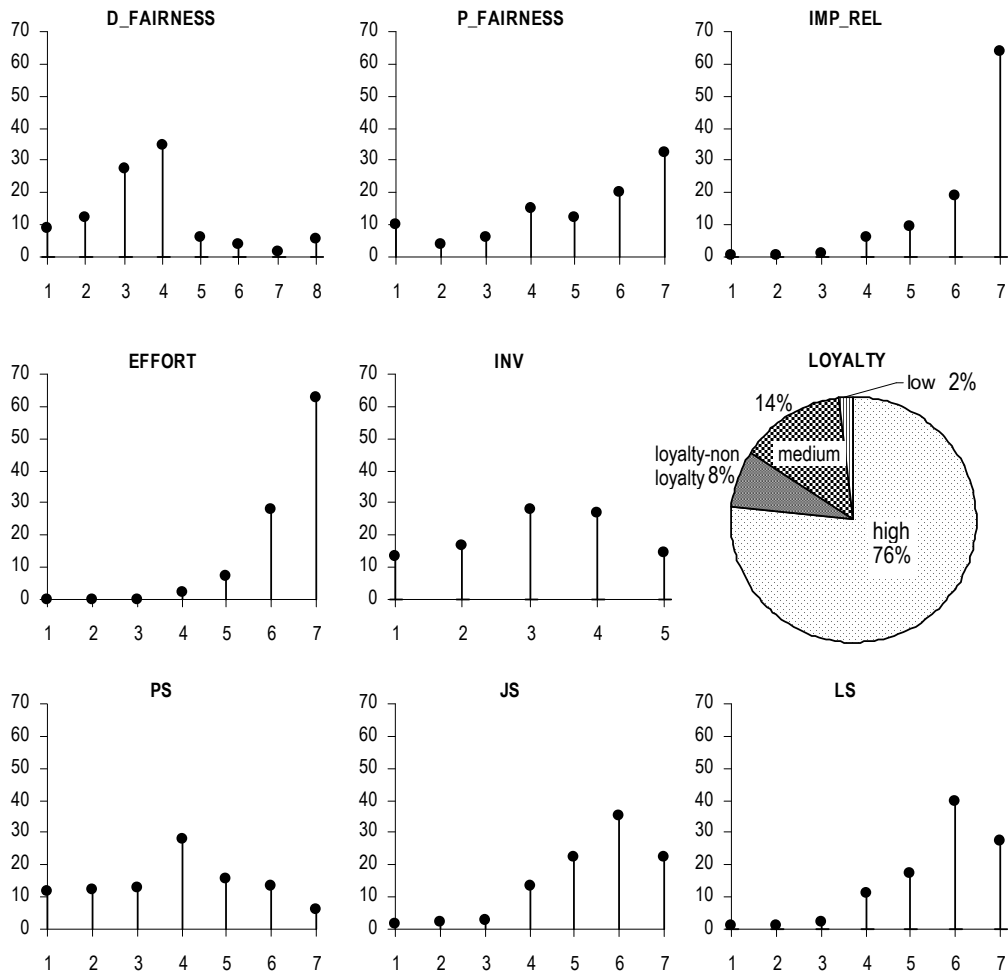


Figure A2 - Frequency (%) distributions of *subjective* variables of quality of work

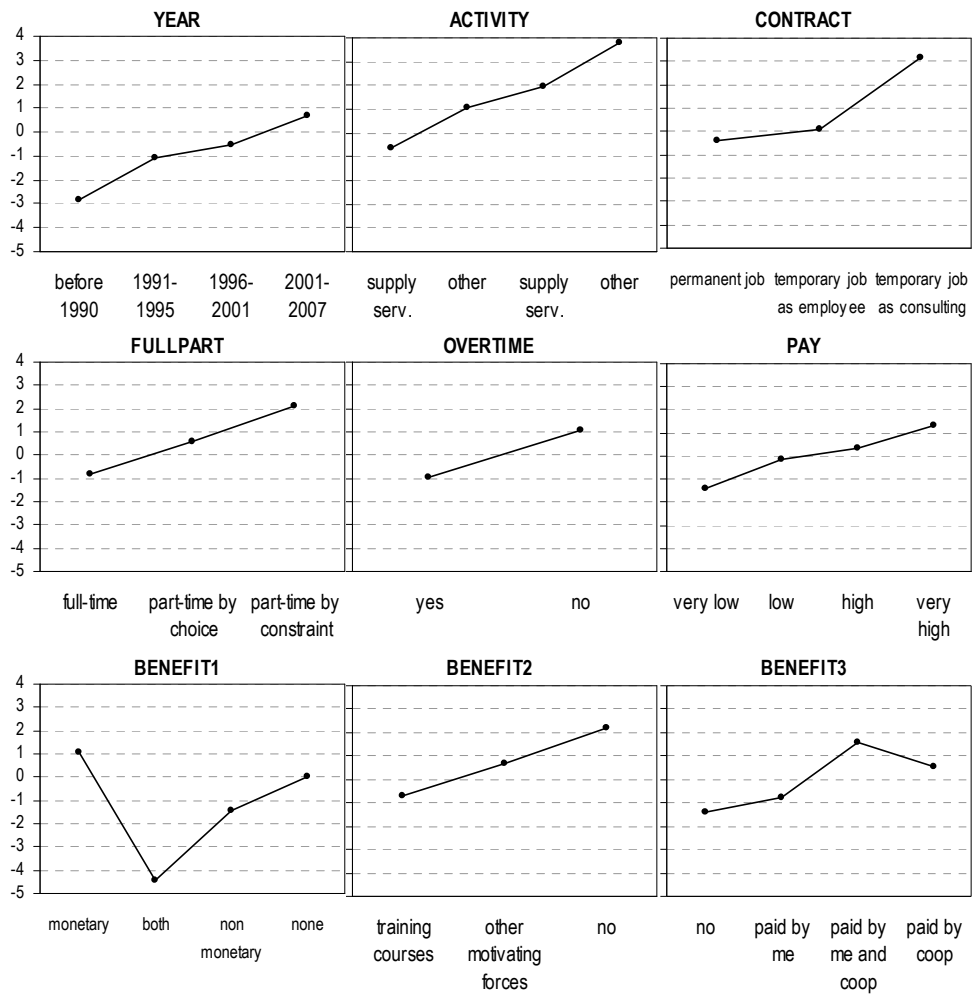


Figure A3 - Transformation plots of *objective* variables of quality of work

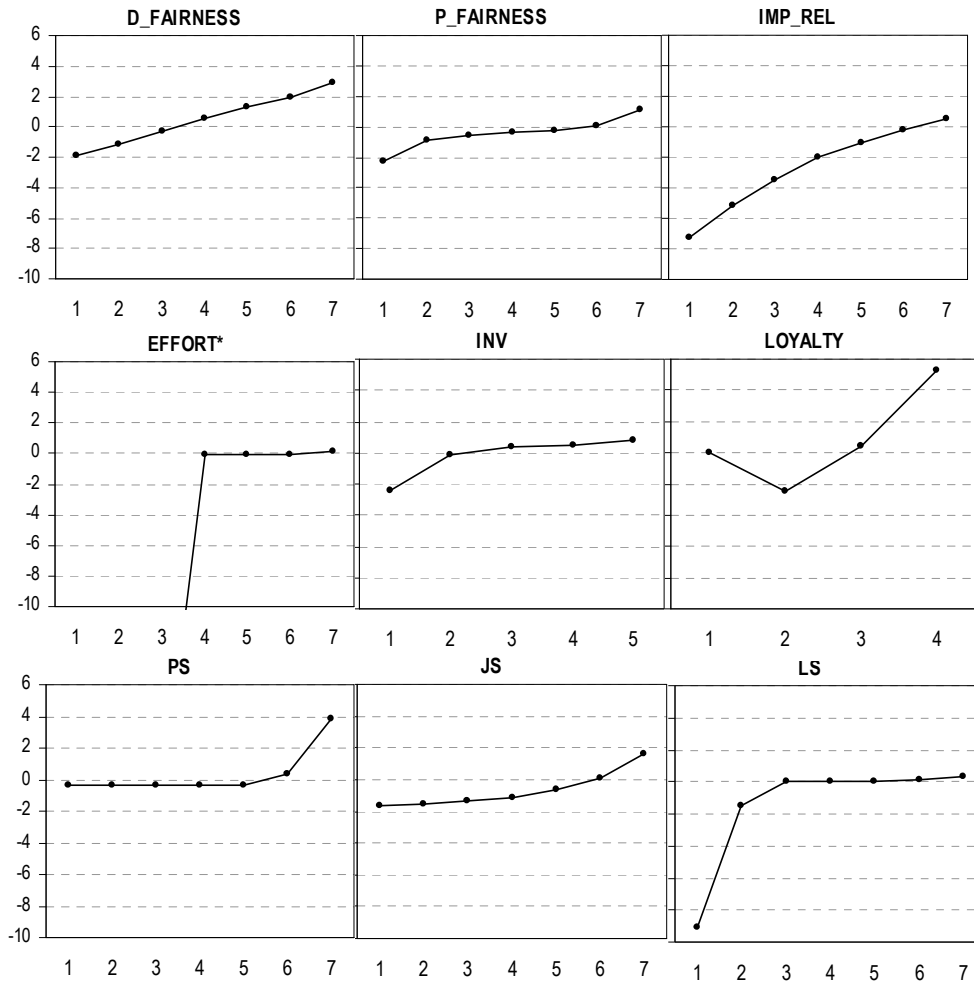


Figure A4 - Transformation plots of *subjective* variables of quality of work
 (* the optimal quantification assigned to category C3 of variable EFFORT is 22,9. Categories C1 and C2 have null frequencies, therefore they are not quantified)

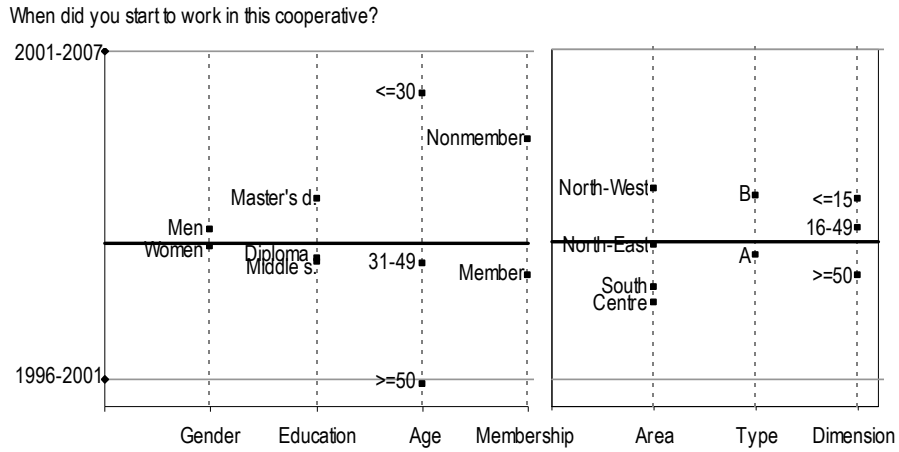


Figure A5 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable YEAR

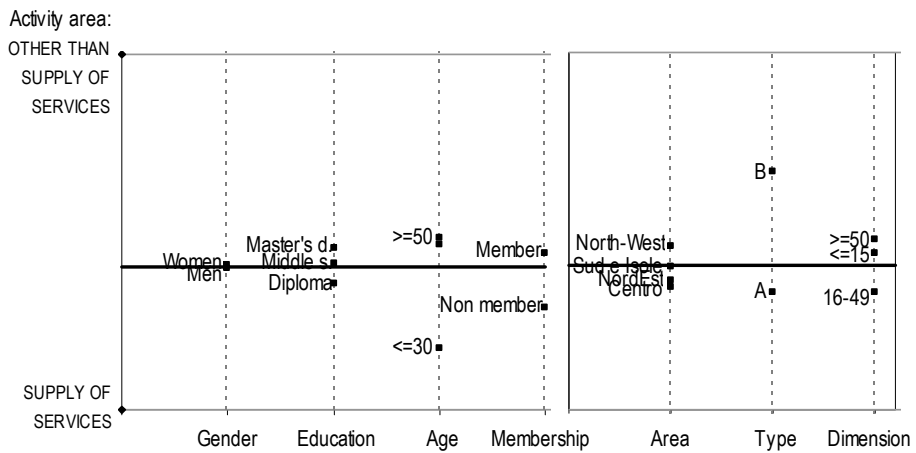


Figure A6 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable ACTIVITY

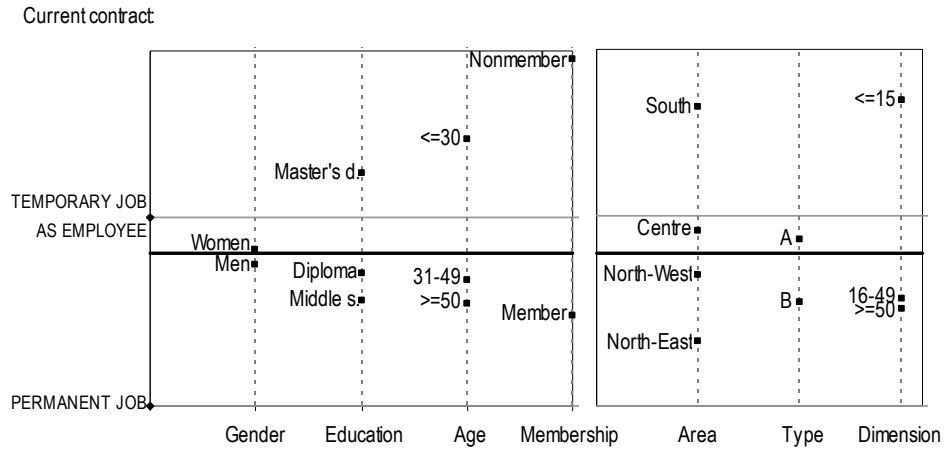


Figure A7 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable CONTRACT



Figure A8 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable FULLPART

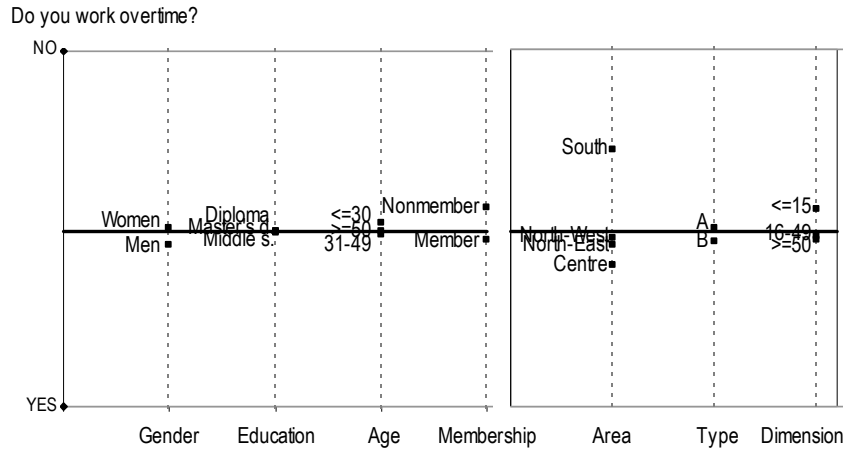


Figure A9 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable OVERTIME

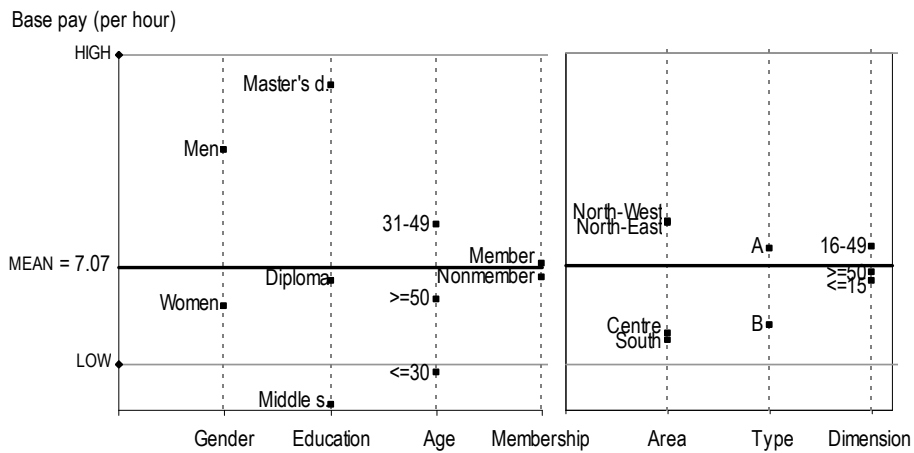


Figure A10 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable PAY

Do you receive any fringe benefits?

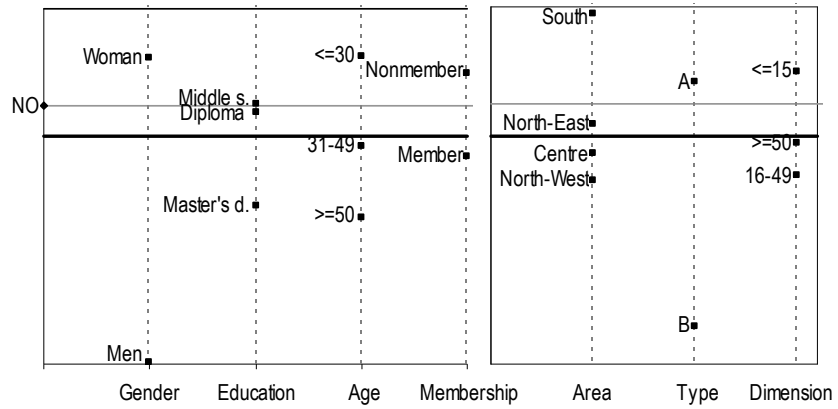


Figure A11 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable BENEFIT1

Does the cooperative allow your professional growth?

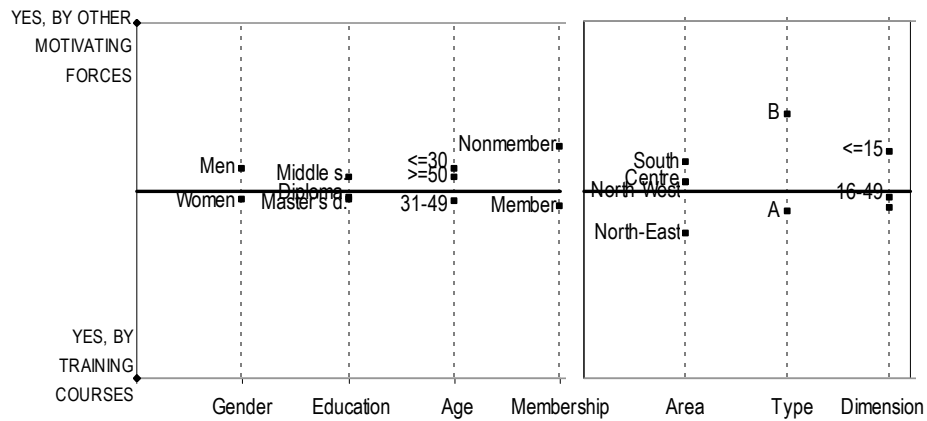


Figure A12 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable BENEFIT2

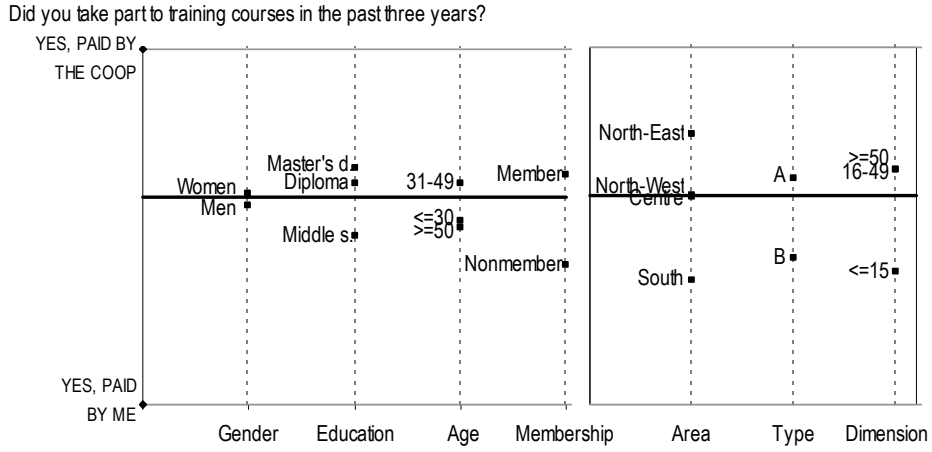


Figure A13 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable BENEFIT3

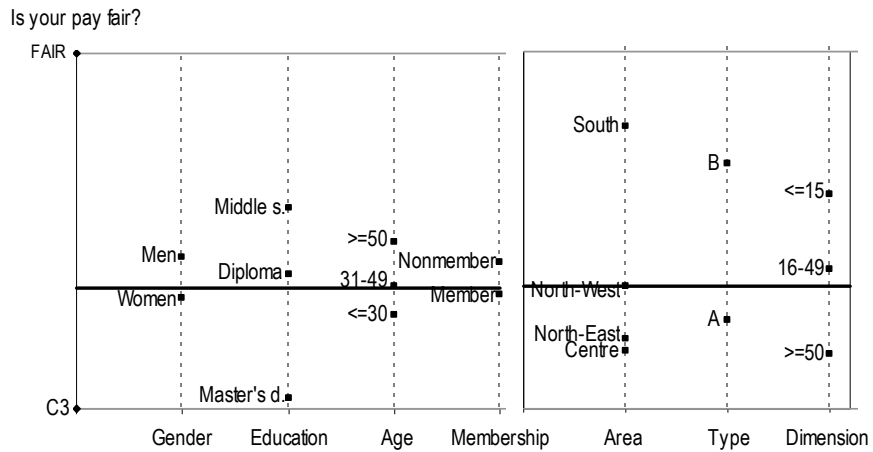


Figure A14 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable D_FAIRNESS

The cooperative correctly deals with me

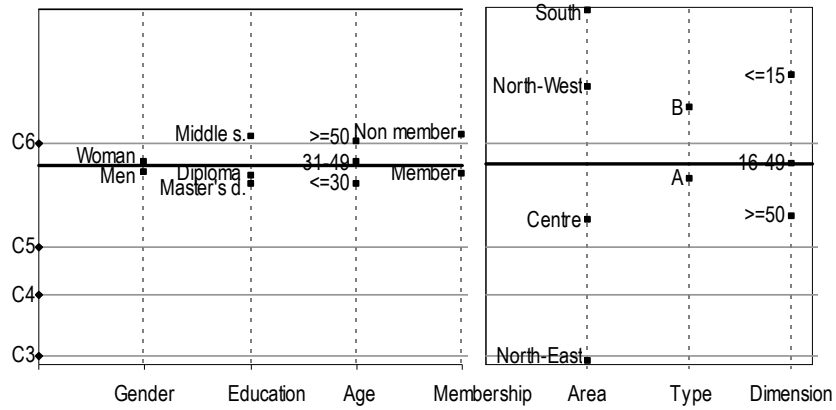


Figure A15 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable P_FAIRNESS

How much important are the interpersonal relationships?

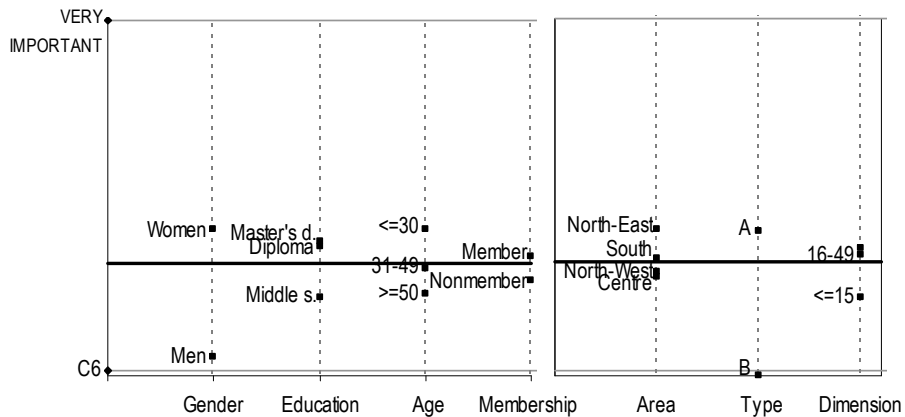


Figure A16 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable IMP_REL

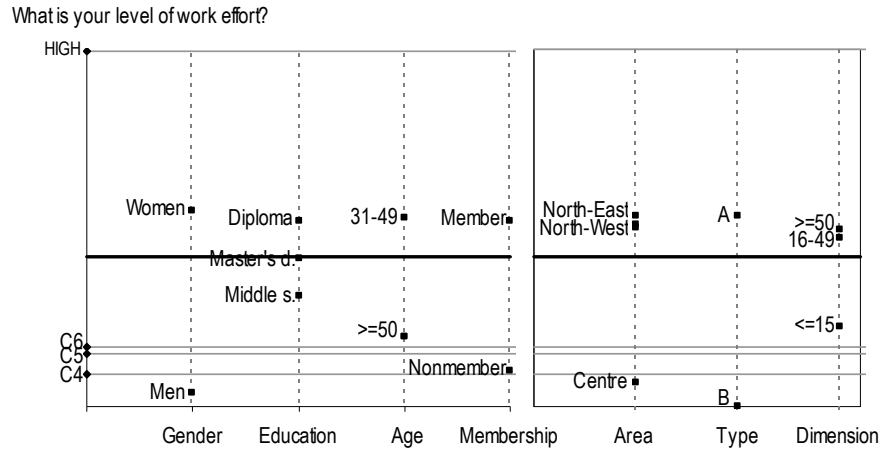


Figure A17 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable EFFORT

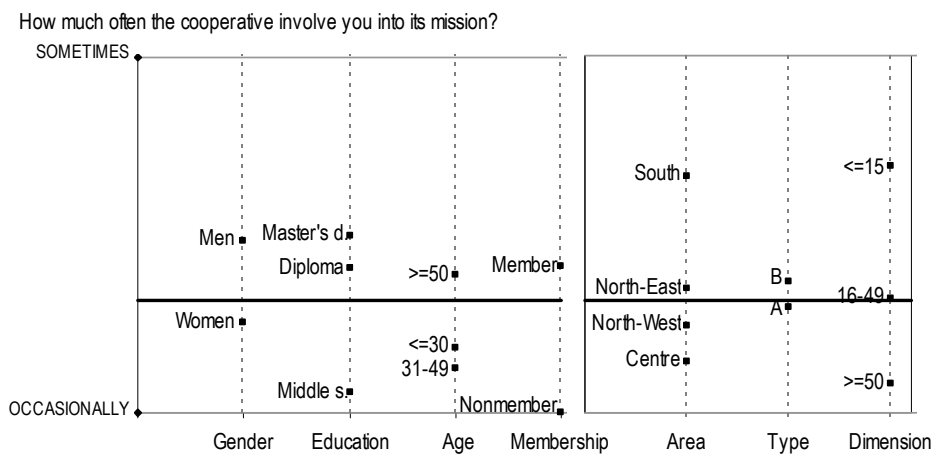


Figure A18 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable INV

Loyalty level towards the cooperative:

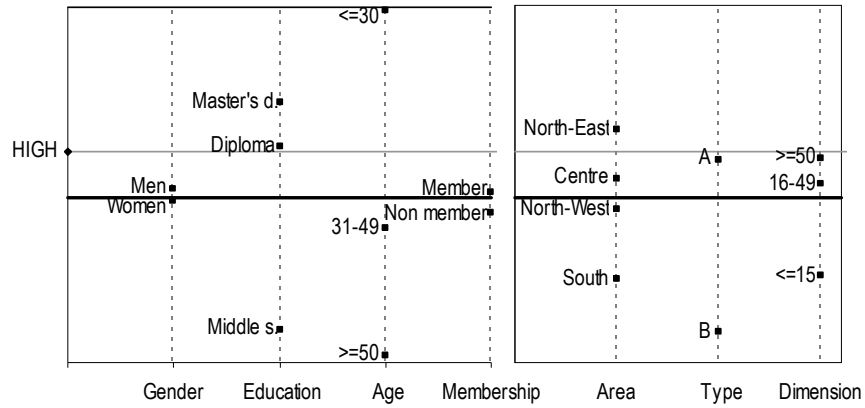


Figure A19 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable LOYALTY

How satisfied are you with your pay?

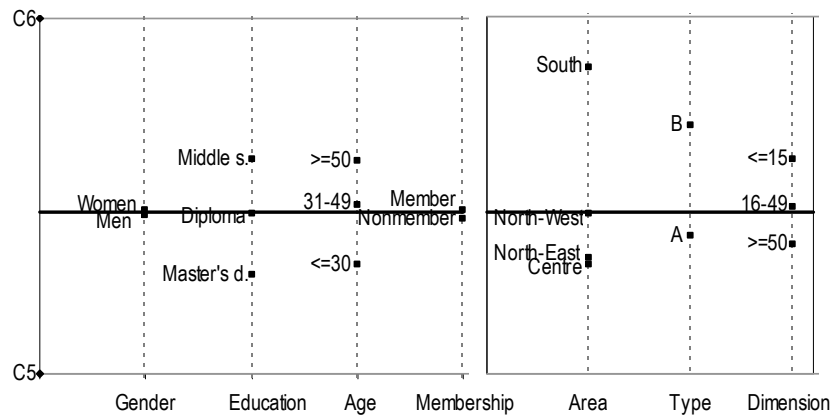


Figure A20 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable PS

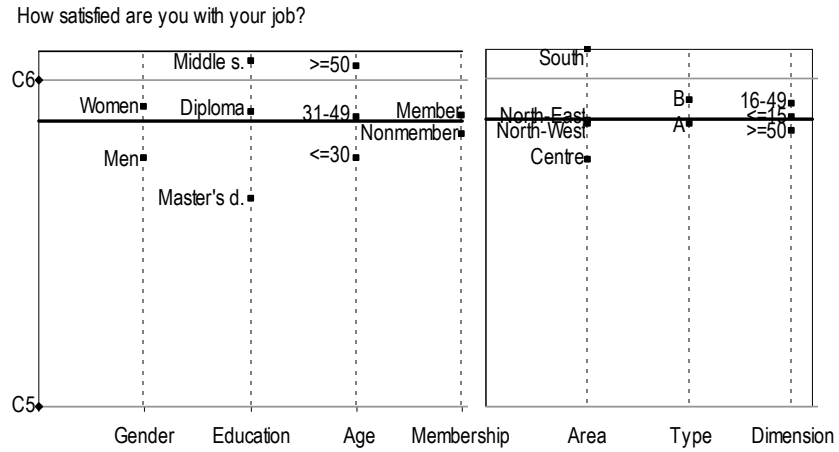


Figure A21 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable JS

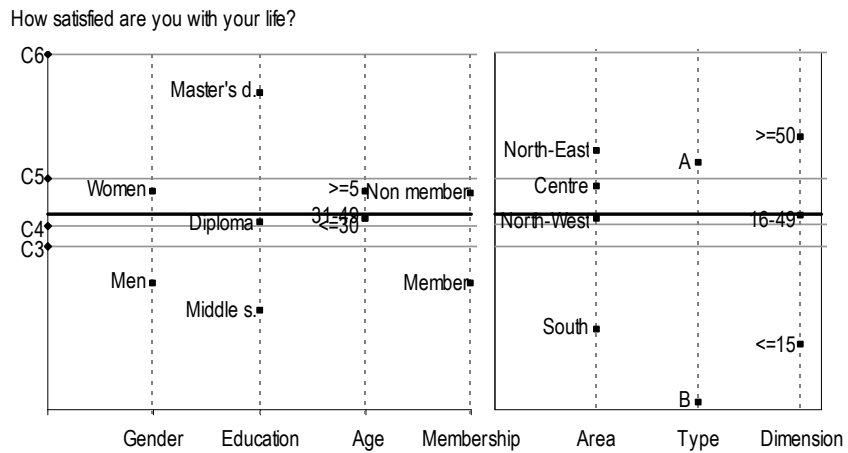


Figure A22 – Projection of centroids of worker profile (Gender, Education, Age and Membership) and cooperative profile (Area, Type and Dimension) onto variable LS