Evaluating Firms' Gender Equity by Fuzzy Logic

Tindara Addabbo[1]   Gisella Facchinetti[1]   Giovanni Mastroleo[2]   Tiziana Lang[3]

1 University of Modena e Reggio Emilia, Department of Economia Politica, Modena, Italia
2 University of Calabria, Cosenza, Italia
3 Isfol, Roma, Italia
Email: tindara.addabbo@unimore.it, gisella.facchinetti@unimore.it, mastroleo@unical.it, t.lang@isfol.it

Abstract—This paper uses a Fuzzy Expert System (FES) in order to evaluate firms in terms of Gender Equity (GE). The scope for using FES is connected not only to the multidimensional nature of GE and to the need of providing a synthetic indicator of firm's GE without losing the its complexity, but even with the composite group of experts involved. The presence of sociologists, economists trade unions members, not used to a mathematics language, carried us to propose an instrument more user friendly like a FES.

Keywords— Fuzzy logic, Fuzzy expert system, gender equity, equal opportunity, discrimination.

1 Introduction

The Italian labour market shows remarkable gender inequalities notwithstanding the advanced labour market regulation in terms of Equal Opportunities. Italian women still experience many inequalities at their workplaces such as: wage differences, lower career paths, higher percentages of fixed-term and short-term contracts, etc. Women's employment rate on average in Italy was 46.6% in year 2007 (Istat, Labour Force Survey data) far below the 60% Lisbon target and far below men's employment rate (70.7%) Inequalities at the workplace are reinforced by and interact with the unequal distribution of unpaid work at home (care and domestic work). Italian women bear a higher share of unpaid work than their partners and when they enter the labour market this is going to produce an unequal share of total (paid and unpaid) work. [3],[10]. Though the Italian situation in terms of gender equity and access to paid labour is particularly weak gender segregation in employment is a feature that characterizes EU27 on average as the results by Burchell, Fagan, O'Brien and Smith [6], based on the European Foundation for the Improvement of living and working conditions 2005 Survey shows. The problem of firms' evaluation with regards to gender equity has been differently tackled across Europe in connection also to the different level of enforcement of equal opportunity laws and a different level of integration of gender equality policies in employment policies [5]. In order to improve women employment rates and to reduce the existing gender gaps in the workplaces the former Italian Ministry of Labour promoted the project "Bollino Rosa" together with Isfol

(Istituto per la Formazione Professionale dei Lavoratori). The project started in June 2007 in the framework of the European Year of Equal Opportunities for All and has been co-financed by the European Commission. The test was carried out from November 2007 until February 2008. This study presents the fuzzy expert system (Section 2.1-3) proposed within the Bollino Rosa project and applied to a sample (section 2.4) of firms. Section 3 comments on the results of the application of the system to firms involved in the project while section 4 contains concluding remarks and proposals for the extension of the project.

2 A fuzzy expert system for evaluation

2.1 Why a fuzzy expert system

To face this complex problem and to reach an aggregated value of the certification level, we propose a Fuzzy Expert System (FES), which utilizes fuzzy sets and fuzzy logic to overcome some of the problems that occur when the data provided by the user are vague or incomplete.

This is not the natural framework of a FES, in fact engineering problems are more typical for FES, but recently economic and management researches have found in this instrument interesting applications, [2], [4], [7], [8], [9], [15]. In a multidisciplinary research, like the one we present, the power of FES shows its ability to describe linguistically a particular phenomenon or process, and then to represent that description with a small number of very flexible rules. In a FES, the knowledge is contained both in its rules and in fuzzy sets, which hold general description of the properties of the phenomenon under consideration. FES provides all possible solutions whose truth is above a certain threshold, and the user or the application program can then choose the appropriate solution depending on the particular situation. This fact adds flexibility to the system and makes it more powerful. FES uses fuzzy data, fuzzy rules, and fuzzy inference, in addition to the standard ones implemented in the ordinary Expert Systems. From the mathematical point of view a fuzzy system can be described as a function approximator. [16] More specifically it aims at performing an approximate implementation of an unknown mapping $f : A \subseteq R^n \to R^m$ where A is a compact of R^n. By means of

variable knowledge relevant to the unknown mapping, it is possible to prove that that fuzzy systems are dense in the space of continuous functions on a compact domain and so can approximate arbitrarily well any continuous function on a compact domain. The following are the main phases of a FES design ([11], [17]):

- Identification of the problem and choice of the type of FES, which best suits the problem requirement. A modular system can be designed. It consists of several fuzzy modules linked together. A modular approach may greatly simplify the design of the whole system, dramatically reducing its complexity and making it more comprehensible. Fixed input and output variables, it is necessary to describe their linguistic attributes (fuzzy values) and their membership function (fuzzification of input and output);

- definition of the set of heuristic fuzzy rules. (IF-THEN rules);

- choice of the fuzzy inference method (selection of aggregation operators for precondition and conclusion);

- translation of the fuzzy output in a crisp value (defuzzification methods);

- test of the fuzzy system prototype, drawing of the goal function between input and output fuzzy variables, change of membership functions and fuzzy rules if necessary, tuning of the fuzzy system, validation of results.

2.2 System structure

The structure of the Fuzzy Expert System (FES) we present is very complex and contains sixty initial inputs. We try in the space we have to explain how it is born. Preparing the questionnaire, the economics and sociology experts fix the macro-indicators that produce the final evaluation called "certification". The two are "Gender Equity"(GE) and "Gender SusTainability" (GT). The two are macro-aggregations may be split in other sub macro-indicators: GE sums up two: Equity in the Firm (EF) and Equal Opportunity (EO). They include information on what firm makes to treat woman at the same level of man in the policy of entrance, haw firm respects welfare laws and so on. The EF intermediate variable, we present in detail, contains information on the firm's gender fairness in terms of wages and career opportunities. Firms are assessed with respect to employment equity (measured by horizontal segregation in terms of area or type of job), equity in earnings (measured by

the gender wage gap and the share of women and men in top positions as a gross index of vertical segregation) and the participation of women as trade unions representatives. The other macro-indicator GT contains several types of information: how firm takes into account work life balance policy (WLB) that is how the way working time is scheduled and its balance with other use of time related to the family. The Human Resource Management (HRM) variables contain information on firm's recruitment methods for entrance into work and on employees leaving or being fired by the firm. The third Safety (S) produces information on security policies that the firm adopts and on the awareness of gender specific health risks at work. Due to limits of space we are going to present more in depth the "Equity in the Firm (EF)". Women tend to be severely underrepresented in Italy in apical positions [13], [14] and their low presence in apical positions in the firm is considered in this system as a negative element in firm's assessment with regards to gender equity both because:

1) it can lead to a higher wage gap at the disadvantage of women;

2) it can be a sign of employment discrimination by gender; 3) it can be a signal of an environment not favourable to women progression of career;

4) it can be a sign of a human resources evaluation system that rewards less women's competences than men's.

The wage gap has been computed by the ratio of women total cost of labour to men's. This is a gross measure of wage gap that, in further research, can be computed as a net wage gap by taking into account employee's characteristics (like work experience, tenure, education, hours of work). We have then considered the bargaining power of women inside the firm by computing how many women are representatives in trade unions with respect to women employed in the firm. An underrepresentation of women in unions representatives contributes to decrease the value of the final outcome since we deem that their voice cannot be enough listened in bargaining on job conditions if they are underrepresented amongst employees representatives. Equal opportunity, EO, takes into account the existence of agreements with unions and public institutions in terms of equal opportunities (the highest mark has been given to enacted agreements and the lowest if there are no agreements and the firm does not
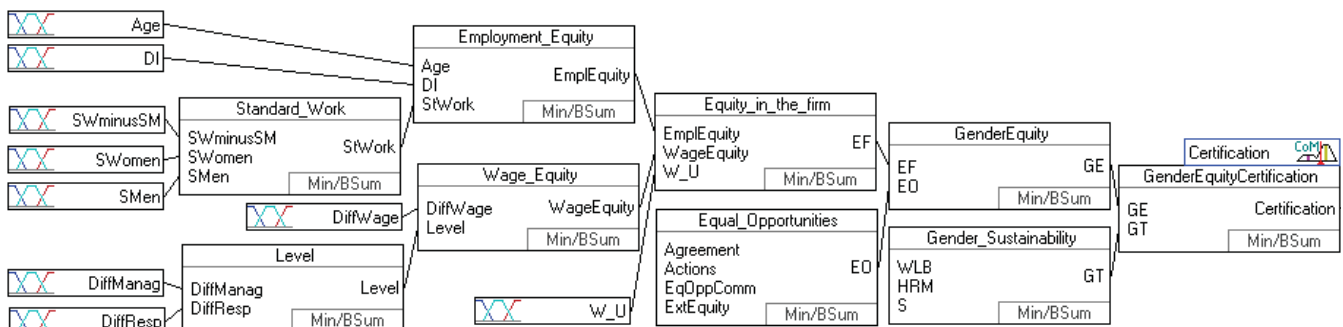

Figure 1: Reduced system layout

intend to sign any in the future), of affirmative actions, of incentives to hire women, of the use of Italian Law 53/2000-that contains measures to increase work life balance in the firm - and equal opportunities and the presence of an Equal Opportunity Commission in the firm. We aim at improving the measurement of this last variable by collecting information on the type of activities performed by the Commission. This dimension contains also all strategies enacted by the firm to inform and make aware personnel about gender differences and all the actions that lead to an increase (in qualitative and quantitative terms) of women's participation in the firm. The equal opportunity dimension is also extended to include firm's awareness of the other firms of the network in which it operates.

2.3 Reduced system layout

We present the inputs involved in EF macro-indicator and the sub-system in which the variable GE is split in the original inputs.

Age. Age

SWminusSM. Gender gap in standard employment inside the firm

DI. Dissimilarity index defined as $\frac{1}{2}\sum_i\left|\frac{w_i}{w}-\frac{m_i}{m}\right|$ where m_i

and w_i are the numbers of men and women in the i-th area.

SWomen. Women in standard jobs

SMen. Men in standard jobs

DiffMang. Gender gap in managerial position

DiffResp. Gender gap in high responsibility white-collar positions

DiffWage. Gender wage gap

W_U. Women share in union's representatives

Intermediate variables:

EmplEquity. Employment equity

EF. Equity in the firm

EO. Equal opportunities

GE. Gender equity

GT. Gender Sustainability

HRM. Human resources management

Level. Level in the job ladder as percentage of women in apical positions

S. Safety

StWork. Standard work

WageEquity. Wage equity

WLB. Work Life Balance

Now we present the fuzzyfied input variable DiffWage and a rule block in which this variable is involved. DiffWage measures the gross wage gap in the firm as the ratio of women's average labour cost with respect to men's. As it is possible to see, this variable enters directly at the second step and is aggregated with the intermediate variable Level. Level measures the share of women in apical positions with respect to men and can be considered as a measure of vertical segregation against women. Wage equity is then evaluated with respect to both variables to evaluate current wage gap and a cause of wage gap at disadvantage of

women. All the cut points that define the fuzzifcation and the rules have been discussed in depth inside the research group where also the researchers who interviewed firm's representatives were involved.
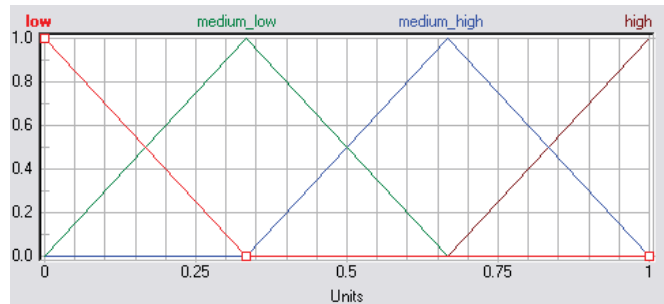

Figure 2: **DiffWage** variable layout

This research step can be deemed very important both in order to state the rules that are at the basis of evaluation in FES and in order to detect problems in the evaluation process and in the tools that have been used.

The following Rule Table is referred to Wage Equity: this intermediate variable is built with the input DiffWage and the intermediate variable Level.

Table 1: rule table of **WageEquity**

#	DiffRetrib	Level	WageEquity
1	low v medium_low	low	very_low
2	low	medium_low	very_low
3	low	medium	low
4	low	medium_high	medium_low
5	low	high	medium_high
6	medium_low	medium_low	low
7	medium_low	medium	medium_low
8	medium_low	medium_high	medium_high
9	medium_low v medium_high	high	high
10	medium_high	low	low
11	medium_high	medium_low	medium_low
12	medium_high	medium	medium_high
13	medium_high	medium_high	high
14	high	low	medium_low
15	high	medium_low	medium_high
16	high	medium	high
17	high	medium_high	very_high

The experts decided that if women's wage cost with respect to men's is low or medium and women's share in managerial and high responsibility white-collar positions are low the wage equity dimension assumes value 'very low'. The experts have suggested this rule that combines wage differentials and gender inequalities in access to apical positions since though the existence of a wage gap at the disadvantage of women can be related to vertical employment segregation one can observe wage differentials also in the same job position. Moreover the measure of the wage gap obtained from the sample of firms, given the structure of the questionnaire, is a gross wage gap (not corrected for employee's level of education or work experience). Inequalities in the access to apical positions can be considered as a proxy of vertical employment segregation by gender to which the experts' group assigns a high weigh in affecting firms' gender equity. This rule block shows that there is a function $f(DiffWage, Level): R^2 \to R$ increasing

in all the two variables but they are weighted in a different way. Looking at rules 5 and 14 we have that: 5) *f(Low, High)→ medium_high;14) f(High, Low)→ medium_low* .

This table translates in a simple way what the experts consider correct. This way to translate the experts' position is simpler than asking them numerical weights for the single variables and what type of function better represents their idea.

2.4 The sample of firms to which the system has been applied

The system introduced in this Section has been applied to the gender evaluation of 34 private firms of different size belonging to the different productive sectors that have been selected by the Italian Ministry of Labour through a public call. The sample was formed by: 14 joint-stock companies, 2 Ltds, 3 cooperatives Ltd, 10 social cooperatives and 5 others form of enterprise. According to the number of employees those firms can be classified as follows: 1 micro-enterprise (<10 employees), 12 small and medium enterprises (>10 employees <250), 21 big enterprises of which 4 employ more than 30.000 employees. 21 firms have got a turnover of max 50 millions euro (SMEs) while 5 companies exceed a turnover of 1 billion euro per year. Concerning the economic sectors, 17 firms belong to the service industry (research and training, welfare services, company services), 5 are utility companies (telecommunications and public transports), 3 of them belong to the pharmaceuticals industry, 3 to the retail trade, 1 is an energy producing industry and 1 is a bank. The last 4 firms of the sample belong to other sectors like: edutainment, food production and airport management. The selected firms filled in the self-assessment questionnaires and the sociologists conducted in-depth interviews to the relevant union representatives. The system has been presented and discussed inside a group of experts to whom the results of evaluation has also been submitted to validate the fuzzy outcome.

3 Results

We can start by observing that none of the 34 firms that applied to be evaluated and were selected in the Bollino Rosa project obtained a high result in terms of "Certification value", the final output of the FES presented in the previous section. The firm at the top position in terms reached a final evaluation of 0.68 against the maximum of 1 (Table 2) and the firm at the bottom has a value of 0.25, with 9 firms out of 34 with a value for the final outcome of the system lower than 0.40 (Table 3).At this stage of the project we cannot analyse in depth the situation of each firm in the sample and, for privacy reasons, we cannot provide more details about the firms involved in this experimental phase of the project. In the two tables we call them Ai and Ci if the firm is "not corporate" or "corporate" respectively. Table 2 shows the value of the intermediate and input variables of the first ten firms (in terms of the value of the final output of the system that we call certification) and Table 3 shows the last 10 firms. The tables show how similar output values can be derived by

different situation in terms of the dimensions of gendered equity condensed in our intermediate variables. For instance the corporate firm C08 that performs as the not corporate firm A01 In terms of the final value of the FES output (0.62) shows a higher evaluation in terms of gender equity (GE=0.57) than in terms of gender sustainability (GT=0.65), whereas firm A01 performs better in terms of gender sustainability (GT=0.71) than in terms of gender equity (GE=0.53). The same result in terms of certification can therefore mean different outcomes in terms of policies suggestions to the firm in order to improve its 'Bollino Rosa' outcome. A further investigation on the reasons of a lower evaluation of firm A01 in terms of gender equity with respect to firm C08 reveals that this is connected to the high degree of vertical segregation in the firm (with no woman in apical positions) whereas the presence of women in apical position in firm C08 though lower (0.32) is higher than in firm A01. On the other hand both perform rather well in terms of gross wage gap.

Table 2: results the first ten best

Firm	DiffWage	W_U	GE	EF	EmplEquity	WageEquity	EO	Level	GT	Certification
A07	0,90	0,00	0,718	0,576	0,777	0,742	0,800	0,500	0,643	0,67812
A04	0,82	0,05	0,593	0,390	0,652	0,291	0,800	0,000	0,714	0,65588
A08	1,17	0,38	0,500	0,659	0,535	0,800	0,300	0,500	0,786	0,65000
A06	1,39	0,00	0,646	0,469	0,792	0,400	0,800	0,000	0,643	0,63774
C05	0,99	0,01	0,635	0,578	0,847	0,796	0,700	0,500	0,625	0,63042
A02	1,86	0,00	0,627	0,690	0,805	1,000	0,500	1,000	0,643	0,62616
A01	0,79	0,08	0,534	0,365	0,588	0,274	0,700	0,000	0,714	0,62058
C08	0,83	0,01	0,570	0,480	0,761	0,568	0,700	0,324	0,650	0,62004
C07	0,00	0,72	0,639	0,584	0,842	0,058	0,700	0,322	0,559	0,60646
A13	0,00	0,51	0,583	0,500	0,500	0,200	0,700	0,500	0,643	0,60000

Table 3: of results the last ten

Firm	DiffWage	W_U	GE	EF	EmplEquity	WageEquity	EO	Level	GT	Certification
A12	0,00	0,00	0,250	0,250	0,573	0,000	0,300	0,000	0,571	0,40000
A10	0,00	0,00	0,247	0,245	0,494	0,000	0,300	0,000	0,571	0,39816
A19	1,03	0,00	0,250	0,441	0,755	0,400	0,100	0,000	0,500	0,35000
A11	0,53	0,03	0,219	0,329	0,620	0,116	0,200	0,000	0,429	0,32890
A03	0,00	0,41	0,119	0,304	0,357	0,000	0,000	0,000	0,571	0,32146
A23	0,90	0,00	0,166	0,374	0,665	0,339	0,000	0,000	0,500	0,31022
A09	0,00	0,00	0,167	0,250	0,500	0,200	0,200	0,500	0,429	0,30000
A15	0,00	0,14	0,167	0,250	0,500	0,000	0,100	0,000	0,429	0,30000
A21	0,00	0,00	0,167	0,132	0,233	0,000	0,200	0,000	0,484	0,30000
A20	0,00	0,12	0,201	0,301	0,575	0,000	0,200	0,000	0,332	0,24554

Turning to the last ten firms in terms of the final assessment of gender certification, we can see that the bottom one performs very poorly both in terms of wage equity (0.00) and in terms of the equal opportunities (0.20) and gender sustainability (0.33) dimensions while it scores better (0.575) in terms of employment equity denoting a more equal presence of women and men in the areas of the firm and with regards to the type of contract. This firm is very far from a sufficient level and has to work a lot in all the dimensions to

be certified as a 'Bollino Rosa' Firm.

The results shown in the previous section can be considered as a step in the whole process of certification that can use FES tools for assessing firms and addressing specific policies for each firm to reach a final assessment. The results of Fuzzy evaluation will be transmitted to the firms and commented upon by the relevant expert/auditor. According to the results obtained each firm will introduce the needed changes for correcting the gender discriminations. At the end of the evaluation path and only when the organizational situation within the firm will be improved, it will receive a Label that will identify it as a "Bollino Rosa firm", i.e. a gender friendly workplace in terms of equity and sustainability. The process towards certification of gender equity and sustainability involves also an assessment of the steps towards a higher values in the critical dimensions by means of the FES application to evaluate the changes occurred over time. Firms can therefore assess their level of 'Bollino Rosa' connected to the strategies enacted to improve its value.

4 Pursuing in the process of certification

The results shown in the previous section can be considered as a step in the whole process of certification that can use FES tools for assessing firms and addressing specific policies for each firm to reach a final assessment. The results of Fuzzy evaluation will be transmitted to the firms and commented upon by the relevant expert/auditor. According to the results obtained each firm will introduce the needed changes for correcting the gender discriminations. At the end of the evaluation path and only when the organizational situation within the firm will be improved, it will receive a Label that will identify it as a "Bollino Rosa firm", i.e. a gender friendly workplace in terms of equity and sustainability. The process towards certification of gender equity and sustainability involves also an assessment of the steps towards a higher values in the critical dimensions by means of the FES application to evaluate the changes occurred over time. Firms can therefore assess their level of 'Bollino Rosa' connected to the strategies enacted to improve its value. Further research involve considering how the level of gender equity and sustainability in the firm relates to the socioeconomic environment the firm is inserted in. As shown in the following chart the firm operates in connection to local, national government and European Commission that can set rules or adopt policies that are going to affect the firm's situation with regard to Gender Equity or Gender Sustainability. For instance the National Law 53/00 introduces the possibility for firms to receive funds dedicated to the implementation of family friendly policies that can improve gender sustainability in the firm. On the other hand the firm can supply childcare services for their employees but open to other families that can improve gender sustainability of employment in the area. Equal Opportunity Counsellor can take an action to remove discrimination in the firm. The firms that are suppliers or clients can be characterized by a different degree of gender equity and the workers in the firm are going to be affected by the equality or gender sustainability policies of the firm. Trade unions at local or at

national level can bargain over working hours schedule to obtain a working time more that balances more with private and family life. The network of relations amongst private and public agents leading to the obtained results can itself be evaluated calling for an extension of the evaluation process to subcontractors, suppliers, clients. The system now includes firms' evaluation on the situation of clients and suppliers with regards to gender equity and this awareness is accounted for as a part of the gender equity dimension. However to have a more precise information on the interactions amongst firms in a gender perspective the whole network of firms should be reconstructed and subject to the evaluation process. Italy is characterized by a highly segmented labour market (by area and type of occupation) and by a different level of diffusion of public care services that can have an impact on gender equity and sustainability of work. Local labour market and institutional variables can be inserted to provide a comparative analysis upon different areas in Italy producing a more complex indicator of gender equity that can be inserted in the evaluation of gender human development.
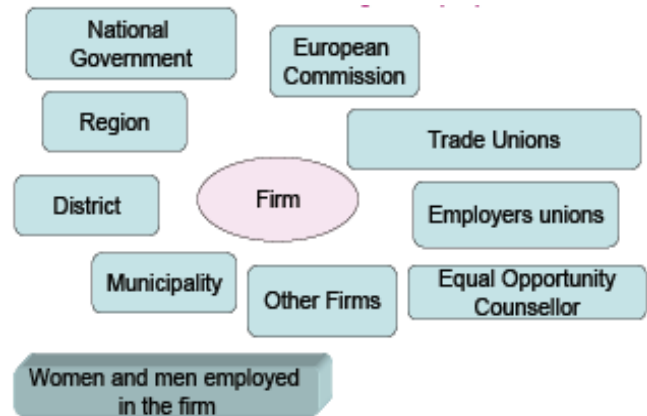

Figure 3: Toward firm's evaluation in a gendered perspective

5 Conclusions

The process of firm's evaluation in terms of gender equity pursued by the project 'Bollino Rosa' promoted by the Italian Ministry of Labour in year 2007 requires collecting and analysing indicators on different dimensions of gender equity. To provide a synthetic indicator on the firm's situation without loosing the complexity of the different dimensions of gender equity we have modelled and applied a Fuzzy Expert System. To our knowledge this is the first attempt of using Fuzzy Expert System to assess firms with respect to gender equity and gender sustainability, though broader issue of the gender perspective in the evaluation of quality of work using fuzzy expert system has been considered in [8]. Other experiences carried out in European countries implies self-evaluation like Total Equity Prize in Germany) or evaluation on the basis of the policies enacted by the firms in terms of equal opportunities, on their human resources management and on the presence of work life balance policies (like Label Egalité in France) however they do not use a system of evaluation structured as the one used

in this application [5]. The micro data used have been collected through a structured questionnaire submitted to a sample of firms in the Private Sector that have proposed themselves by answering to a public competition on participation to the experiment, further extension to the public sector and a calibration of the questionnaire should follow its experimental phase. In this line we plan to let firms construct measures of net gender wage gap (by connecting wages to employees' individual characteristics on their work experience and education) that can improve the system of gender equity evaluation (currently based on gross wage gap). With respect to other systems of evaluation the proposed method entails an analytical model of evaluation that confers numerical indicators useful for the firm to assess its position as far as gender equity and sustainability are concerned allowing a backward process to detect causes of poor grades in terms of gender certification. Another advantage of the system is the transparency of the evaluation system reached by a clear statement of input variables and the rules used by the experts. Sometimes the transparency is not an advantage especially in situations in which politics is involved, but we think that a clear and transparent method is better than others in which the choices are expressed in "obscure" words in order to hide real choices from people involved. Public institutions and government can use the results of this model in terms of gender certification of firms to take policy decisions. They can also infer by comparative analyses on different areas how different policies and agreement carried out also at local level may interact with the gender assessment of firms in that area. Policies to consider firms' gender certification in gender equity and sustainability can also be used as an indicator for the assessment of firms when public institutions or firms contract out part of their production. This approach, more typical of engineering problems, finds here an interesting multi-disciplinary application. A very heterogeneous research unit containing mathematics, economics, sociology, political and trade union experts have faced this application. The fuzzy approach has given us all the possibility to work together, to have a common language. This language is due to the linguistic attributes of the variables, the rules given in a verbal way and the final interpretation of the results

Acknowledgment

References

[1] Addabbo T.- Borghi, V. -Favaro, D."(2006) Differenze di genere nell'accesso a posizioni apicali. Risultati di una ricerca sul campo, in A. Simonazzi (ed.) Questioni di genere, questioni di politica. Trasformazioni economiche e sociali in una prospettiva di genere, Roma, Carocci, 2006.

[2] Addabbo T. – Facchinetti G. - Mastroleo G. (2005). "A fuzzy expert system to measure functionings. An application to child wellbeing". In K. Saeed, R. Mosdorf, J. Pejas, P. Hilmola, Z. Sosnowsky (eds) Proceeding of Image Analysis, Computer Graphics, Security Systems and Artificial Intelligence Applications. Bialystok Vol. 1, 29-42.

[3] Addabbo, T.: Unpaid work by gender in Italy,Ch.2 (2003) in'Unpaid work and the economy', A.Picchio (ed.) Routledge,London and New York (2003)

[4] Addabbo, T. - Di Tommaso, M.L. -Facchinetti, G.(2004): To what extent fuzzy set theory and structural equation modelling can measure functionings? An application to child well being. Materiali di Discussione del Dipartimento di Economia Politica n.468, Modena (2004)

[5] Bassanini, C. (2008) 'Modelli e buone pratiche per la certificazione di genere nelle imprese: un confronto internazionale', in Príncipe G. et al.,(2008). Strumenti per certificare e promuovere la parità di genere in azienda, ISFOL, 2008, Ch.10.

[6] Burchell, B., Fagan, C., O'Brien, C. and Smith, M. (2007) Working conditions in the European Union: The gender perspective, Dublin, European Foundation for the Improvement of living and working conditions.

[7] Addabbo T. – Facchinetti G -Mastroleo G. - Solinas G. (2006). "A fuzzy way to Measure Quality of Work in a multidimensional view" Plenary lecture in the ACS Conference Poland October 2006. Jerzy Pejas, Imed El Fray, Khalid Saeed Editors Vol I, 13-24. ISBN 83-87362-75-

[8] Addabbo T. – Facchinetti G -Mastroleo G. (2007). "Capability and functiongs: A Fuzzy Way to measure interaction between Father and Child" in Biometrics, Computer Security Systems and Artificial Intelligence Applications. Khalid Saeed, Jerzy Pejas, Romuald Mosdof Editors 185-195, Springer, ISBN 978-0-387-36232-8 (Print) 978-0-387-36503-9 (Online).

[9] Facchinetti G. –Franci F.- Mastroleo -G. Pagliaro V.-Ricci G. (2007) Illogica di un conflitto. La logica fuzzy applicata al conflitto tra Israele e Libano, Eurilink editor ISBN 978-88-95151-04-5

[10] Picchio A. (ed.) (2003) Unpaid work and the economy London and New York: Routledge.

[11] Piegat A. (2001), Fuzzy modelling and control. Springer-Verlag, Heidelberg-New York.

[12] Príncipe G. et al. (2008). Strumenti per certificare e promuovere la parità di genere in azienda, ISFOL, 2008.

[13] Rosti, L.(2006) La segregazione occupazionale in Italia, in A. Simonazzi (ed.) Questioni di genere, questioni di politica. Trasformazioni economiche e sociali in una prospettiva di genere, Roma, Carocci, 2006.

[14] Sabbadini L.L. (2004) Come cambia la vita delle donne, Ministero per le Pari Opportunità, 2004.

[15] Shun-Hsien L. (2005) Expert System Methodologies and application- a decade review from 1995 to 2004. Expert Systems with application. Vol 28 Isuue 1 93-103.

[16] Wang L., (1992), Fuzzy systems are universal approximators Proc. Of Int. Conf. On Fuzzy Engineering, 471-496, 1992.

[17] Von Altrock C. (1997), Fuzzy Logic and NeuroFuzzy applications in Business and Finance, Prentice-Hall Inc.