A Novel Consensus Model for Group Decision Making with Hesitant Fuzzy Linguistic Information

R.M. Rodríguez[1], **Luis Martínez**[2]

[1] *Dept. of Computer Science and A.I., University of Granada, Granada, Spain*
rosam.rodriguez@decsai.ugr.es

[2] *Dept. of Computer Science, University of Jaén, Jaén, Spain*
martin@ujaen.es

Group Decision Making (GDM) is a usual process in companies and administration in which a group of decision makers try to obtain a joint solution for a complex decision problem by taking into account their different points of view situation [2]. Notwithstanding, in principle group decisions should be better accepted than decisions made by a single decision maker because they try to include several viewpoints, sometimes the decision processes do not consider the agreement in the solution, therefore such solutions can fail in their goal. To overcome such a problem, a consensus reaching process is added to GDM processes (See Fig 1), in which an iterative discussion process supervised by a human figure so-called *moderator* tries to guide by providing advice to experts in order to obtain agreed solutions by all decision makers participating in the decision problem [7].

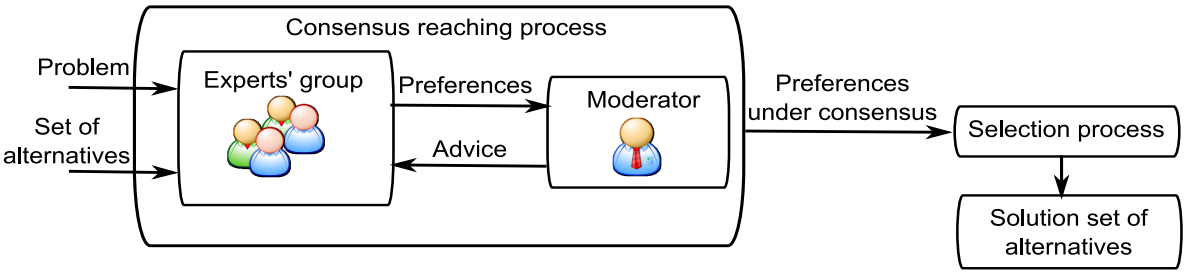

Figura 1: Consensus and GDM scheme

The complexity of GDM problems are often due to the uncertainty related to the imprecision and vagueness of the meaning of the decision situation that is modelled by linguistic descriptors [3]. Different linguistic *consensus* models have successfully dealt with these GDM problems [4, 5]. However, recently it has been pointed out that in GDM problems dealing with linguistic information may be necessary to offer a higher flexibility to experts for eliciting their preferences to manage mainly their hesitancy about linguistic assessments when a single linguistic term does not adjust enough to their knowledge/preference [6]. This contribution provides below a novel *consensus* model for GDM problems dealing with Hesitant Fuzzy Linguistic Term Sets (HFLTS) that have been proposed to deal with hesitancy in linguistic GDM problems.

This work is partially supported by the Research Project TIN2015-66524, Spanish Ministry of Economy and Finance, Postdoctoral Training (FPDI-2013-18193) and ERDF..

1. *Determining Group Decision Problem*: it determines the GDM problem defining the alternatives, experts and domains of expression for experts' preferences.
2. *Gathering Preferences*: Each expert provides her preferences by means of a preference relation P_i, with linguistic terms and linguistic comparative expressions.
3. *Making Information Uniform*: Preferences (fuzzy membership functions representing the linguistic terms and the comparative linguistic expressions) are conducted into a unified expression domain by using fuzzy sets [1].
4. *Computing Consensus Degree*: It computes the degree of agrement or consensus degree, amongst decision makers [2], measured as a value in [0,1] such that the more value the better.
5. *Consensus Control*: Consensus degree is compared with a consensus threshold $\mu \in [0,1]$, established a priori by the group.
6. *Advice Generation*: When consensus required is not achieved, decision makers are advised to modify their preferences to make them closer to each other and increase the consensus degree in the next round of the Consensus Reaching Process.

This contribution has presented a consensus model that deals with HFLTS information in GDM to achieve agreed solutions in GDM problems defined in qualitative settings in which experts can hesitate when eliciting their preferences.

Referencias

[1] F. Herrera, L. Martínez, and P.J. Sánchez. Managing non-homogeneous information in group decision making. *European Journal of Operational Research*, 166(1):115–132, 2005.

[2] J. Kacprzyk. Group decision making with a fuzzy linguistic majority. *Fuzzy Sets and Systems*, 18:105–118, 1986.

[3] L. Martínez, D. Ruan, F. Herrera, E. Herrera-Viedma, and P.P. Wang. Linguistic decision making: Tools and applications. *Information Sciences*, 179(14):2297–2298, 2009.

[4] F. Mata, L. Martínez, and E. Herrera-Viedma. An adaptive consensus support model for group decision-making problems ina multigranular fuzzy linguistic context. *IEEE Transactions on Fuzzy Systems*, 17(2):279–290, 2009.

[5] I. Palomares, J. Liu, Y. Xu, and L. Martínez. Modelling experts' attitudes in group decision making. *Soft Computing*, 16(10):1755–1766, 2012.

[6] R.M. Rodríguez, L. Martínez, V. Torra, Z.S. Xu, and F. Herrera. Hesitant fuzzy sets: state of the art and future directions. *International Journal of Intelligent Systems*, 29(6):495–524, 2014.

[7] S. Saint and J.R. Lawson. *Rules for Reaching Consensus. A Modern Approach to Decision Making*. Jossey-Bass, San Francisco, 1994.