



## **Survey and brain storming studies about machines, constructions, human and environmental risk consideration in the careers of the Universidad Politécnica de Madrid**

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The Universidad Politécnica of Madrid (UPM) includes schools and faculties that were for engineering degrees, architecture and computer science, that are now in a quick EEES Bolonia Plan metamorphosis getting into degrees, masters and doctorate structures. They are focused towards action in machines, constructions, enterprises, that are subjected to machines, human and environment created risks. These are present in actions such as use loads, wind, snow, waves, flows, earthquakes, forces and effects in machines, vehicles behavior, chemical effects, and other environmental factors including effects of crops, cattle and beasts, forests, and varied essential economic and social disturbances. Emphasis is for authors in this session more about risks of natural origin, such as for hail, winds, snow or waves that are not exactly known a priori, but that are often considered with statistical expected distributions giving extreme values for convenient return periods. These distributions are known from measures in time, statistic of extremes and models about hazard scenarios and about responses of man made constructions or devices. In each engineering field theories were built about hazards scenarios and how to cover for important risks. Engineers must get that the systems they handle, such as vehicles, machines, firms or agro lands or forests, obtain production with enough safety for persons and with decent economic results in spite of risks. For that risks must be considered in planning, in realization and in operation, and safety margins must be taken but at a reasonable cost. That is a small level of risks will often remain, due to limitations in costs or because of due to strange hazards, and maybe they will be covered by insurance in cases such as in transport with cars, ships or aircrafts, in agro for hail, or for fire in houses or in forests. These and other decisions about quality, security for men or about business financial risks are sometimes considered with Decision Theories models, using often tools from Statistics or operational Research.

The authors have done and are following field surveys about risk consideration in the careers in UPM, making deep analysis of curricula taking into account the new structures of degrees in the EEES Bolonia Plan, and they have considered the risk structures offered by diverse schools of Decision theories. That gives an aspect of the needs and uses, and recommendations about improving in the teaching about risk, that may include special subjects especially oriented for each career, school or faculty, so as to be recommended to be included into the curricula, including an elaboration and presentation format using a multi-criteria decision model.

References could be about OR, Decision Theory, but also from UPM schools or careers fields of action.

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