New methodologies to evaluate risks in the agricultural sector

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Abstract
The agricultural sector is characterized by a set of highly dynamic and diversified productive activities, in which the evaluation of the risks doesn't depend only on elements connected to all these activities, but also on external factors (climatic, biological, pathological, etc.) that during the analysis of the risk at the workplace necessarily have to be considered. So, increasingly emerges the demand to individualize a series of application tools that can facilitate the agricultural entrepreneur in the evaluation of the risks. The principal objectives of this job are the construction of a model of analysis of the risks *ad hoc* for the agricultural sector; the development of operational and managerial safety systems; the construction of prevention and protection measures for the workers of this sector. This research has been divided into four phases (cognitive; analytical; planning; operational). The agricultural entrepreneur underestimates the importance of a correct analysis of the risks and, besides not carrying out the formal obligations of law, he doesn't effect a correct business organization in terms of prevention and protection. Many critical points are emerged also in terms of the training of the workers: the seasonal labour (so diffused in agricultural) is often not trained on the specific risks of his work, and the firms often don't preserve the documentation about safety procedures, training manuals, etc. This research has brought to the construction of an analytical model for the situations of risk. The model has been developed identifying as priority the simplicity in the use and the versatility of the same model. This work wants to be the starting point for the identification of new guidelines to cope with the problem of the safety at the workplace in the agricultural context.

Keywords: safety, agricultural worker, safety management.

Introduction
The elements of risk and danger daily join the working life of the farmers: the agricultural sector is characterized by a high dynamism and diversified productive activities, in which the evaluation of the risks doesn't depend only on elements connected to all these activities, but also on external factors. As reported by OSHA (European Agency for Safety and Health at Work), over 10 million people work in agriculture in Europe. In addition to full time workers, there are many temporary and seasonal workers. Agriculture is a significant employer of women, and women are often on 'family farms'. Additionally, children are often present in the workplace.

Starting from the wine growing sector and arriving to the animal husbandry, all the agricultural workers have to transversally compare with mechanical, physic, chemical, biological risks. Every year the number of the accidents in which farmers are involved grows radically with an average, in the last years, of 1200 deaths. Along with the building sector, the agricultural one is the most dangerous and, despite recent improvements in Italian directives

concerning safety at the workplace, records accidents with a high frequency index (INAIL, 2007).

Materials and methods

The objectives of this work are to identify some strategies for the reduction of the risks; to develop some new systems for the prevention and protection of the workers; to define some application models.

The whole search originates from the experience realized in the agricultural, wine growing and of animal husbandry sectors. Starting form the conviction (according to the OSHA precepts that must belong to everybody) that to protect workers' health and safety we may carry out a risk assessment, we have developed our work, for each sector, proceeding through these 4 steps:

a. Context Analysis
b. Evaluation Methods
c. Planning
d. Proposal of operating solutions

STEP 1: Analysis of the context

This analysis has been the starting point of the work and lead up to the development of the following elements of analysis: the characterization of the sampling and the analysis of risk conditions.

Table 1. Elements for the characterization of a firm

Characterization of the sampling
Firm Dimensions
Number of Workers
Address
Production Typology
Technological Level
Machinery
Buildings
Managerial and Organizational Structure
Specific Technical Areas
Storage
Animal husbandry: number of animals
Type of Production

The characterization of the sampling allows the individualization of a series of elements (table 2) in which subsequently develop the evaluation. These are descriptive elements identified depending on the typology and productive address of the firm and correlated to the potential risk deriving from a bad management. So we need to know where the workplace are located; who works there (distinguishing their typology: temporary, seasonal, foreigner and their number); what tasks are performed; what is the technological level; what machinery are used; the conditions of the buildings; the way the firm is organized, etc.

The analysis of the risk conditions (table 3) has allowed us to underline the elements (managerial, formal and substantial ones) external and internal at the business strategies, that determine some negative effects in the safety conditions, increasing the critical points in the working environment.

Table 2. Conditions of risk

Substantial Aspects	Managerial-Organizational and Behavioural Aspects	Formal Aspects
Insufficient mechanical equipment	Underestimate the danger	Lack of documentation
Scarce maintenance	Lack of organization in terms of Safety	Not formalized employments
Scarce predisposition to make investments	Impossibility to determine a business organization in terms of safety	Absence of formal managerial levels
Obsolescence of bulidings and plants	Familiar Management	Lack in training and information of the workers
Incorrect management of workers	Lack of organizational measures	

STEP 2: Evaluation methods used

Two lines of evaluation have been studied: an evaluation based on a quantitative model and an evaluation that use a qualitative one.

1) Evaluation with a quantitative model.

This method has been developed by using check lists specific for the context.

For each area of investigation, some sub-areas of analysis have been identified (Table 1) Then, by using the formula:

risk = frequency x gravity

The analysis of the context has been developed.

2) Evaluation with a qualitative model

To each area of study we have associated a series of quantitative describers, able to give a visual image of the situation to the entrepreneur.

Table 3. Example of the application of the qualitative evaluation

Locations	**Conformity to the destination of use**	**Hygienic-sanitary conditions**	**Order**	**Structures and equipments functionality**	**Safety operator**
Viability					
Warehouse					
Offices					
Machinery store					

This method, from the scientific and analytical point of view, has only been used for managerial objectives: in such way, that the agricultural entrepreneur can easily have the business situation under control in real time.

Table 4. Symbols used for the qualitative evaluation

Good conditions	
Standard conditions	
Good enough conditions	
Not good enough conditions	
Grave anomaly	

STEP 3: Planning
In this step we have developed a series of measures of planning:

- Planning of spaces from the safety point of view
- Planning of interventions on agricultural machines
- Planning of interventions of training
- Redefinition of strategies for the management of the risk

STEP 4: Proposal of working solution
At the end of the three previous phases, we have defined some working solutions in the contexts and business reality with greater critical points. So, the following areas have been identified:

- Development of plans for the management of the risks
- Business plan for the strategic interventions
- Handbook business
- Formation plains

This methodology has been developed on a sample of 60 firms, belonging to heterogeneous economic sectors. Then, all the identified lacks have been analyzed in the analytical part.

Results

We can observe that there are some big problems in the management of the stores: in this context, the analysis have underlined numerous problems, both in the conditions of use and in the condition of exercise and use of the spaces, that are often obtained in not appropriate places.

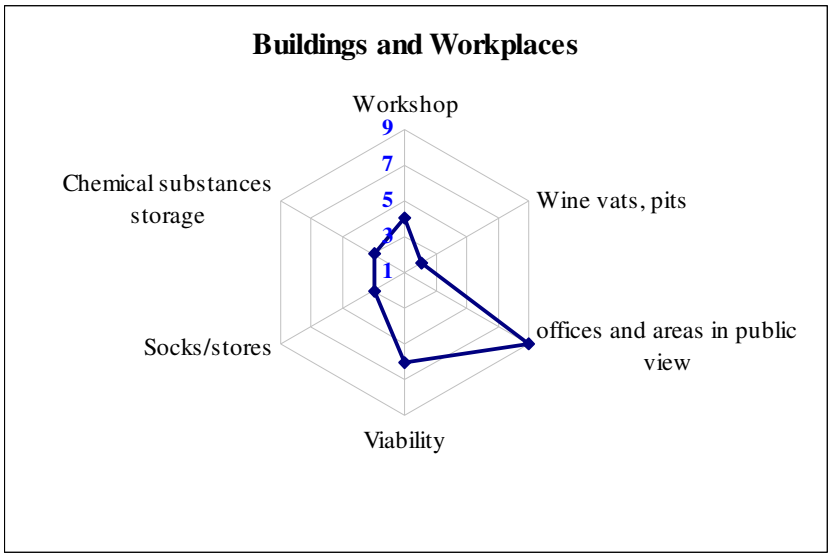

Figure 1. Greater critical points in the structural aspects of the analyzed sample

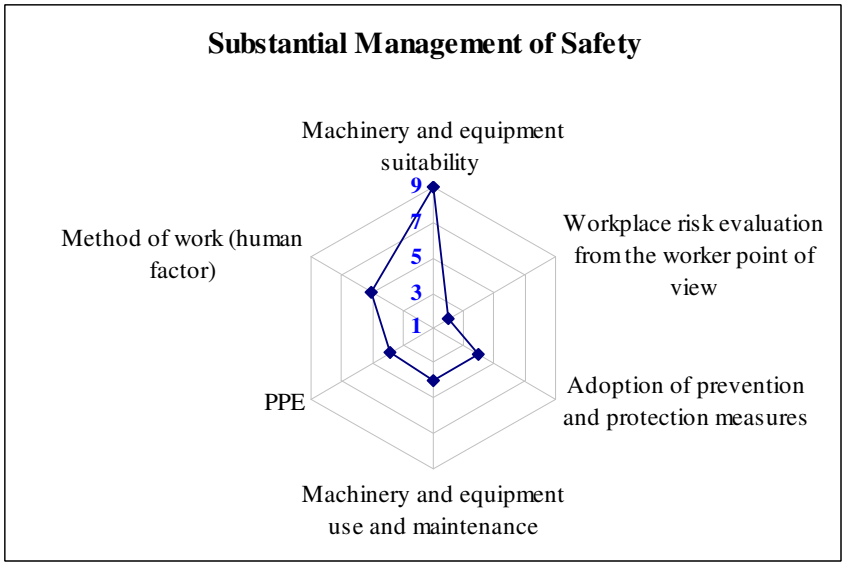

Figure 2. Risk evaluation considering the substantial aspects

Analysing these aspects that we have defined as the 'substantial' ones, we have noticed critical situations in the aspects of normal maintenance of the equipments and also there are incorrect behaviours in the work phases. In particular, there is a lack in the use of the personal protective equipments (PPE) also during the most hazardous activities.

Figure 3. Evaluation of the managerial and organizational aspects

In the firm management, the theme of the safety is hardly considered. This area of analysis is, in fact, the most problematical and many critical points have been individuated.
Safety is mostly lived inside the organizational and managerial context as an element of expending, not tied to the functional context of the firm. Only the certified firms and the one of great dimensions have slightly had some positive evaluations: we found a correlation between the safety levels and the number of busy people. A tool that reassumes all the procedures and best practices that should be developed inside a winery for the management of a tractor is represented in the following graph:

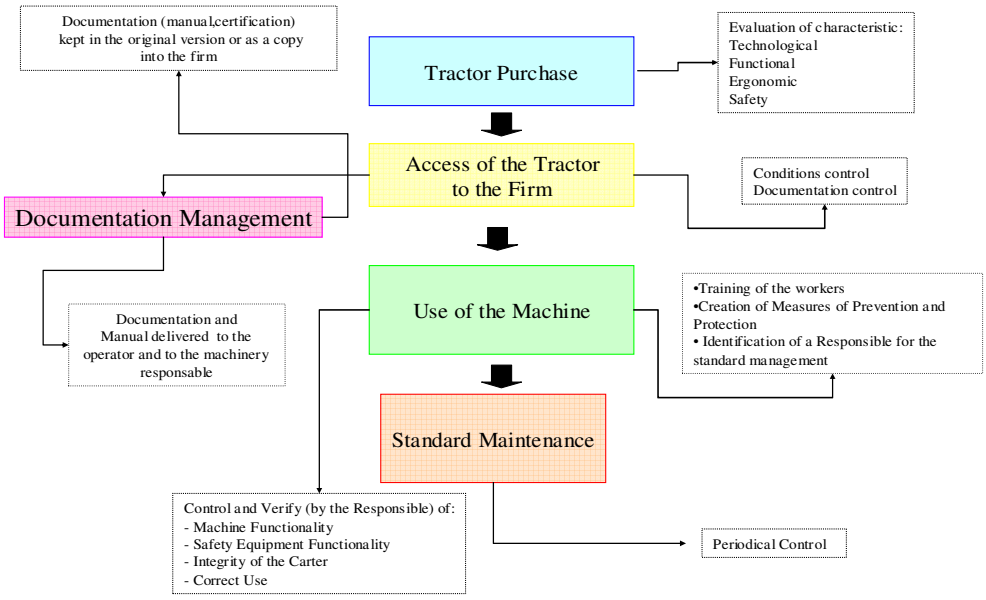

Figure 4. Example of management of the agricultural machines

Conclusions

We therefore need new methodological forms of risk evaluation (see for instance table 4) close to new strategies for the management of the organizational trials concerning the prevention and protection at workplace.

This work has underlined the critical situation of the firms in terms of management of the safety. This determines the necessity to sensitize the agricultural entrepreneur not only on the general aspects of the safety, but also on the aspects of the work organization and of fulfilments of the formal aspects. Resorting to simple mechanisms as the training and the information during the assumption of the temporary or seasonal, a virtuous mechanism that would allow the diminution of the accidents would be established. Besides, from the managerial point of view, the identification of some figures, that internally can make a punctual and constant control on the safety conditions, would be necessary for a correct management of safety levels, in order to make growing the culture of safety. These concepts are already applied in other sectors (agro-industrial, tertiary), while are not present in the agricultural one.

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