

ASPECTS OF THE MAINTENANCE WORKERS' SKILL SHORTAGE IN AGRICULTURE

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Abstract

Skill shortage exists when there are not enough people with a particular skill to meet demand. In agriculture, this is also generated by the technical revolution that can be characterized by the Farming 4.0 concept. This paper analyzes the serious problems of maintenance in agriculture, especially those related to workers' skills and competencies, in order to identify applicable solutions to solve, to improve the sustainability of production processes and accelerate innovation in the field.

This article is the result of research based on the analysis of achievements, experiences and international trends in the field, compared to the situation in Romania.

Due to the high value of fixed assets maintained, worker's abilities and skills have a major impact on the results of companies. Only a practical competency-based education, certification of those skills and competencies, complemented by financial motivation will lead to increasing the number and quality of the maintenance workers. There was made a comparative presentation of procedures of management for maintenance problems, in context of globalization, followed by choosing those that best fit and will bring the greatest benefits for Romanian agriculture.

This article is a warning to educational institutions and business environment, to the awareness of the serious problems of maintenance.

Key words: maintenance, Farming 4.0, overhaul, MRO, IoT, precision agriculture.

INTRODUCTION

The Department of Economic and Social Affairs, Population Division, of the United Nations, (United Nations, 2017) has predicted that the global population will reach 8.55 billion people by 2030 and 9.77 billion people by 2050. In order to feed this growing population, according to FAO, food production must increase with 70 percent by 2050 and a 60 percent increase in demand for high quality protein such as milk, meat, and eggs. In 2017 the number of undernourished people is estimated to have increased to 821 million according to FAO (Food and Agriculture Organization of the United Nations, 2018),

In the current uncertainty and economic crisis, reducing costs is a primary goal. The objective of maintenance is to reduce the number of unexpected breakdowns due to failures, which may be catastrophic and may cause huge loss. In today's companies, maintenance is one of the costliest aspects of operation and plays an important role, not only the costs of maintenance itself, but also the costs of production losses due to equipment breakdown. In order to cut the cost and increase profit margin, it is necessary to develop an optimization system to achieve the system

maintainability, reliability, availability and safety at the same time. The direct maintenance cost would be estimated in the range of 450 billion € for the European member states (KPMG Advisory, 2015). The ageing of maintenance employees in EU could become a stringent problem within 10 - 15 years if no adequate measures are taken (KPMG Advisory, 2015).

According to the EN 13306 standard, maintenance is a combination of all technical, administrative and managerial actions during the lifecycle of an item intended to retain it in, or restore it to a state in which it can perform the required function. Today, it's often a mixture of asset management and maintenance. The KPMG study published in 2015, revealed that in the field of MRO (Maintenance, Repair and Overhaul), there are working 10 - 15 percent of the active population of each EU country (KPMG Advisory, 2015).

Like most crises, it was announced initially in the USA, with more than 10 years ago (Schmidt E., 2015) and in 2008 it was a song done to raise awareness to maintenance problems (https://youtu.be/WJJ_zFvAS1M).

Unfortunately, in addition to specific technical maintenance problems, it was emphasized the lack of skilled employees in this sector. The USA has forecast an annual growth of jobs in this field for over 1 percent. (Bureau of Labor Statistics, 2017).

Solving human resource issues involved in the maintenance of fixed assets should be treated not only at company level but also at the level of state institutions.

KPMG Advisory (2015) recommends the development of a Europe 2020 strategy with regards to maintenance problems.

The aspects studied are those related to organizing, education (certification), news dissemination, safety and wage. Based on the measures and results obtained in the USA and in the EU, regarding to the maintenance crisis, conclusions will be highlighted and recommended for implementation in Romania.

MATERIAL AND METHOD

This study analyzes the stage of achievements and the necessary directions for evolving workers' skills due to the new revolution from agriculture.

Because agriculture is regarded as an industry, most analyst's transposes industry forecast in agriculture. In the manufacturing industry, after the term Digital Revolution, the Industry 4.0 or Fourth Industrial Revolution (i4.0) concept appears. Similarly, in agriculture, appear initially the term "Digital Farming" and after that Agriculture 4.0 and Farming 4.0.

Unfortunately, there are two major issues affecting agriculture, the

evolution of the weather and the environment protection in the long term (especially soil) which complicates achieving optimal solutions.

Because of the complexity of the workers' skill shortage problem, in this paper we deal only with four of its aspects.

The first considered aspect of the problem is the professional association in maintenance domain. Professional associations are important, not to defend the rights of its members, but to disseminate the latest information from the field, to certify member's knowledge, to develop and propose procedures and standards to improve working conditions, to increase safety and environmental protection.

The largest professional associations in the field of maintenance are: Global Forum on Maintenance and Asset Management (<http://www.gfmam.org>), European Federation of National Maintenance Societies (<http://www.efnms.org>), Latin American Federation of Maintenance (<http://www.fim-mantenimiento.org>), Gulf Society of Maintenance Professionals (<http://gsmpegulf.org>).

At these important associations, there are affiliated national associations like: The Japan Institute of Plant Maintenance (<http://www.jipm.or.jp/en/>), The Society for Maintenance and Reliability Professionals USA (<http://www.smrp.org>), Asset Management Council Australia (<http://www.amcouncil.com.au>), Association Française des Ingénieurs et Responsables de Maintenance (<http://www.afim.asso.fr>), Plant Engineering & Maintenance Association of Canada (<http://www.pemac.org>). Most national associations are recognized as a public interest organization by their states. Most of the former socialist countries, Slovenia, Slovakia, Lithuania, Croatia, Serbia, are represented in EFNMS.

Romania has no representative in these associations, although there is the Romanian Society of Maintenance (<http://www.soroment.ro>) located in Constanța, which requested affiliation to EFNMS in 2012, but it has not yet been accepted. We can mention the specialty club, Romanian Maintenance Club and Maintenance and Industrial Distribution magazine, founded by the association Impact in Society (<http://www.msdi.ro>), but which no longer have activities.

The second considered aspect of the problem is the education for maintenance jobs. "Europe has long faced the problem of mismatches between worker's qualifications and skills and job requirements; the crisis has made this situation worse. According to Eurofound, 39 percent of the EU employers reported difficulties finding workers with the right skills in 2013. Investing in skills is crucial to overcome these bottlenecks." (European Commission, 2014).

Employee's specializations in MRO are usually trained in the

company, by learning from those experienced, due to the fact that there are no sufficient specializations in educational system. There is an increasing need for a quality-controlled assurance of competence among the people active in maintenance. To facilitate the integration of competent employees in the MRO domain, there were developed internationally several certifications. Most professional associations in the field of maintenance are involved in the training of maintenance specialists and in the examination for obtaining the certificate of specialization in maintenance.

The internationally highest recognized certificate belongs to The Certified Maintenance & Reliability Professional (CMRP) Certificate accredited by the American National Standards Institute (ANSI), which follows ISO standards for its accreditation and processes. The Certified Asset Management Assessor (CEMA) certifies the knowledge and understanding of the Asset Management System in accordance with ISO 55001. The Certified Maintenance & Reliability Technician (CMRT) is used mainly in America.

The European Federation of National Maintenance Societies (EFNMSvzw), is the European organization, which has got all the necessary knowledge of the competence requirements in the areas of maintenance. The European Certification Committee (ECC) will, on behalf of the EFNMSvzw, perform the certification of persons in the field of maintenance in Europe, in accordance with international and European rules and requirements. The ECC will also be able to certify people according to the EFNMSvzw rules and requirements, even outside of the member countries of the EFNMSvzw.

Among the modules studied for getting these certificates, there are: Integrated Strategy for Maintenance Management, Production and Operations Management for the Maintenance Manager, Human Resources Management for the Maintenance Manager, Financial Management for the Maintenance Manager, Developing and Implementing Maintenance Tactics, Maintenance Work Management, Computerized Maintenance Management Systems.

At European level, an important step was the start of the project based on European funds INTERREG IVB, MORE4CORE – Maintenance for competitiveness, started in 2014. The More4Core project has a total financial budget invested by its partners of 2.5 million Euros of which approximately 50 percent is funded by EU. Through this project, a framework was developed for the European Maintenance Skill Passport, linked to individual sector-specific European Credit system for Vocational Education and Training (Strijbosch, 2015). Another important achievement of this project was identifying priority cases for transnational normalization of standards, providing guidance to business that aim to expand

internationally, and starting the dialogue for action with standardization authorities (Association française des ingénieurs et responsables de maintenance, 2015).

Regarding the Romanian Ministry of National Education and Scientific Research (Ministerului Educației Naționale și Cercetării Științifice, 2016) there is a constant concern, reflected by updates to implement the EU educational policies. Unfortunately, subordinate institutions were not concerned about education in the field of maintenance. In order to compensate the shortcomings in the qualification of employees, according to the National Institute of Statistics (Institutul Național de Statistică, 2012), 24.1 percent of Romania's economic units have provided professional training to employees.

The third considered aspect of the problem is the safety and health at maintenance jobs. According to the European Union (European Agency for Safety and Health at Work, 2010), because maintenance workers carry out a wide range of activities, they are exposed to many and varied risks at work. Subcontracting maintenance is considered an aggravating factor in terms of safety and health. Analysis of EUROSTAT data based on the ESAW methodology, indicate that around 15 – 20 percent of all accidents in 2006 were related to maintenance operations. It's also important that around 10 – 15 percent of all fatal occupational accidents were related to maintenance operations.

Studies indicate that industry maintenance workers might be especially at risk of contracting occupational diseases. According to a study by AFIM (Association Française des Ingénieurs et Responsables de Maintenance, 2013), maintenance employees have an occurrence of occupational diseases 8 – 10 times greater than the average population.

Occupational Safety & Health Administration, part of the United States Department of Labor, reported for October 1st, 2015 - September 30th, 2016, 625 people fatalities (https://www.osha.gov/dep/fatcat/dep_fatcat.html). In the 2014 report of the Bureau of Labor Statistics (2015), there was an average of 107 cases of work accidents per 10,000 full-time employees. Regarding the 3 maintenance activities evaluated, the average is 827 cases per 10,000 full-time employees.

In 2015, according to the statistical bulletin "Working Conditions" of the Ministry of Labor, Family, and Social Protection of Romania (Ministerul Muncii, Familiei, Protecției Sociale și Persoanelor Vârștnice, 2016), it was registered a number of 4300 people injured in work, from whom 183 workers were deadly injured. Unfortunately, data are not divided by activities.

The fourth considered aspect of the problem is the wages and salaries for maintenance works. Because maintenance activity is performed in all

economic sectors, wages in this area are very close to the average wage in each country. For example, in the US, according to the Bureau of Labor Statistics (2016), compared to an average hourly gross salary per economy which is 24.3 US dollar, the average wages and supplemental pay in maintenance is 23.71 US dollar. According to the Romanian National Institute of Statistics (Institutul Național de Statistică, 2016), in the first month of 2016, the average hourly net wage per economy was the equivalent of 2.52 Euros, and the average hourly net wage in maintenance was the equivalent of 2.48 Euros. This situation is determined by the fact that people in companies' management do not realize the impact on the profitability of the company, neither do they realize the higher level of technical knowledge required of those who perform maintenance work. An important exception are the big international companies, which are investing in the latest technologies, so they have revenues resulting from maintenance activities. They need extremely trained employees to work with systems such as maintenance resource management, condition-based maintenance, computerized maintenance management system or real-time maintenance. For instance, ThyssenKrupp Elevator AG Company with 50000 employees maintains more than 1.1 million elevators worldwide (Heinemann, 2016).

RESULTS AND DISCUSSION

It is essential to draw attention to the complex problems of the maintenance, repairs and overhaul that are not yet perceived to the true severity in Romania. Due to accelerating globalization and labor mobility, it is highly necessary to takeover and implement all standards, norms and procedures regarding maintenance by economic agent and educational system, too. In parallel, there should be increased the investment in new maintenance techniques, through computerization, automation and robotics, which lead to a higher degree of safety at work for employees and better environmental protection.

From the employer's point of view, the two major issues regarding specialists in maintenance are inadequate qualification and their reduced number. As in any field, to attract more competent young men, it is not enough to get motivating salaries and bonuses.

A first step is to change the vision of economic agents: maintenance is not an expense but a source of business sustainability and increasing competitiveness (Mărăscu and Thomas, 2007). With such a vision, the employee will be stimulated to create, to bring a plus to the business and to be convinced that this specialization guarantees him/her a successful career. Partnership and sponsorship of an associations dedicated to maintenance will help the employer by stimulating and increasing competence of the employee that will activate in that association.

An important issue of the qualifications of workers in the field of maintenance is the lack of practical abilities of those with undergraduate studies. By restarting and development of vocational and post-secondary schools we hope this will be resolved in a reasonable time, but it requires the involvement of the business environment so that students can practice in a competitive environment close to the real world. One solution is to use simulated enterprises (Băban et al., 2013), but students will learn a lot in a real company. Given that the necessary for maintenance specialists with higher education will grow continuously due to technological progress, increasing their skills and qualifications is the biggest problem. Although we have internationally recognized professors, some even lecture in other countries, who understand the symbiosis required between maintenance and the other activities of the company, production, marketing, quality tracking etc. (Verzea and Luca, 2013), there is not enough emphasis on this interdisciplinary field. In Romania, for Bachelor's degree there is no specialization focused on maintenance and for master level studies, we have only three specializations that contain the word maintenance.

To combat the shortage of skills and qualifications, economic agents should get involved in solving the problem, both by raising awareness of responsible ministries and educational institutions, and especially by working with them at all levels: specialization, types of subjects, subjects content, organizing competitions and thematic symposia and especially in specialized internships. Students' internship within economic units will be beneficial not only for students, but for the economic agents, too, because they will be able to hire staff with the specific knowledge required by the company and will integrate more easily into current activities.

CONCLUSIONS

The European Innovation Partnership 'Agricultural Productivity and Sustainability' was highlighted the importance of developing an EU ICT Architecture Strategy for AGRI-FOOD. In the current H2020 call for proposals, there is a call to submit a proposal for a multi-actor project on business models in agriculture (Boot, 2016).

We can conclude that the agricultural industry is about to be disrupted and will transform into a high-tech industry and will need a high skilled workers. In order for these workers to maintain, repair and operate high technology equipment in agriculture, with high quality and security, but also with high productivity, a national policy involving both state institutions and the environment private business. This national policy will have to support both education at all levels in the technical field as well as the actions taken by companies to increase the technical competence of agricultural workers.

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