

## Economical aspects of ergonomical integration in Latvia agriculture

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It has been found out in the authors' previous research that the 90 % respondents (students, workers and becoming specialists of occupational health and safety) disregard ergonomical conditions for safe work with computers. In result of computers usage 95% of respondents stated symptoms which testified negative influence on the health.

The aim of the study was to investigate the economical aspects of ergonomic integration of computers into farm life and to determine those aspects most economically advantageous to the Latvian agriculture industry. The methodologies used in the research were semi-structured interviews and inquiries to find out influence of ergonomical hazards on occupational health, analyse of statistical data. The respondents were the farmers of Latvia. Authors concluded that occupational in Latvia agriculture are short of understanding how important is ergonomical integration, and work environment adjustment on occupational needs.

The further investigations are necessary for valuation ergonomic hazards on occupational health in Latvia agriculture.

*Ergonomic, economical efficiency, agriculture'*

### Introduction

Crop production is a significant branch of agriculture. Its mandate is to supply plant products for human consumption and to produce raw materials for food processing. From an economics perspective, it is essential to find new ways and methods to increase economic efficiency and productivity while preserving human resources, and without reducing product quality. Therefore it is important to follow technological developments and market trends in the agriculture industry. One contributing factor to the economical efficiency of crop production is the growing use of computer technologies. Significant capital investment is needed for process automation and computer applications, as they greatly facilitate the work of employees, reducing the influence of ergonomical hazards on health.

As shown in previous studies at three Latvian universities - Latvia University of Agriculture, University of Latvia, and Riga Technical University (Brizga, Pēks, Bērtaitis, 2013) – emerging agriculture specialists do not understand how ergonomic requirements influence employee health and productivity. Although all of the respondents in these studies had several years of experience in computer use, and for 75% of the respondents it was longer than 10 years, they disregarded the conditions for safe and healthy work interface with computers. Therefore the authors have chosen to undertake this study examining computer usage in crop production.

In many developed countries of the world and in Latvia too, safe work practices are regulated by state-defined requirements for employers, employees and the state. Latvia adopted OHSAS 18001:2007, an internationally recognized and widely used occupational health and safety management system serving as the foundation for safe work practices. Ergonomics plays a significant role in this Standard: "Ergonomics (or human factors) is the scientific discipline concerned with the understanding of the interactions among humans and other elements of a system, and the profession that applies theoretical principles, data and methods to design in order to optimize human well being and overall system Performance," (International Ergonomics Association, 2010).

Ergonomic integration in any industry is crucial for increasing productivity and economic effectiveness. The collective research of scientists around the world shows (Miller, 2003) that for a knowledge society, the source of all wellbeing is human capital. The researchers point out that it is necessary to link ergonomics not only to human health improvement but also explicitly to company strategies and business goals, ensuring human prosperity through technological improvements (Dul, Neumann, 2009). The main purpose of ergonomics is to help us select more appropriate technologies for humans, taking into account their physical, mental, and intellectual capacities and body size, as well as the necessary competences for work performance.

Based on 45 years of research experience, Hal. W. Hendrik holds the view that ergonomics, as a science, investigates human capacity, limits and other factors, and how they are linked in the interaction between humans and other system components. He points out that specialists in the field of ergonomics (occupational health and safety specialists) are not always able to persuade organization leaders to invest in the implementation of ergonomical solutions (Hendrick, 2003).

### Research results

The study was conducted in a tomato growing hot-house in 2014. To determine the economic aspects of integrating ergonomics into plant production, the authors of the research carried out semi-structured interviews, inquiries, examined statistical data and evaluated ergonomic risks on production.

The tomato growing process is automated, its manual work aspects carried out with computer assistance. An employee's total working time with the computer is less than 2 hours and does not present a health hazard. During harvest time, an employee's activities involve sustained, awkward positions with frequent bending, as well as heavy lifting and moving, for example in manually harvesting tomatoes (Fig. 1).



Fig. 1. Tomato collection using a push-cart

Harvesting work involves frequent and repetitive movements, lifting, pushing and pulling. There is a significant risk of musculoskeletal injury.

The Quick Exposure Check (QEC) method was used for determining biomechanical exposure at work, and the following anatomical components were taken into account: back, shoulder/arm, wrist/hand, and neck (Kaļķis, 2008). Exposure descriptors for the work to be performed are summarised in Table 1.

Table 1. Exposure descriptors

Scores		Exposure level			
		Low (I)	Medium (II)	High (III)	Very high (IV)
Back	34	10...20	21...30	31...40	41...56
Shoulder/arm	38	10...20	21...30	31...40	41...56
Wrist/hand	26	10...20	21...30	31...40	41...56
Neck	12	4...6	8...10	12...14	16...18

The results indicate that during tomato harvest, employees are exposed to high levels of risk (III), particularly for back, shoulder/arm and neck. To reduce employees' exposure to ergonomic risk, the employer has to ensure compensatory activities: regulate rest breaks at work, evaluate options for load weight reduction, rotate employees, and conduct obligatory health examinations. To reduce biomechanical risk exposure and enhance productivity, the push-cart car was exchanged for an electric drive platform (2. Figure).



Fig. 2. Tomato harvesting on the electric platform

This change reduced employee workloads and also elevated work safety assurance and quality of health protection.

Research by the European Agency for Safety and Health at Work (2002) reports that member countries of the European Union (EU) suffered losses in the amount of 2,5 – 3,8% of EU gross domestic product (GDP) from work-related health problems, and every year lost 600 million working days which resulted in 20 billion euro losses per year (Europe OSHA, 2010).

Data from 2007 (EUROSTAT Statistics in Focus, 63/2009) show that 3,2% of EU employees (about 7 million people) have suffered in industrial accidents, but 8,6% of employees (about 20 million people) mention health disorders caused by working conditions.

Data from German insurers gives evidence that in 2006 the direct costs of work-related sickness and industrial accidents was 40 thousand million euros or 1, 8% of German GDP (German FIOSH, 2006). The 2007 research conducted in Europe showed that sick-leave certificates create notable losses for the economy, for example in Belgium 3,1% of GDP, in Czech Republic 3%, in Estonia 5,5%, in Netherlands 2,96% but in Latvia 2,8% of GDP (European foundation for the improvement of living and working conditions: Absence from work, 2007).

Calculations show that approximately one third of all absences from work (sick-leave certificates) are related to poor work conditions, and that at least 40% of those reasons responsible for work capacity losses are easily preventable (German FIOSH, 2006). Unfortunately, there is no such accurate accounting in Latvia of how much the disregard of workplace safety requirements costs the economy.

At the end of 2010 a research project was completed, financed by the European Commission, in which investments in various work safety events and accident prevention activities were analysed, and it was concluded that the cost/benefit ratio ranges from 2,19 to 2,89 (Belgium, 2010).

In this research, the questionnaire method was used to assess ergonomic risks in field-crop cultivation in the province of Latgale, Latvia. A random selection of 73 field workers were sent the questionnaire via email. Half of the respondents indicated that manually lifting heavy loads in the field is a major risk factor if the load exceeds 20 kg, 23% of respondents said that 11-20 kg is a risk factor for them, and a quarter of respondents said a medium load of 6-10 kg is a risk factor. Spending more than 4 hours at a time lifting heavy loads is typical for agricultural workers, who are usually men between the ages of 40 to 59 - the major risk group in the context of these risk factors. Most of the surveyed farm workers were aged 50-59 (33% or one-third of all respondents), 29% between the ages of 40-49, followed by 30-39 year-olds (23%), and 10% more than 60 years old. Most of the respondents (77%) have completed upper secondary or vocational education. The second largest group, 15%, have primary education (15%). Five percent have an Honours Undergraduate Degree and 3% have a Bachelor's Degree. Most of the respondents (almost two-thirds, 62%) have worked more than 10 years in crop cultivation, 30% of respondents have worked in the field for 6-10 years, and 7% for 2-5 years, while 1% have begun only recently.

State Labour Inspectorate statistics show that the number of fatal accidents in crop production increased by 66,7% in 2013 over 2012. In 2013 there were 64 accidents - 17 serious, but 4 fatalities (State Labour Inspectorate, 2013)

The number of work-related accidents involving first-time injured agricultural labourers has tended to increase – 35 patients in 2012, but 49 in 2013 (State Labour Inspectorate, 2013). According to data collected by the State Labour Inspectorate, it can be concluded that agricultural workers lack understanding of the importance of integrating practical ergonomics into their working environment. Research indicates that “ergonomic integration affects employee participation, their ergonomic awareness and practical skills, costs, type of organization, structure, policies and work culture“ (Kaļķis, 2014).

## Conclusions

1. Field-crop cultivation typically is hard manual labour, with sustained work postures and movements; it is consequently necessary to introduce technologies and devices appropriate to ergonomic requirements.

2. The authors consider that following the improvements made, tomato pickers achieved cost-effectiveness where the average cost-benefit ratio is 2.5, which should be clarified in a subsequent longer-term study.

3. There is an urgent need to educate agricultural workers about potential ergonomic risk factors in their workplace.

4. The introduction of computer technology in field-crop cultivation is not a risk factor in the health of employees, and will decrease existing risk factors.

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Улдис Карлсонс, Вия Озолина, Даце Бризга, Линардс Сисенис

Экономические аспекты интеграции эргономики в сельское хозяйство Латвии

Резюме

Авторы статьи исследовали интеграцию эргономики в растениеводство. Целью исследования являлось выяснение экономической эффективности и выгоды от интеграции эргономики и компьютерных систем управления в растениеводство. Авторы провели интервью и опросы, исследовали статистические данные и оценили эргономические риски в теплице по выращиванию помидоров и пришли к выводу, что

интеграция компьютерных систем в управлении растениеводством не создает эргономических рисков при работе с компьютером, так как суммарное время работы за компьютером не превышает 2 часов в смену.

Авторы считают, что введение эргономических мероприятий для уборки помидоров дает экономически выгодный вариант, где среднее отношение расходов и прибыли составляет 2,5. Авторы также постановили, что растениеводство характеризуется тяжелым ручным трудом, принудительными рабочими позами и повторяющимися движениями, для устранения которых необходимо соответствующее оборудование и установки, и необходимо проводить обучение рабочих по правильному применению оборудования и приспособлений для устранения эргономических факторов риска.

*Эргономика, экономическая эффективность, сельское хозяйство*

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