

# A study of the impact of ergonomically designed workplaces on employee productivity

Leber, M.<sup>a,\*</sup>, Bastič, M.<sup>b</sup>, Moody, L.<sup>c</sup>, Schmidt Krajnc, M.<sup>d</sup>

<sup>a</sup>University of Maribor, Faculty of Mechanical Engineering, Maribor, Slovenia

<sup>b</sup>University of Maribor, Faculty of Economics and Business, Maribor, Slovenia

<sup>c</sup>Coventry University, Faculty of Arts and Humanities, Coventry, United Kingdom

<sup>d</sup>University of Maribor, Faculty of Education, Maribor, Slovenia

## ABSTRACT

Ergonomics principles help designing the workplace in a way that makes work more efficient and safer. Employee satisfaction increasingly affects the productivity of a process, which also includes disabled people and represents an important source of human resources. In the framework of the EU-project ERGO WORK a survey-based research was conducted to measure the satisfaction of people with disabilities (PWD) in their workplace and assess how their satisfaction was perceived by employers in UK, Poland and Slovenia. Three hundred and three respondents were involved in the survey. Results show that PWD place a great emphasis on the satisfaction in the workplace. PWD in Slovenia are more satisfied than PWD in Poland, whereas the employers' perception of the satisfaction of PWD and other employees in Poland, Slovenia and UK does not vary. A general adaptation of the workplace significantly and positively influences the satisfaction of persons with disability and that the adaptation of the workplace to the needs of PWD is better if employers have access to knowledge, special equipment and financial resources.

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*\*Corresponding author:*  
[marjan.leber@um.si](mailto:marjan.leber@um.si)  
(Leber, M.)

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## 1. Introduction

### 1.1 Theoretical frame

In a time of high unemployment, employers are generally less interested in fulfilling employees' individual needs. This trend is especially visible in poorer European countries for example in Poland where employees are often underpaid with poor job agreements [1]. In a situation where non-disabled employees are struggling, with many agreeing to work in very unfavourable conditions, people with disabilities are even more challenged to enter the labour market. In Poland, discrimination against persons with disabilities (12.2 % of the population) has been tackled in numerous ways, however whilst their role is seen to be increasing, PWD are still largely invisible in public [2]. Companies in Poland with at least 25 employees are legally obliged to employ a minimum of 6 % of employees who have a disability.

More than 15 % of people living in the European Union have a disability. In Slovenia, the percentage of PWD is between 12 % and 13 %, not significantly less than in the wider EU (according to estimates). In 2014, PWD represented approximately 4 % of the work force in Slovenia. The number of employed PWD is slowly but steadily increasing compared to the previous years in regular working environments [3]. Regular working environments include all employments in

the public and private sector in the mandatory quota system for employing PWD; this means that in relation to the total number of employees the employer has to employ a certain number of PWD as notes Statistical Office of the Republic of Slovenia 2014.

In the UK, almost one in five persons has a disability [3]. The employment rate of working disabled employees is 47.8 % compared with 75.9 % of non-disabled people, and disabled people are nearly four times as likely to be unemployed or involuntarily out of work as non-disabled people [4]. In the UK, the Equality Act 2010 covering disability (as well as age, sexual orientation, religious beliefs) legally protects people from discrimination in the workplace and in wider society. It requires equal treatment in access to employment; and employers and service providers are obliged to make reasonable adjustments to the workplace to overcome barriers experienced by disabled people. Reasonable adjustments should be made in a range of ways for example through workplace furniture, training, adjusted hours, changes to policies, and provision of assistive technology.

## 1.2 Literature overview

It is recognised that ergonomics in a business environment improve the operational performance (production and product efficiency or the quality of services), productivity and create wellbeing of employees in the workplace [3]. For improving business performance organisations have to create an environment that facilitates operational performance and addresses the employees' wellbeing (health, safety). Considering ergonomics principles in designing workplaces and the adaptation of tasks to the physical and mental abilities of workers contributes to the creation of such an environment which can contribute to a better climate that fosters success and wellbeing at the same time [5].

Ergonomics as a scientific discipline tries to increase effectiveness by designing workplaces or adapting work, and by eliminating processes without added value as well as threats which increase the risk of developing illnesses and injuries of employees [6]. The application of ergonomics principles in a business environment can ensure a direct benefit for employees and organisations by easing physical and psychological burdens, reducing the risk of developing occupational diseases and injuries, and increases work efficiency [7]. Based on an EU directive, institutions in individual member states demand a risk and threats assessment for individual jobs. Ergonomics is a recognised discipline used to assess whether work, equipment and environment match the required performance of persons involved [8].

When designing jobs and products the aggregated information on processes, tools, machines, subjects of work, tasks and operators must be taken into account, limitations, which are often conflicting, must be met and a design must be generated, which will be acceptable for all parties involved [9]. The successful optimization of products is only possible if ergonomic aspects are systematically embedded into the product life cycle and if an Ergonomic evaluation is carried out of prototype solution variants. The optimisation process brings the most appropriate foam thickness and its stress-strain relationship to produce low contact pressures while maintaining high level of stability of the product grasp [10].

In a two-year period, a group of researchers [5] has taken a look at larger production plant and examined to what extent ergonomics measures for increasing operational performance and wellbeing of employees influence the incidence of diseases, injuries and pain. Based on measurements and evaluations they found out that the number of injuries and diseases recorded was smaller if the organisation applied ergonomics principles for facilitating the employees' efficiency and wellbeing.

Inclusive employment is one of the key priorities of the European Commission and its ten-year Europe 2020 strategy in the field of work and growth of the employed population. In order to avoid social exclusion of PWD it is important to adopt additional measures to meet their needs and at the same time consistently implement the principle of equal opportunities and the principle of non-discrimination due to disability [11].

Taking into consideration the fact that every one of us is different, the need for individual ergonomic support in the workplace becomes a necessity. Employees have special ergonomic

needs, whether it is due to disability, age or other special personal circumstances. The aging of the population and prolonging working lives contribute to an increasing number of employed persons with disability, whether it is a sight, hearing, movement or other type of impairment.

A holistic ergonomics access in companies supports human factors and the increasing diversity of employees; as such it contributes to the company's economic performance. It is recognised that ergonomics measures reduce absenteeism or absence from work (less work-related injuries and diseases) and raise the satisfaction and efficiency of employees. Taking this into consideration intensive campaigns oriented towards decision makers in organisations / companies must be promoted and supported [11].

Many factors influence the satisfaction of employees at work. They can be divided into organisational, group and personal factors, today we are considering further understanding of ergonomics in the workplace and the creation of workplaces for ergonomic principles [3]. Individuals will be satisfied if results are achieved at work that are in line with their personality, work values, needs and aspirations. Organisational factors such as content of work, distribution of working time, work conditions (adaptation of workplace, safety, and removal of disruptive factors), career prospects etc. influence the satisfaction as well. The following factors must not be overlooked: working atmosphere, relationships at work, treatment of people at work, which prevails in an undertaking [12]. On the path to achieving social inclusion in working environments it is important that people with disabilities are included in appropriate and meaningful work which leads to independence, creativity and enables an increasing self-respect and a positive self-image [13]. Removing and reducing obstacles at workplaces, understanding the needs of employed people with disabilities and creating opportunities for social participation and inclusion are important factors for the wellbeing and satisfaction of employed PWD [14].

## 2. Purpose of empirical research and hypotheses

The aim of this study was to research the satisfaction of PWD in the workplace and to find out how their satisfaction is perceived by employers in Great Britain, Poland and Slovenia. The following hypotheses were developed in order to achieve the aim of the research:

H1: PWDs' satisfaction varies according to the country of their workplace.

H2: The employers' perception on the satisfaction of PWD in the workplace is the same in all countries examined.

H3: The higher the perceived adaptation of the workplace for PWD or the better the knowledge of PWD on ways of adapting the workplace, the greater is the satisfaction of PWD in the workplace.

H4: The better the employers' knowledge of PWD-related legislation and their understanding of PWDs' needs are, and the better the employers' access to the resources is, the better the employers can adapt the workplace to PWDs' needs.

The study was limited to three European countries; and in the framework of the questionnaire to employers and employed PWD (the research did not consider higher education institutions). In the statistical processing of responses the study was limited to three indicators (adaptation of workplace to PWD, knowledge on legislation covering persons with disability and their needs, access to resources).

## 3. Research method

We conducted an online survey to obtain data from PWD and employers. We used Kruskal-Wallis H test to verify H1 and H2 and multiple regression analysis to test H3 and H4.

### 3.1 Sample

The study is an integral part of a wider research in the framework of the international ERGO WORK project ([www.ergo-work.eu](http://www.ergo-work.eu)). Target population in ERGO WORK research was PWD and their employers in six countries: Belgium, UK, Italy, Poland, Slovenia, and Spain. Companies and

institutions have been invited to participate - we chose those that are employing more PWD. We tried to cover production companies from different branches and different sizes. The statements of employers on topics under research were obtained by self-administered questionnaire. We applied different means of communications with PWD regarding their level of disability. Some of them obtained self-administered questionnaire with additional oral interpretation of questions and extra time to complete it. We also used an interview based on the questions from the questionnaire to elicit the statements of PWD who were not able to fill in the questionnaire on their own. The questionnaires were distributed in printed version by post (approximately 250) and on line (approximately 270).

Of the 520 invited participants 480 questionnaires were successfully completed. However, we analysed and discussed only data obtained by respondents in three partner countries: UK, Poland and Slovenia. The response rates in other partner countries (Belgium, Italy and Spain) were too low. From all three countries (UK, Poland and Slovenia), we obtained 303 usable questionnaires.

A total of 303 individuals responded to this research. 29 % of respondents were PWD and 67 % were employees without disability (Table 1). The major part of respondents came from Slovenia (47.9 %), followed by respondents from Poland (28.4 %) and UK (23.8 %).

**Table 1** Profiles of the samples

Country		Disability	Without disability	No information	Total
Poland	Count	33	53	0	86
	% of Total	10.9	17.5	0.0	28.4
Slovenia	Count	37	100	8	145
	% of Total	12.2	33.0	2.6	47.9
UK	Count	18	50	4	72
	% of Total	5.9	16.5	1.3	23.8
Total	Count	88	203	12	303
	% of Total	29.0	67.0	4.0	100

### 3.2 Data collection procedure and questionnaire

The questionnaire consisted of 70 questions (items) grouped into four sections. Considering the aims of this research, we selected 24 out of 70 items. The concept 'adaption of workplaces for PWD' was measured by 7 items, 'feelings on the workplace' by 5 items, 'familiarity with ergonomic design' by 4 items, and 8 items were selected to measure 'employers' knowledge of legislation covering PWD and their access to funding for adapting workplaces for PWD'. In addition, the respondents were asked to provide some demographic data. The original questionnaire was in English and it was translated to the language of each participating country. The online questionnaire was run using Bristol Online Surveys (BOS). This allowed easy distribution of the survey through a web link across Europe. Items from the questionnaire measuring specific concepts are presented in Table 2.

**Table 2** Description of concepts and variables

Code	Description of concepts and variables
Adaptation of workplace for persons with disability	
Q14	How well does your workplace accommodate people with disabilities?
Q17	This workplace is well adapted for people with disabilities - generally.
Q18	This workplace is well adapted for people with visual impairments.
Q19	This workplace is well adapted for people with hearing impairments.
Q20	This workplace is well adapted for people with physical impairments.
Q21	This workplace is well adapted for people with mental health needs.
Q22	This workplace is well adapted for people who have intellectual disabilities.
Feelings of persons with disability	
Q26	People work well together in this workplace.

**Table 2** Description of concepts and variables (continuation)

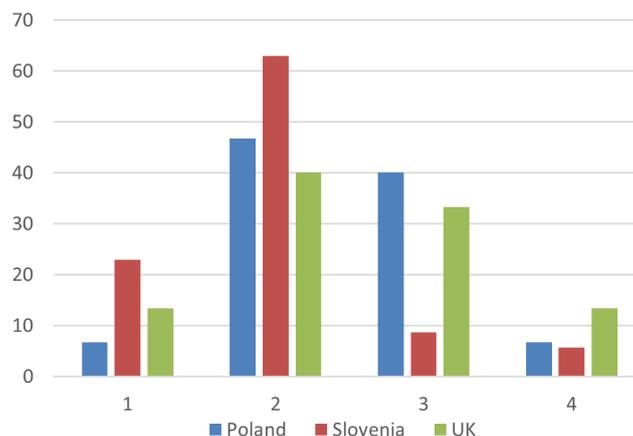
Q27	Management & staff work well together.
Q28	I feel included by my workmates and part of a team.
Q29	Most employees are happy here.
Q30	I am generally happy here.
Knowledge of workplace design	
Q31a	Familiarity with Ergonomic Design?
Q31b	Familiarity with Universal Design?
Q31c	Familiarity with Inclusive Design?
Q31d	Familiarity with Accessible Design?
Knowledge of legislation covering persons with disability and access to resources needed for workplace adaptations	
Q52	Do you know where to get advice from experts about adapting your workplace?
Q53	Do you know how to find specialised equipment?
Q54	Do you have access to funding for adapting your workplace?
Q55	How well do you understand the legislation applicable to employing people with disabilities?
Q56	How well do you understand the legislation applicable to adapting your workplace for PWD?
Q57	How far does your organisation consider the needs of the people who are going to do a job or work process, when you set up a new process or make changes?
Q61	When making changes to our workplace we pay attention to the needs of people with disabilities.
Q62	When changing work processes we pay attention to the needs of persons with disability.

### 3.3 Data processing procedures

Data analysis was carried out with statistical package IBM Statistical Package for Social Sciences Statistics (SPSS 21). We used Kruskal-Wallis H test to verify H1 and H2 and multiple regression analysis to test H3 and H4. Before we tested research hypotheses H3 and H4, exploratory factor analysis was applied to detect the presence of meaningful patterns among measured variables. The principal component analysis, as the extraction method, and varimax rotation procedure were applied. The factors' reliability was tested with Cronbach's alpha.

## 4. Results

To test Hypothesis H1 – PWDs' satisfaction varies according to the country of their workplace - the PWDs' attitudes about the item 'I am generally happy at this workplace' (Variable Q30) were taken into account. The attitudes were measured on a five point Likert scale, where 1 means 'Strongly agree' and 5 'Strongly disagree'. The respondents were offered the option 'I don't know enough about it to say', but it was not included in data analysis. The distributions of variable Q30 are presented in Fig. 1. The majority of PWD in Poland chose 2 and 3 (86.7 %), in Slovenia 1 and 2 (85.7 %), and 73.3 % of PWD in UK expressed their attitudes about this item with 2 and 3 on the five point scale.



**Fig. 1** Distributions of Q30 for PWD in three countries

A Kruskal-Wallis H test was conducted to determine if there were differences in the level of satisfaction (variable Q30) among three groups of PWD with their workplaces in different countries: Poland ( $n = 33$ ), Slovenia ( $n = 37$ ), and UK ( $n = 18$ ). Distributions of Q30 scores were not similar for all groups, assessed by visual inspection of boxplot. Values are mean ranks unless otherwise stated. The mean ranks of Q30 scores were statistically significantly different between groups,  $\chi^2(3) = 14.468$ ,  $p = 0.002$ . Pairwise comparisons were performed using Dunn's procedure with a Bonferroni correction for multiple comparisons. Adjusted  $p$ -values are presented. This post hoc analysis revealed statistically significant differences in Q30 scores between Slovenia (32.50) and Poland (47.03) ( $p = 0.018$ ), but not between any other group combination. The significant difference in PWDs' satisfaction confirms H1.

To verify hypothesis H2 – The employers' perception on the satisfaction of PWD in the workplace is the same in all countries examined – the employers' attitudes about the item 'Most employees are happy at this workplace' (Q29) were analysed. The employers expressed their attitudes on the five point Likert scale where 1 means 'Strongly agree' and 5 'Strongly disagree'. The respondents were offered the option 'I don't know enough about it to say', which was not included in data analysis. The distributions of Q29 for employers in three countries are shown in Fig. 2. The majority of employers expressed their attitudes about the PWDs' satisfaction with two on the five-point scale: in Poland (73.2 %), in Slovenia (59.3 %), and in UK (55.6 %).

The Kruskal-Wallis H test was conducted to determine if there were differences in the level of the employers' perception about the PWDs' satisfaction among three groups of employers who worked in three different countries: in Poland ( $n = 41$ ), in Slovenia ( $n = 91$ ), and in UK ( $n = 45$ ). Distributions of Q29 scores were similar for all groups, assessed by visual inspection of boxplot. Medians of Q29 were not statistically significantly different between three countries  $\chi^2(2) = 0.264$ ,  $p = 0.876$ . All these results confirm hypothesis H2.

Before verifying hypothesis H3 – which assumed that PWDs' perception of workplace adaptation, and their knowledge on ways of how workplaces can be adapted affect their satisfaction in the workplace – a factor and reliability analyses were applied to test the dimensionality and reliability of the following concepts: adaptation of the workplace, knowledge on ways of adapting the workplace and the satisfaction of PWD in the workplace. When deciding on the number of factors for each concept the eigenvalue, the percentage of the total variance explained by the factors, and interpretability of factors were taken into account.

The results of the factor analysis for seven variables measuring the adaptation of the workplace to PWD showed two factors with eigenvalue higher than one (Table 3). The first dimension (factor F1), measured by variables Q18, Q19, Q21 and Q22, was named as 'adaptation of the workplace to specific types of disabilities' and the second (factor F2), measured by variables Q14, Q17 and Q20, as 'general adaptation of the workplace'. The majority of the factor loadings were higher than 0.7, which indicates a very well defined structure [15]. Both factors together explained approximately 66 % of the total variance and Cronbach's alphas were higher than 0.7. All this confirms their reliability.

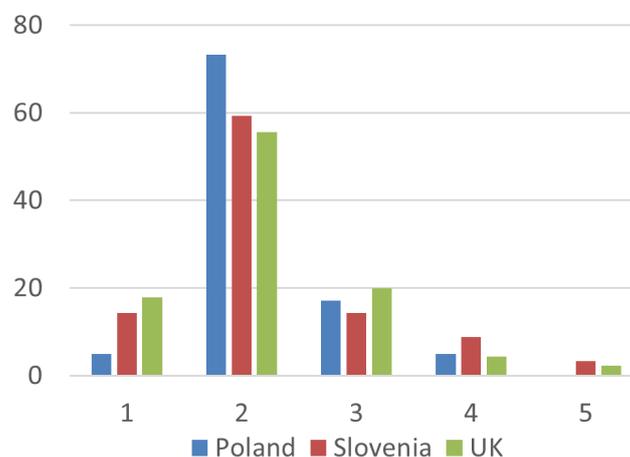


Fig. 2 Distributions of Q29 for employers in three countries

**Table 3** Factor loadings, communalities, explained variance and Cronbach's alpha for the adaptation of the workplace

Variable	F1	F2	Communalities
Q18	0.644	0.327	0.522
Q19	0.700	0.279	0.568
Q21	0.803	0.131	0.622
Q22	0.831	0.114	0.704
Q14	0.065	0.834	0.699
Q17	0.273	0.837	0.774
Q20	0.370	0.758	0.711
Eigenvalue	3.497	1.14331	
% of explained variance	49.963	16.333	
Cronbach's alpha	0.782	0.810	

Remark: The meaning of variables Q14 to Q20 is explained in Table 2

**Table 4** Factor loadings, communalities, explained variance and Cronbach's alpha for the factor 'People with disabilities' feelings in the workplace'

Variable	F1	Communalities
Q26	0.825	0.681
Q27	0.740	0.547
Q28	0.853	0.727
Q29	0.848	0.718
Q30	0.857	0.735
Eigenvalue	3.408	
% of explained variance	68.16	
Cronbach's alpha	0.854	

Remark: The meaning of variables Q26 to 30 is explained in Table 2

The results of the factor analysis (Table 4) for variables measuring the PWDs' feelings in the workplace (variables Q26 to Q30) have shown that one factor had eigenvalue higher than one and it explained 68.16 % of the total variability. All factor loadings were higher than 0.7 and the reliability test with Cronbach's alpha confirms the reliability of this factor.

As indicated in Table 5, the results of the factor analysis have shown that it makes sense to merge all variables measuring the various possibilities for adapting a workplace (variables Q31a to Q31d) into one factor, which explains the 72.26 % of the total variance. All factor loadings as well as Cronbach's alpha were high, thus indicating the reliability of this factor.

Hypothesis H3 – which assumed that the PWD' feelings in workplace depends on the workplace adaptation for PWD or their knowledge on ways of adapting the workplace – was verified through a multiple regression analysis in which the dependent variable was the factor 'PWD' feelings in the workplace' and factors 'adaptation of the workplace to individual types of disabilities', 'general adaptation of the workplace' and 'knowledge on ways of adapting the workplace' were independent variables. The multiple regression analysis was carried out on data provided by PWD ( $n = 76$ ).

The regression coefficient of the factor 'general adaptation of the workplace' was 0.34 and it was significantly different from zero at a significance level of 0.05. By improving the general adaptation of the workplace the PWD' feelings in the workplace increases too. For the other two factors, the regression coefficients were not significant. The general adaptation of the workplace explained 6 % ( $R^2 = 0.06$ ) of the variance in the PWD' feelings in the workplace. As the factor 'general adaptation of the workplace' takes a significant and positive impact on the PWD' feelings, hypothesis H3 is confirmed.

**Table 5** Factor loadings, communalities, explained variance and Cronbach's alpha for the factor 'Knowledge on ways of adapting the workplace'

Variable	F1	Communalities
Q31a	0.765	0.585
Q31b	0.871	0.759
Q31c	0.897	0.804
Q31d	0.862	0.743
Eigenvalue	2.8904	
% of explained variance	72.26	
Cronbach's alpha	0.871	

Remark: The meaning of the variables Q31a to Q31d is explained in Table 2

**Table 6** Factor loadings, communalities, explained variance and Cronbach's alpha for the variables, which measure the level of knowledge on the legislation covering persons with disability and their needs as well as the employers' access to resources needed for workplace adaptations

Variable	Factor loadings		Communalities
	F1	F2	
Q52	0.185	0.818	0.703
Q53	0.227	0.835	0.748
Q54	0.141	0.732	0.556
Q55	0.754	0.372	0.706
Q56	0.736	0.350	0.665
Q57	0.730	0.230	0.586
Q61	0.820	0.184	0.706
Q62	0.813	0.021	0.661
Eigenvalue	4.015	1.316	
% of explained variance	50.19	16.4	
Cronbach's alpha	0.852	0.762	

Remark: The meaning of variables Q52 to Q62 is explained in Table 2

Before verifying the hypothesis H4 factor analysis was conducted to test the dimensionality of concepts 'the employers' knowledge on the legislation and needs of PWD' and 'employers' access to knowledge and resources needed for workplace adaptations'.

The results of the factor analysis (Table 6) showed that the variables Q52 to Q57 and Q61 and Q62 measured two dimensions, which were represented by two factors with eigenvalue higher than one. The first factor (F1), which consisted of variables Q55 to Q57 and Q61 and Q62, was named 'employer's knowledge on the legislation and PWD's needs'. It explained 50.19 % of the total variance. The second factor (F2), which composed of variables Q52 to Q54 explained 16.4 % of variance was named 'employers' access to resources needed for workplace adaptations'. By resources, we mean knowledge, specialised equipment and financial resources.

Hypothesis H4 – which assumed that the adaptation of the workplace for PWD depends on the employers' accessibility to resources needed for workplace adaptations as well as their knowledge of PWD-related legislation and understanding of PWDs' needs – was tested with two regression models because two dimensions were detected for the concept adaptation of the work place to PWD. The dependent variable in the first regression model was the factor 'general adaptation of the workplace for PWD' and the factor 'adaptation of the workplace to specific types of disabilities' was dependent variable in the second model. In both regression models, the factors 'knowledge on the legislation and PWDs' needs' and 'access to resources needed for workplace adaptations for PWD' were independent variables. Both regression analyses were conducted on data obtained by employers ( $n = 177$ ).

The results of the multiple regression analysis for the dependent variable 'general adaptation of the workplace for PWD' showed that both independent variables together explained 46 % of variance of variable 'general adaptation of the workplace to the needs of PWD' ( $R^2 = 0.46$ ). The regression coefficients of variables 'employers' knowledge on the legislation and PWDs' needs' and employers' access to resources needed for workplace adaptations' were 0.209 and 0.461, respectively. Both coefficients were significantly different from zero at  $p < 0.05$  or  $p < 0.001$ , respectively. The higher regression coefficient for the factor 'employer's access to resources

needed for workplace adaptations' showed that this factor has a greater impact on improving the general adaptation of the workplace to the needs of PWD than the factor 'employer's knowledge on the legislation and PWDs' needs'.

A multiple regression was run to predict impact of 'knowledge on the legislation and PWD's needs' and 'access to resources needed for workplace adaptations for PWD' on 'adaptation of the workplace to specific types of disabilities' (ADAPT\_SPEC). The multiple regression model statistically significantly predicted ADAPT\_SPEC, adj.  $R^2 = 0.088$ . Only the regression coefficient of the factor 'employer's access to resources needed for workplace adaptations' has a positive and significant value ( $b = 0.296$ ,  $p = 0.023$ ), which demonstrates its impact on adapting the workplace to specific types of disability. The results of both regression analyses confirmed hypothesis H4.

## 5. Discussion

The research was carried out to measure the satisfaction rate of PWD and employers in relation to the workplace and to analyse whether differences exist in the three studied countries. An additional purpose of the research was to examine the factors (general and specific adaptation of the workplace, knowledge on universal, inclusive and ergonomic workplace) which affect the satisfaction level in the workplace from the viewpoint of PWD and employers.

*The results of the research support hypothesis H1, which assumed that PWD's satisfaction varies according to the country of their workplace. In addition, we found out that PWD in Slovenia are more satisfied than PWD in Poland.*

Based on the current situation in Slovenia which shows that difficulties in employing PWD still exist, we could conclude that this group of PWD was satisfied to even have a job given the current situation. Likewise, it is possible that the difference is on the one hand conditioned by personal characteristics, namely that these were friendly, reliable persons with a positive self-image, and on the other hand by perceiving social inclusion and the sense of belonging to the company, as evidenced by several international studies [13, 14, 16]. In general, the satisfaction among employees is also affected by minor ergonomic improvements in the workplace which, are mostly initiated by employees (including PWD) and can be carried out at low cost and are based on good local practices [17].

*Hypothesis H2 assumed that in Poland, in the UK and in Slovenia the employers' perception regarding PWDs' satisfaction in the workplace does not differ. The hypothesis was confirmed.*

Our assumption that employers apply similar criteria for job satisfaction of their employees and that their evaluations are usually between 2 and 3 on five-point scale where 1 means very satisfied or between 3 and 4 when 5 means very satisfied was confirmed. It is not expected that they will evaluate the job satisfaction of their employees very bad (bad evaluation of employers' work) or extremely good (lack of self-criticism – there are always possibilities for improvements). Employers assessed the satisfaction of PWDs on the basis of regular annual interviews with them. Detection of satisfaction of PWDs is similar in all three countries. This is probably the consequence of the implementation of the Strategy Europa 2020, carried out in these countries. Employers consider social responsibility and the ergonomics principles to improve the process to social inclusion of PWD in the workplace.

*Hypothesis H3 was also verified when we saw that the PWD's satisfaction in the workplace depends on the general adaptation of the workplace to the person with disability.*

Employees are often focused on the protection of safety and health at work, including (but not restricted to) reducing risks of injuries and diseases and promoting a work-life balance – factors improving the satisfaction in the workplace and the quality of life [5].

We are of the opinion that working environments from which people with disabilities from our research come from gradually respect and meet needs, capabilities, potentials and advantages of PWD which is one of the goals of the Europe 2020 strategy. The success of future human-systems integration efforts requires the fusion of paradigms, knowledge, design principles, work places, tools and devices and methodologies of human factors and ergonomics with those of the science of complex adaptive systems as well as modern systems integration [22]. To perform a task not only the tools and/or adaptations are needed but also human support and

supportive services in order to overcome barriers faced by PWD in working environments. Appropriate adaptations and a concept of universal design must be implemented in the labour market to its fullest extent so as to give the PWD concrete options for finding and keeping a job. The success of future human-systems integration efforts requires the fusion of paradigms, knowledge, design principles, work places, tools and devices and methodologies of human factors and ergonomics with those of the science of complex adaptive systems as well as modern systems integration [18].

*In examining the H4 hypothesis, it was concluded that the better the employers' access to knowledge on adapting the workplace for PWD, to special equipment for adapting the workplace for PWD and to financial resources, the better is the adaptation of the workplace to the needs of PWD.*

It is clear that certain conditions must be met to provide an appropriate ergonomic-friendly environment in an organisation containing in particular knowledge on ergonomics, access to ergonomic solutions when designing equipment and last but not least the provision of appropriate financial resources. This finding is also similar to the results of a study conducted in a larger Swiss company which carried out an analysis of ergonomic work conditions in the workplace. The conditions significantly improved after a training programme was carried out, and at the same time the individual knowledge level and interest as well as a sense of self-responsibility in the field of ergonomics increased [19]. This includes that employees and employers must obtain appropriate knowledge and information on principles of ergonomic workplace design adapted to PWD. We believe, that a programme of education and training was prepared in the framework of the "ERGO WORK – Joining academia and business for new opportunities in creating ergonomic workplaces" project and it would be reasonable to use it in practice and in educational institutions across the EU in future. The aim of the project was to improve the ergonomic design of workplaces for PWD and at the same time promoting social inclusion through the improvement and adaptation of workplaces so as to accommodate the various needs of PWD. Macro ergonomics offers a perspective as well as methods and tools for more successful human factors and ergonomic design, development, intervention, and implementation. Thus the present human factors can be used engineers, psychologists or ergonomist to achieve better results or can expand their cooperation [20].

## 6. Conclusion

The research which was conducted in the framework of the ERGO WORK project as a survey among decision-makers and PWD provides guidelines for an ergonomic workplace design strategy and strengthens the importance of PWDs' satisfaction in the workplace. Because the integration of PWD in the workplace is an EU priority the need for better cooperation among EU member states, and knowledge and practices transfer in this field is starting to develop. Therefore, it will become ever more important (as in the ERGO WORK project) to lay the focus on understanding and eliminating the obstacles in integration and in resolving these questions through training and cooperation between the academia and industry.

As mentioned in the Article 27 of the UN Convention on the Rights of Persons with Disabilities and the EU's Strategy for Europe 2020, employment and employment opportunities are key priorities of all EU governments. The inclusion of PWD in the open labour market is high on the EU's priority list. Addressing the special needs of PWD through tailor-made ergonomic solutions and the adaptation of workplaces is one of the possible solutions to achieve this target.

The purpose of the research was to provide further support in developing and innovating the employment sector in all partner countries of the ERGO WORK project and in EU's industry in general. Regardless of the field, in discussions on disability the quality of life must play a central role when decisions are being made. It is of utmost importance to recognise that in the employment sector each and every person has different needs in terms of support and different life goals. Therefore, it is necessary to support and respect the individual decisions as far as possible.

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