IDENTIFICATION OF THE DEMAND OF WELDERS IN THE LABOUR MARKET OF LITHUANIA

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Abstract
The shortage of welding specialists is a long-term problem in the labour market of Lithuania. Statistical data show the lack of thousands specialists in this field with increasing gap between their supply and demand. It creates concern, because the shortage of skilled welders forces enterprises to refuse many profitable orders. In this article is presented the analysis of the reasons regarding the shortage of welding specialists in the labour market of Lithuania; also here are disclosed the gaps in the identification of the demand of welders and justifying the importance of this identification of demand for effective functioning of labour market. Referring to the results of research there can be stated, that the goal to satisfy the real needs of economy in welding specialists can be achieved by identifying the demand in terms of concrete qualifications of these specialists and in terms of numbers of required specialists. Absence of exact data in these fields creates the situation of uncertainty which does not permit smooth functioning of vocational guidance and vocational education and training of these specialists. As a consequence, it is not possible to ensure adequate reaction of the VET system to the demands of labour market. There are suggested instruments helping to identify the levels of qualifications and competences of welding specialists, to classify them into specialities and specialisations and to define the limits of their qualifications. There is also provided the model for identification of the demand of welding specialists in the national labour market. These measures create favourable preconditions for adequate reaction to the existing shortages of welding specialists and for the satisfaction of corresponding needs in the sectors of economy.

Keywords: labour market, national labour exchange, occupation, profession, qualification, welding specialists.

Background
Shortage of welding specialists is a long-term trend in the labour market of Lithuania. According to the data of the Lithuanian Labour Exchange there is a shortage of thousands of these specialists (Lietuvos darbo biržos svetainė, 2013). Mass-media indicate, that due to shortage of welding specialists companies are forced to refuse or to cancel available profitable orders and projects (Suvirintojai – aukso vertės: Klaiptėdos laivyų statytojai pešasi dėl darbuotojų, 2013). The loss of such orders means the loss of the national budget incomes and wasted potential of jobs creation.
In this situation employers are surprised with the controversial situation in the labour market of Lithuania, when in the conditions of comparatively high unemployment the companies cannot satisfy the demand of comparatively well paid welding specialists.

In assessing labour market situation and looking for the possible solutions of above mentioned mismatch between demand and supply of workforce employers tend to transfer the responsibility for this situation to the unsuccessful job seekers and unemployed persons (Narkevičius, 2012). Such simplified attitude to the shortage of specialists cannot be justified, because the mismatches of supply and demand, as well as resulting unemployment emerge due to different objective and subjective reasons (Nazelskis, 2013a).

However, looking to the existing labour market situation, there is no evidence of the objective or subjective reasons of the shortage of welding specialists. This issue remains under-researched. In this situation of incertitude and lack of information on the reasons of shortage of welding specialists it is important to understand the structure of labour market and it’s functioning. Modern labour market emerged only when people acquired legally approved rights to become hired employees receiving agreed remuneration for executed work. Evolution of the modern labour market is explained by the wide range of economy theories analysing it’s functioning: 1) classical theory, 2) marxist theory of political economy, 3) neo-classical theory of labour market; 4) keynesian theory of labour market, 5) monetary model of labour market, 6) neco-classical theory of labour market synthesis, 7) institutional labour market theory (Дрогдинина, 2011; Антипов et al., 2013).

These theoretical approaches had very different impact to the development of the typical national labour market models shaped by the multiple socio-economic factors (Мрачковский & Михайлов, 2011). Despite of existing variety of theoretic approaches to labour market, all these approaches consider labour market as a system and a part of the common market economy.

One of the core elements of the labour market ensuring it's functioning is the totality of exchanges in this market connecting it's subjects and objects. These exchanges are characterised by rather precise parameters and characteristics. Companies do not search for any kind of employees to occupy job positions, they look for the skilled specialists able to execute defined functions and responsibilities. Therefore the identification of the workforce demand becomes integral part of labour market exchanges.

Identification of the workforce demand also poses concrete questions about the profile of needed workforce: occupational field, qualification and it’s level, competences. However, the practice of definition of demand of welding specialists in the labour market of Lithuania is much more abstract and straightforward, because it is limited with the indication of the tittle of welder occupation and overall number of needed professionals (Darbo birža skelbia paklausiausių profesijų dešimtukus, 2014; Top5 užsieniečių – profesijos, 2014; Išduotų leidimų dirbti užsieniečiams Lietuvos Respublikoje pasiskirstymas pagal profesijas, 2013; Profesijų, kurių darbuotojų trûksta Lietuvoje, sąrašas, 2013). Such definition of demand of welding specialists completely ignores complexity and rich variety of
work parameters typical for welding defined by: 1) the range of welded materials (metals, plastics, ceramics, rubber, leather etc.); 2) variety of welding equipment and energy sources (welding with electric arch, gas, ultrasound, thermic welding, plasma, laser, friction, explosive welding etc.); 3) the types of welding applications in the sectors of economy (civic constructions, shipbuilding, pipelines, etc.); 4) variety of welding environments and conditions (welding in the workshop, outside, under water, in the height, underground, in the closed spaces etc.). Besides, welding operations and work processes differ by their technological characteristics, level of process automation, consumption materials, peripheral equipment, auxiliary tools, etc. Welding technologies experience fast development. In the patent agencies of industrial countries there are being registered 200 inventions and innovations of welding technologies monthly (Маслов, 2012). Fast development of welding technologies directly influences the demand of skills and competences of welding engineers, technicians, welders and operators, quality control specialists, vocational teachers and trainers, instructors, researchers and developers of welding innovations. Therefore simple statement of the fact of shortage of welding specialists and indication of number illustrating this shortage is insufficient to grasp the core qualitative and quantitative aspects of demand of these specialists. It becomes serious obstacle for normal and effective functioning of vocational guidance, initial and continuing vocational education and training systems, where the demand of specialists is being satisfied.

Other important challenge for identification of demand of welding specialists in the nowadays labour market is intensifying internationalization of the product and labour markets directly influencing changing requirements for qualifications and competences of employees. Satisfying of labour market needs becomes increasingly complicated task, because internationalisation of markets fosters the changes in the contents of occupations and work processes creating new requirements and demands for education and training systems (Billett, 2000).

In regard to the above mentioned arguments the research issue refers to the insufficiency and shortages of the identification of demand of welding specialists in the labour market. The main object of research is application of qualifications and their systems for the identification of this demand. The research aim is to disclose the possibilities and potential of the application of qualifications and their systems for identification of demand of welding specialists.

Research methods were applied the following: 1) the literature review was applied to disclose the functions of qualifications in the identification and forecasting of labour market needs, 2) the content analysis of the national and international policy documents was used to disclose the contents of qualifications of welding specialists, to analyse the trends of demand and supply of welding specialists in the labour market and to develop the model of identification and forecasting of demand of qualifications of welding specialists.

There were analysed the Guidelines for International Welding Engineers, Technologists, Specialists and Practitioners (IAB-252r2-14/SV-00, 2014) developed by the International Institute for Welding and the European Federation for Welding, international standards regulating the training, assessment
of competences and awarding of qualifications of welding specialists, the documents issued by the Welding Institute of E.O.Paton at the Academy of Science of Ukraine, as well as training curricula, VET standards, regulations of assessment of competences and awarding of qualifications of welders.

The role of qualifications in identification of demand of welding specialists

Welding is one of the most important technological processes of production in the modern economies, because more than a half of the gross domestic product is produced by using welding and allied technologies (Патон, 1998).

Besides, welding technologies are often used in the production of potentially dangerous and important constructions, components and technological products. Therefore the users of these constructions and products must have guarantees of their quality. International production and quality assurance standards (ISO 9001) attribute welding to those production processes, where the quality of results cannot be guaranteed only by quality tests and analysis. Guarantee of the quality and reliability of welded product must be ensured by following quality requirements in the execution of welding operations and executing consecutive quality control of welding operations throughout whole production cycle. This requirement delegates the exceptional responsibility for the quality of welding to the welding specialists. Consequently, vocational training, qualifications and competences of welding specialists directly influence possibilities and chances of companies to compete for the orders, to certify their products and to acquire product quality certificates (International qualifications, 2012). Qualifications of welding specialists are exceptionaly important for the production processes of the companies using welding technologies.

Management of qualifications and competences in the identification of demand of specialists becomes increasingly complex and challenging due to intensifying internationalisation of labour market and intensive change of the content of professional activities (Changing Qualifications, 2010). Many enterprises in Lithuania face big difficulties and hard-to-achieve tasks in seeking to satisfy their needs in skilled welding specialists. These difficulties and challenges are especially acute in the exporting enterprises of shipbuilding and ship repair, manufacturing of civic constructions, machinery production, metalworking, because exporting of products in these sectors requires to satisfy very stringent international quality standards (Specialistų rengimo Lietuvos institucijų galimybės užtikrinti inžinerinės pramonės konkurencingumo augimą, 2013), as well as international requirements for qualifications of welding specialists. The enterprises of these sectors selling their products and services only in the domestic or local markets usually do not face such challenges and satisfy their production needs with the welders posessing „national“ qualifications defined by the VET standards. This situation evidences existence of the „dual“ system of qualifications in the field of welding when aside of „national“ qualifications of welding specialists coexist qualifications approved by the influential international providers and professional bodies. Here it is important to consider, that the
qualifications’ needs of enterprise can significantly differ from the sector’s needs, because development of the sector of economy usually demands wider qualifications that also fit to the interests of regional economy and society (Billett, 2000). Therefore optimal satisfaction of quantitative and qualitative labour market needs in qualifications requires to consider the needs of enterprises in the context of the sector of economy, training curricula and organisation of the provision of training. In the contrary case there emerges the risk of conflicts and tensions between the needs of enterprises that are often focused on narrowly specialised qualifications and the needs of the sectors of economy and society focused on wider and more universal qualifications. Duality of qualifications in the field of welding is not universal phenomenon. In many industrially developed countries international qualifications of welding specialists are completely integrated in the national systems of qualifications. However, where this duality is present it creates additional challenges in the identification of the demand of workforce, especially if we consider nowadays’ mobility of workforce and workplaces.

In many EU countries there can be noticed the increasing regulatory function of qualifications in the national labour markets and in the common EU labour market enhanced by the spread of international quality standards and development of international business (Changing Qualifications, 2010). In the same time qualifications become important instrument for identification and forecasting of labour market needs.

Maier et al. (2015) in analysing demand of skilled employees and the models of identification and forecasting of this demand in Germany notice, that if the identification and forecasting of demand of skilled employees is based only on formal qualifications, it entails one important shortage – the factors of workforce demand are often mechanically added to the features of workforce supply. To solve this problem these authors suggest that identification and forecasting of the demand of workforce should consider not only qualifications but also the requirements of occupations and education. Application of requirements of occupations and education also permits to consider the changes of work processes and changing variety of the pathways of vocational education, including continuing vocational education and work-based learning and training. Of course, this approach of identification and forecasting demand of workforce entails difficulties related to objective identification, assessment and measuring of requirements of the work processes. Reference to the requirements of activities and work processes permit to identify momentary situation of activity subjected to quick changes.

Qualifications regulate labour market by defining requirements and possibilities of access to labour market and career (Changing Qualifications, 2010). For example, in Germany and other countries of „collective skill formation“ model qualifications are used as references for remuneration levels defined by collective agreements between social partners and governments (Cedefop, 2010; Busemeyer & Trampusch, 2012). In the countries of liberal market economy (the UK, Ireland) the reform of qualifications and their systems is oriented to the increase of flexibility of the contents of
qualifications and pathways of their acquisition (e.g., by fostering modularisation of qualifications and training curricula) (Le Deist & Tūtlys, 2012). These reforms target to reduce the state regulation of the labour market access and to increase the role of individual choice in this field by sustaining certain regulatory function of qualifications, e.g., in the quality assurance of training provision. The strengthening of regulatory functions of qualifications can be noticed in many EU countries and this trend goes in parallel with the internationalisation of qualifications, spread of implementation of international quality standards and growth of international business (Changing Qualifications, 2010).

Qualifications and their systems also execute other functions, that are important for identification and forecasting of workforce demand: a) a function of communication between the system of activities and the system of vocational education and training, b) a function of regulation of the system of vocational education and training, c) a function of information of society and learners on the needs and requirements of labour market and work processes.

Execution of the communication function between the system of activities and the VET system largely depends on the interrelationships between the contents of qualifications, their design, provision and awarding processes and the system of activities, it’s stakeholders and regulation processes. Validity and value of qualifications, as well as their suitability for the identification and forecasting of workforce demand depend on the activeness and involvement of social partners and stakeholders in the design of qualifications, provision of education and training and in the assessment of competences. Level and extent of usage of qualifications in the human resource management in enterprises (e.g., in the planning of human resources, search and recruitment of staff, organisation and provision of continuing vocational training and skills development, career planning, management of remuneration systems, etc.) also define the validity and value of qualifications in identification of workforce demand (Andriušaitienė et al., 2008).

The functions of qualifications in the field of regulation of the vocational education system are defined by usage of qualifications as reference basis in the curriculum design, organisation of training provision and assessment of learning outcomes and competences. These functions of qualifications largely define and stipulate the match or mismatch between the demand of skills in the labour market and supply of skilled workforce in the system of education (Changing Qualifications, 2010).

The information and guidance function of qualifications is defined by the usage of qualifications in the provision of information about the requirements of work processes, fields of activities and sectors of labour market to the candidates seeking to occupy certain employment positions. Effectiveness of this function of qualifications contributes to the building and development of trust of learners and labour market stakeholders in qualifications and, subsequently, increases validity and reliability of labor market forecasts based on qualifications. In applying qualifications for the labour market forecasting the most important criteria are the contents of qualifications (competences, learning outcomes) and the level of qualification in the system of qualifications which is defined by the national or sectoral qualifications frameworks. The content of qualifications indicates concrete
requirements to the performance of activity and horisontal relationships of performance in the different fields of activities (e.g., possibilities to work in a given job positions with different qualifications, or to acquire new qualifications on the basis of possessed skills and competences), while a level of qualification indicates vertical relationships between different qualifications, e.g. possibilities of professional development and advancement by acquiring higher level qualification. When these functions of qualifications and their systems are ignored, it can result in the different disorders and malfunctioning of the system of qualifications leading to the structural unemployment and shortages of skilled workforce.

The gaps in identification of the demand of welding specialists: reasons and consequences

Seeking to disclose the reasons of shortage of welding specialists and the gaps in the identification of their demand there was analised statistical information provided by the Lithuanian Labour Exchange under the Ministry of Social Security and Labour. This institution is in charge of implementation of the national labour market policy including the functions related to the labour market monitoring and forecasting, such as adjusting supply and demand of workforce in seeking to sustain balanced labour market, as well as implementation and monitoring of labour market situation together with forecasting of it's change (Lietuvos darbo biržos nuostatai, 2011).

However, these tasks are very challenging and difficult to achieve and the case of welding specialists just proves it. Statistical data show increasing shortage of welding specialists in the labour market of Lithuania in the last years (Table 1).

Table 1

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfilled workplaces of welding specialists, thousands</td>
<td>1.5</td>
<td>1.7</td>
<td>2.5</td>
<td>2.9</td>
<td>3.1</td>
<td>3.8</td>
</tr>
</tbody>
</table>

With the increasing shortage of skilled welding specialists in the national labour market enterprises try to solve this problem by searching and employing the specialists from the other countries (Table 2).

This information shows, that current identification of the needs of welding specialists in Lithuania does not help to deal with the problem of shortage of skilled workers in this field. However, it is not relevant and rational to held only the Lithuanian Labour Exchange responsible for this situation. The Lithuanian Labour Exchange since 1995 has been preparing the annual labour market forecasts and so called Barometer of Opportunities of Getting Job.
Table 2

Number of issued permissions to work in Lithuania for the citizens of other countries.
(Source: Lithuanian Labour Exchange. Available at https://www.ldb.lt/EN/INFORMATION/LABOURMARKET/Pages/Tendencies_archive.aspx)

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welders</td>
<td></td>
<td>91</td>
<td>166</td>
<td>322</td>
<td>280</td>
</tr>
<tr>
<td>Welders working with electric and gas welding</td>
<td></td>
<td>-</td>
<td>39</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Welders and assemblers of metal ship huls</td>
<td></td>
<td>149</td>
<td>363</td>
<td>406</td>
<td>363</td>
</tr>
<tr>
<td>In total</td>
<td></td>
<td>230</td>
<td>568</td>
<td>728</td>
<td>643</td>
</tr>
</tbody>
</table>

Preparation of these labour market forecasting measures is based on the three main sources of information: 1) statistical data on the official number of registered unemployed population, 2) surveys of employers executed by the territorial units of the labour exchange, 3) expert evaluations. Surveys of employers is a basic source of information for labour market forecasts. It is executed by applying stratified selection of respondents and the representativeness of the respondents is achieved by proportional selection of the of survey participants according to the fields of activities. Representatives of the Labour Exchange recognise, that employers participate in these surveys rather passively and reluctantly. It directly influences the quality of received information and data for labour market forecasts (Nazelskis, 2013b). Therefore employers should also take rather important part of responsibility for the existing gaps in identification of the labour market needs.

Other important problem concerns the definition of demand of welding specialists, which is often limited to entitling of the welder occupation and indicating the number of needed employees. In 2011 the database of the Lithuanian Labour Exchange attempted to classify welding specialists into three groups: 1) welders with electricity and gas; 2) welders; 3) welders and assemblers of metal ship huls. However, such classification is also far from providing sufficient clarity and grasping the real diversity of work processes in the sector of welding. Even the discerning of the occupation of welder and assembler of metal ship huls is not sufficiently concrete, because it ignores the fact, that ships are exceptionally complex engineering products with very wide typology and range of the fields of application. This variety also influences corresponding diversity of shipbuilding technologies, applied materials and work processes (Горынын, 1996). Therefore welding of ship huls is characterised by the wide range of applied welding technologies and processes requiring welders with different qualifications, specialisations and competences.

One of the key concepts used in the definition of demand of specialists in Lithuania is „profession“. This concept has a wide range of definitions and interpretations in the scientific, academic, economic and political contexts and there is no common agreement on it’s definition (Becker, 1970).
Grenwood (1957) discerns the following typical structural elements of profession: 1) power possessed by the representatives of the professional group or community; 2) influence and status in the society; 3) system of specific knowledge and education; 4) presence of professional community that defines the rules and norms for its members; 5) the culture of profession.

These elements disclose important role of acquisition and transfer of special vocational knowledge and professional experience for the profession and professional group. Acquisition, transformation and development of vocational knowledge is important not only for the development of skilled workers as members of professional community, but also becomes one of the key drivers of development of work processes and their contents. Such development and increasing complexity of the contents of work processes enhance differentiation of the units of professional activities, such as specialities and specialisations. These aspects are also important to consider in defining and forecasting of labour market demand.

For example, the information on the demand of welding specialists provided by the Lithuanian Labour Exchange does not match the data provided by the Lithuanian Welders Association (Suvirinimo įmonių sertifikavimo ir specialistų profesinio mokymo ir jų kvalifikacijos pripažinimo problemos Lietuvoje, 2014). The data provided by the Lithuanian Welders Association show, that there is a demand of high skilled metal welders with competences and qualifications referenced to the international standards and approved by corresponding awarding bodies. The demand of such welding specialists is influenced by the increasing export activities of enterprises producing metal civic constructions, mechanical parts and units, transport equipment, pipelines, what requires to satisfy strict requirements of EU directives, EN and ISO standards. Besides, there is a shortage of the welders of plastics and polymer materials, solderers, joiners with glue, contact welders, operators of automated welding processes and specialists of thermospray belonging to the group of professions related to welding. There is also a lack of higher level welding specialists, such as coordinators of welding operations with qualifications according to the international standard EN ISO 14731. These specialists are being prepared and certified by applying unified International Training, Qualification and Certification Systems in Welding based on harmonised training and certification so the welding specialists in the EU countries. Enterprises also need the specialists of welding quality control working with the different methods of nondestructive tests of welds. These specialists are trained and certified according to the requirements of the standard EN ISO 9712. There is also a shortage of welding supervisors, inspectors, specialists of nondestructive weld testing. The biggest shortage is for the welding specialists with internationally certified qualifications (Profesijų, kurių darbuotojų trūksta Lietuvoje, sąrašas, 2013).

Looking to the existing data on the lack of welding specialists in Lithuania provided by the Lithuanian Labour Exchange, Lithuanian Welders Association and the Ministry of Social Security and Labour there can be noticed inconsistency and fragmentation of provided information. Particular and
comprehensive identification of demand of welding specialists requires more specific instruments based on qualifications and their levels.

**Qualification levels of welding specialists**

Qualifications in the welding sector are extensively regulated on the international level due to high requirements of quality, as well as high impact of work performance and products to the safety of workers and users. Since the ninth decade of the last century there have been observed fast technological changes in this sector together with increasingly stringent requirements of work safety and environment protection and fast development of the processes of quality assurance integrated in the quality chain of welding. This quality chain combined the responsibilities of competence requirements of the different welding related occupations (*International Qualifications*, 2012). It resulted in the development of typical sectoral system of qualifications in the field of welding and this system of qualifications is partially or completely integrated in the national systems of qualifications in the different countries (*International Qualifications*, 2012). Therefore consideration of the international experience in managing of welding qualifications is highly important in analysing levels of qualifications typical for this sector.

There can be distinguished several expert institutions and professional bodies playing important roles in the design and international certification of qualifications in the field of welding: 1) *European Federation for Welding* (EWF), 2) *International Institute for Welding* (IIW) and 3) E. O. Paton Welding Institute at the Academy of Science of Ukraine. These three have institutions significantly contributed to the establishment and development of the international qualifications and their frameworks in the field of welding, as well as to the international recognition and harmonisation of qualifications in the sector of welding.

Beginning of development of the European framework of welding qualifications started in the beginning of the eight decade of the last century and it was targeted to ensure the quality of welding processes and products and to harmonise vocational training of welding specialists. The European Federation of Welding played the crucial role in this process. In 1992 all EEC member states and the countries of Central and Eastern Europe were invited to join this organisation. It coincided with the beginning of design of the common European guidelines for vocational education and training of welding engineers, technicians and skilled welders, as well as with the definition of the common levels of qualifications.

In 1998 EWF concluded agreement with the International Institute for Welding, which prepared the international standards and norms related to welding processes, including the fields of training of welding staff, assessment of competences and awarding of qualifications. EWF and IIW became the leading international bodies regulating professional activities in the sector of welding. Together they developed the International Training, Qualification and Certification Systems in Welding stipulated
by the international standards ISO 3834 (addressed to regulation and quality assurance of welding processes in enterprises) and ISO 14731 (addressed to vocational training and certification of welding specialists). These two institutions also established the International Authorisation Board (IAB) to monitor the development of welding processes. This board is responsible for the effective implementation of the International Training, Qualification and Certification System in Welding in the member states of the above mentioned international bodies. It also manages the international system of assessment of competences and awarding (certification) of qualifications in the field of welding.

The interests of member countries in the EWF and IIW are represented by the Authorised National Bodies (ANB). These institutions are empowered to execute the monitoring and supervision of the International Training, Qualification and Certification System in Welding in the member states. Responsibilities of the ANB in the field of qualifications include: 1) approval of the training providers working according to the rules of the EWF/IIW, 2) management and supervision of the examination procedures, 3) organisation and execution of assessment and certification of the competences of welding specialists, 4) registering of information and data related to these processes.

**Figure 1. Institutional scheme of the international system of qualification of welding specialists established by the European Federation of Welding (EWF) and the International Institute of Welding (IIW)**

The Welding Institute of E.O. Paton at the National Academy of Science of Ukraine established the International Centre for Training and Certification of Welders. This Centre has been actively involved in the development of curriculum design and implementation of the vocational training systems of welding specialists.
In analysing the development of international qualifications of welding specialists and their levels the main sources of information are the international documents and standards stipulating vocational training of welding specialists, such as the lists of international qualifications of welders and the guidelines for vocational training and qualifications of welding specialists developed by EWF and IIW. There were also analysed the international standards stipulating the rules and regulations of training, assessment and certification of competences and awarding of qualifications of welding specialists, the training curricula and regulations of training and competence assessment of welders developed by the International Centre for Training and Certification of Welders. These documents provide sufficient information for the design of the qualifications framework of welding specialists. The qualifications framework of welding specialists developed by the EWF and IIW is provided in the Table 3.

<table>
<thead>
<tr>
<th>Level of qualification</th>
<th>Title of qualification</th>
<th>Documents stipulating training of welding specialists that lead to corresponding qualification</th>
<th>International standards stipulating qualification of welding specialists</th>
<th>Requirements to education and work experience for candidates seeking to obtain international qualification defined by the International Authorisation Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>International Welding Engineer (IWE)</td>
<td>Guideline for International Welding Engineers (IWE), Technologists (IWT), Specialists (IWS) and Practitioners (IWP) (IAB-252r1-2011).</td>
<td>EN ISO 14731</td>
<td>At least bachelor degree at the university in the technical field of study, minimal duration of studies – 4 years.</td>
</tr>
<tr>
<td>2.</td>
<td>International Welding Technologist (IWT)</td>
<td>Guideline for International Welding Engineers (IWE), Technologists (IWT), Specialists (IWS) and Practitioners (IWP) (IAB-252r1-2011).</td>
<td>EN ISO 14731</td>
<td>At least bachelor degree at the university of applied sciences in the technical field of study, minimal duration of studies – 3 years.</td>
</tr>
<tr>
<td>3.</td>
<td>International Welding Specialist (IWI-C) (IWS)</td>
<td>Guideline for International Welding Engineers (IWE), Technologists (IWT), Specialists (IWS) and Practitioners (IWP) (IAB-252r1-2011).</td>
<td>EN ISO 14731</td>
<td>Higher vocational education in the technical field.</td>
</tr>
<tr>
<td>4.</td>
<td>International Welding Practitioner (IWP)</td>
<td>Guideline for International Welding Engineers (IWE), Technologists (IWT), Specialists (IWS) and Practitioners (IWP) (IAB-252r1-2011).</td>
<td>ISO 9606</td>
<td>Minimal work experience – 2 years and acquired skills to weld in at least 3 ways.</td>
</tr>
<tr>
<td>Level</td>
<td>Qualification</td>
<td>Guideline</td>
<td>Requirements</td>
<td></td>
</tr>
<tr>
<td>-------</td>
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<td>------------</td>
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<td></td>
</tr>
<tr>
<td>7.</td>
<td>International Welding Inspector – Comprehensive level</td>
<td>Guideline for International Welding Inspection Personnel (IWIP) (IAB-041r3-2008).</td>
<td>At least bachelor degree at the university in the technical field of study, minimal duration of studies – 4 years. At least 3 years of work experience in the machinery production sector.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>International Welder (IW)</td>
<td>EN ISO 9606</td>
<td>No special requirements of formal education.</td>
<td></td>
</tr>
<tr>
<td>8/1</td>
<td>International Fillet Welder (IFW)</td>
<td>International Welder Guideline (IW) (IAB-089r4-2012).</td>
<td>EN ISO 9606</td>
<td>No special requirements of formal education.</td>
</tr>
<tr>
<td>8/2</td>
<td>International Plate Welder (IPW)</td>
<td>International Welder Guideline (IW) (IAB-089r4-2012).</td>
<td>EN ISO 9606</td>
<td>No special requirements of formal education.</td>
</tr>
</tbody>
</table>

As it can be noticed from the Table 3, the international qualifications of welders are grouped into eight levels and three main occupational groups: engineering staff, welding quality control staff, welders and welding operators. The training and certification of welding specialists belonging to these three groups are regulated by the different international standards. Referring to the requirements of formal education and work experience, it is interesting to notice, that this qualifications framework and corresponding standards do not stipulate the formal education requirements for welders (level 8) what can be probably explained by the existing diversity of the initial VET systems and models (school-based training, company based apprenticeship, dual VET) from the one side and by the importance of experiential and work-based learning in acquiring the skills and competences of welder
from the other side. As it can be seen, work experience plays very important role for the acquisition of the international qualification of welding specialists, especially for the welding quality control staff.

The International Training, Qualification and Certification System in Welding and corresponding framework of qualifications can serve as precise and reliable sources of background information for identification of the demand of welding specialists in the labour market.

However, today this system can not be applied for this purpose in Lithuania, because there is no Authorised National Body that could award corresponding qualifications and monitor the application of the system in this country. It does not permit to establish and/or approve training providers working according the rules of EWF / IIW and to organise the training of welding specialists, assessment of their competences and awarding of qualifications according to the requirements of the International Training, Qualification and Certification System in Welding. Therefore the integration of vocational training and certification of welding specialists in Lithuania in the above mentioned system remains one of the strategic objectives of the development of welding sector in this country.

**Welding specialities and specializations**

As it was mentioned before, the vertical structuring of qualifications is executed via qualifications frameworks, whereas the horizontal structuring of qualifications is executed through differentiation in the specialities and specializations. This differentiation can be based on the different parameters.

In the international practice of welding qualifications this differentiation is executed on the basis of the type of energy source used in the welding process. Referring to this criterium there are outlined the types of welding and allied processes: 1) electric arc welding, 2) contact welding, 3) welding with gas, 4) pressure welding, 5) fiber welding, 6) other specific welding processes, 8) thermal cutting and carving, 9) soldering. The types of welding and allied processes are defined by the international standard EN ISO 4063:1998 Welding and allied processes – Nomenclature of processes and reference numbers.

These types of welding processes define the speciality types of welders and welding specialists. Each type of welding processes consists of similar specific welding processes having different technological specifications. For example, electric arc welding is differentiated in the following processes: a) electric arc welding with melting electrode without gas shielding, b) electric arc welding with flux, c) electric arc welding with melting electrode with gas shielding, d) electric arc welding with non-melting electrode and protective gas (the complete list of processes is provided in the standard EN ISO 4063:1998). This differentiation of welding specialisations corresponds to the international practice.

The international certificates of competences or diploma of qualifications of welders include references of the mastered welding process, spatial positions of welding, groups of welded materials,
their thicknesses and applied equipment. Therefore the value of welder in the labour market depends on the number of mastered welding processes and acquired certifications.

The types of welding processes can also be differentiated by using other parameters. Big variety of these parameters creates favourable conditions for comprehensive description of welders’ activities and definition of the limits of their qualifications. Such parameter of the welding processes can include:

- product type (plate, pipe, socket);
- type and thickness of welded material;
- protective materials, auxiliary materials and welding consumables (active gas, inert gas, flux, electrodes, wire, rods);
- type of welding joints (butt joint, corner joint, edge joint, tee joint, lap joint);
- features of welding joint (one layer, multi-layer, with or without backing);
- spatial positions of welding (PA, PB, PC, PD etc.);
- access possibilities (one side, both sides);
- applied edge preparation (X, V, U shapes, without edge preparation);
- welding environment (welding in open air, in controlled environment, under water, vacuum, closed spaces);
- welding mechanisation level (manual, semi-automatic, automatic, robotic).

The example of the description of limits of qualification of welder is provided in the Table 4.

<table>
<thead>
<tr>
<th>Welder qualification parameters</th>
<th>Limits of qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>135 Welding process</td>
<td>MAG welding</td>
</tr>
<tr>
<td>P Plate</td>
<td>P, T: D≥ 150 mm</td>
</tr>
<tr>
<td>FW Corner welding joint</td>
<td>FW</td>
</tr>
<tr>
<td>1.2 Material group according ISO TR 15608</td>
<td>1.1, 1.2, 1.4</td>
</tr>
<tr>
<td>S Welding material</td>
<td>Wire</td>
</tr>
<tr>
<td>T10 Thickness of metal</td>
<td>10 mm</td>
</tr>
<tr>
<td>PB Welding spatial position</td>
<td>Horizontal corner welding joint</td>
</tr>
<tr>
<td>ml Features of welding joint</td>
<td>Multilayer joint</td>
</tr>
</tbody>
</table>

The current practice of identification of the demand of welding specialists in the labour market is strongly focused on the object of the welding process and it’s relationships with the sector of economy (e.g., welder of civic constructions, welder of ship hulls, welder of gas pipelines). Such comparatively narrow focus ignores bigger variety of parameters that are important for identification
of the demand of specialists, such as the range of used welding materials, diversity of welding processes and technologies.

**Current state of qualifications of welding specialists in Lithuania**

Analysis of the current state of qualifications of welding specialists in Lithuania is needed to map the levels and fields of currently provided qualifications in the welding sector. The main sources of information for this analysis were the online database AIKOS providing the information on all education and training programmes and qualifications in Lithuania, the initial VET standard of welder approved in 2004 and the initial VET curricula.

Analysis of these documents has disclosed, that welders and welding operators are prepared in 46 initial VET centres. Related VET curricula are quite diverse in terms of contents and duration of training (from 11.5 weeks training programmes for unemployed persons to 3 years programmes of initial VET). However, in the public initial VET system there are neither training programmes and providers of the international qualifications of welders according to the requirements of the EWF/IIW, nor the VET curricula that could correspond by their contents, volume and procedures the IW level training curricula. It is one of the main reasons of the shortage of welders with qualifications satisfying EU requirements. Currently the international qualifications and certifications of welders are being provided by the different private providers and representatives of the foreign agencies and training providers and the only accessible pathway of the acquisition of these qualifications is continuing vocational training of employees. The situation with the provision of international qualifications of welding specialists in the neighbouring Baltic states is considerably better. In Latvia there are training programmes providing the qualifications of ship hull welders certified by Lloyd's Register. In Estonia the Tallinn Lasnamäe School of Mechanics and the Tallinn School of mechanics are accredited by the EWF and the IIW and provide training programmes leading to the welder qualifications according to the standard EN ISO 9606-1. This certificate gives the right to work in the concrete field of welding for 1 year with subsequent prolongation after assessment of competences.

At the moment of preparation of this article the main reference for VET curriculum design if VET Standard. The VET Standard of welders was approved by the Minister of Education and Science and the Minister of Social Security and Labour in 2004 (The order No. ISAK-1159/A1-178 of the 16th of July 2004). In the nearest future the current VET standards will be replaced by the sectoral-occupational standards, that will define the contents of all national qualifications by providing information on the units of qualifications, competences, specialisations, requirements for awarding of qualifications and references to the international standards (*Qualifications and Vocational Education and Training Development Centre*, available at [http://www.kpmpc.lt/kpmpc/?page_id=1253]).
Existing VET standards define the requirements for the curriculum design and assessment of competences necessary for the awarding of initial VET qualifications. The VET Standard of welder defines the competences, learning objectives and competence assessment specifications leading to the welder qualification referenced to the 3rd level of the Lithuanian Qualifications Framework (EQF level 3) (see Table 5).

Table 5

<table>
<thead>
<tr>
<th>Qualifications of welding specialists provided in the initial VET system of Lithuania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualifications of welders (VET Standard of welder S352101)</td>
</tr>
<tr>
<td>1. Welder MMA (electric-arc welding with melting electrodes, manual operation)</td>
</tr>
<tr>
<td>2. Welder OFW (welding and cutting with gas)</td>
</tr>
<tr>
<td>3. Welder MIG/MAG (semi-automatic welding in the environment of protective and inert gas)</td>
</tr>
<tr>
<td>4. Welder TIG (welding with non-melting electrode and inert gas)</td>
</tr>
</tbody>
</table>

Current initial VET standards foresee only two qualifications of metal welders covering two ways of welding (welding with electricity and gas) and four welding and allied processes (electric arc welding with melting electrodes, gas welding and soldering, welding in the protective and inert gas (MAG, MIG, TIG), metal cutting). The VET Standard also indicates the sectors and fields of activity where the holders of these qualifications are expected to work - enterprises working in the field of assembling and repair of metal constructions, specialised metalworking, welding of car bodies, soldering and provision of individual services related to welding (Suvirintojo profesinio mokymo standartas, 2004). However, the above mentioned welding processes nowadays are being extensively replaced with the new ways and processes of welding, because the range of application of welding in the different sectors of economy is expanding. For example, in the production and assembling of equipment and machinery for food and beverage industry there is increasingly applied automated laser welding of stainless steel. Such trends of technological development significantly expand the diversity of required competences of welders and welding operators. Therefore the current structure and contents of provided qualifications of welders demand essential revisions.

The model of identification and forecasting of demand of qualifications of welding specialists in the national labour market

When comparing the provision of training and qualifications of welders on the international level with the current situation of the provision of these qualifications in Lithuania there can be discerned two main groups of qualifications, that are important to consider in identifying demand of welding specialists in Lithuania: 1) welding specialists with the international qualifications and certifications, and 2) welding specialists who acquired national qualification in the field of welding after graduation of initial VET or higher education programmes (without international qualifications or certifications).
Thus the demand of the welding specialists with international qualifications starts from the identification of the level of qualification of these specialists according to the corresponding guidelines stipulating training of welding specialists defined by the EWF and IIW - International Welder Guideline (IW) (IAB-089r4-2012), Guideline for International Welding Inspection Personnel (IWIP) (IAB-041r3-2008), Guideline for International Welding Engineers (IWE), Technologists (IWT), Specialists (IWS) and Practitioners (IWP) (IAB-252r1-2011). Afterwards there is defined specialisation of needed specialists by referring to the international standard EN ISO 4063:1998.

![Diagram of identification and forecasting of demand of qualifications of welding specialists](image)

**Figure 2.** The model of identification and forecasting of demand of qualifications of welding specialists in the national labour market

The demand of welding specialists with the national qualifications starts from the identification of the level of qualification according to the Lithuanian Qualifications Framework and is followed with the identification of specialities and specialisations defined in the sectoral occupational standards.
(currently – in the VET Standard). In both cases the identified profiles of qualification of the needed specialists should be precised by specifying the limits of qualifications (Fig. 6).

Collecting the information about the qualifications of demanded welding specialists (level of qualification and specialisations), activities of enterprises, time and place parameters of demand of specialists permits to ensure sufficiently precise identification of demand of these specialists in the national labour market. When this information and forecasts are related to the plans of strategical development of the sector of economy and to the wage setting policies there emerges even wider possibilities for the regulation of labour market and satisfying it's demands in systemic way.

**Conclusions**

Qualifications system of the welding sector in Lithuania is dual in terms of co-existence of the national qualifications provided in the public VET system as well as international qualifications that are provided by the private providers and not integrated in the national system of qualifications. The contents of qualifications in the field of welding is changing very fast and expanding in terms of diversity due to the emergence of new technologies and welding processes, application of new materials and consumables. These circumstances significantly complicate identification of the demand of welding specialists.

Occupation and qualification of the welding specialist can not be considered separately from their context by ignoring the trends of technological development, transfer of professional experience and know-how, development of specialised functional knowledge and competences. These contextual factors constitute development of occupations and professions in the field of welding leading to fast spread of specialities and specialisations. Referring to qualifications and competences, the welding specialists can be differentiated into two main groups: holders of international qualifications or certificates and holders of national qualifications provided in the systems of the initial VET and higher education (without international certification). The levels of qualifications of welders are defined by the different reference frameworks and standards depending on whether concerned qualification is international or it belongs to the national system of qualifications. Specialisations of welders are defined referring to the corresponding international standards regulating the welding processes and to the national occupational standards. Qualifications-based identification of the demand of welding specialists significantly increases the reliability and relevance of this process due to systemic and comprehensive consideration of the needs of labour market and work processes.

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