

# Migration and Employability Indicators: A Structural Analysis

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## Abstract

*After the recent sharp increase of migrants, refugees and asylum seekers (MRAs) arrival in Europe, the issue of migration is forefront in the policy agenda of all European countries. In this context, a crucial issue is to investigate the employability potential of MRAs and their integration process into the labour markets of their host countries. The aim of this research is twofold: first, to propose a methodology for estimating the MRAs' employability for a specific economy and, second, to investigate the results of the methodology for a selected panel of EU countries, namely the Czech Republic, Denmark, Greece, Switzerland and the United Kingdom. Two composite indicators are introduced, providing a method for the matching of skills and qualifications of MRAs across the various sectors (the first indicator) and the occupations (the second indicator) of the economy; aiming at the optimization of the integration process. For the construction of the indicators a number of variables are taking into account in order to identify the structural characteristics of the examined labour market at the sectoral (2-digit NACE Rev. 2) and occupational level (2-digit ISCO-08). These variables are: (i) the structure of employment by sectors of economic activity and by occupations; (ii) the growth rate of employment; (iii) the backward and forward employment multipliers; (iv) the occupational multipliers and v) job vacancy rate by sector. Additionally, the similarity of the MRAs' skills (educational attainment level) is estimated in sectoral and occupational level using the Manhattan distance. The data used in the research are: the input-output tables for the examined countries (WIOD), data on the structure of employment by sector and occupation at the 2-digit level (LFS) and data on job vacancy rate by sector of economic activity (Eurostat). The findings suggest that employability opportunities for MRAs' in most economies are allocated in primary and secondary sector, whereas in terms of occupations these opportunities are allocated to skilled workers and elementary occupations. Nonetheless, it is apparent from the analysis that these labour markets exhibit increased heterogeneity in terms of structure. This in turn implies that tailor-made policy actions should be put forward in order to aid the smooth integration of MRAs' in these economies. The study was funded by HORIZON 2020, European Union, Horizon 2020 Research programme: H2020-SC6-REVINEQUAL-2017 (770515).*

*Keywords: Labour Market, Integration, Skill, Composite Indicators*

## 1. Introduction

The current refugee crisis occurred a few years after the beginning of the economic crisis and at a juncture where a number of European countries have not fully recovered. The heterogeneity of the social and economic situations in the different European countries intensified after the crisis, with important impact in their labour market: rise in unemployment and precarious jobs difficulties in preserving social security policies and increased risk of social exclusion and poverty (Carmo et al., 2018, p. 11).

Moreover, besides the impact of the economic crisis on the labour market of all European countries, a number of labour market's challenges arise from changes in the demographic composition of the labour force and from the shifting of production to more complex processes (Cedefop, 2016, pp. 6, 18, 29). In the future, Europe is expected to face a significant decline in working age population, accompanied by an increase in old age dependency ratio (old age dependency ratio is the ratio between the number of persons aged 65 and over and the number of persons aged between 15 and 64). The decline of the working age population will result, in some countries, in the reduction of labour force, putting downward-pressure on labour supply with possible negative impact on economic growth potential (Bredtmann, 2014, p. 36; Peschner and Fotakis, 2013, p. 23). Moreover, the production of products and services of increased complexity will, also, rise the complexity of work and create the need for employment of more qualified and better skills (Pikos and Thomsen, 2016, p. 12).

The future role of MRAs in the labour market of the host countries is difficult to predict. According to Peschner and Fotakis (2013, p. 39) the impact of migration on economic growth and employment of the receiving country is connected with MRAs skills and with their compatibility and/or complementarity in the domestic labour market (for the demand side). Within the next few years, the dynamic labour markets of European countries will be found confronting significant changes in occupations' and skills' demand. At the same time, constrains in economic growth could appear due to labour supply bottlenecks. Issues of skills shortages and skills mismatches will be crucial for the economies and the adopted policies to confront the MRAs integration should take full account (OECD, 2016, p. 24).

Against the background of these labour market's features, the MRAs integration into the host countries' labour markets is a critical policy goal. A crucial factor towards MRAs integration is the enhancement of their employability in order to access employment opportunities. Based on the research of RISE (2013, p. 36) for the situation of asylum seekers and refugees in three European countries, important barriers for their labour market integration are, among others: (i) The lack of knowledge of the host-country's language, especially of "vocational language"<sup>1</sup>, (ii) the lack of qualifications' and skills' recognition, (iii) the lack of host-country references or experience recognition, and (iv) the lack of appropriate training courses. It is crucial to note that a major prerequisite towards this direction is the recording and recognition of MRAs skills and qualifications, in order to construct the suitable educational and training programs plan. The integration process should start with a comprehensive skills' assessment, accompanied with the recognition of occupational skills and qualifications. Additionally, gaining vocational skills and work experience in the host country's labour market should be an important policy

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<sup>1</sup> Although the knowledge of the host country's language is a necessary precondition for accessing employment and successful overall integration, language-learning programs for MRAs are rarely linked to employment. In the literature the importance of integration programs which provide the opportunity to build both language and vocational skills is highlighted (Benton and Diegert, 2018, p. 22).

measure for MRAs. To this end, it is necessary to examine the complexity of the host country labour market in order to explore the MRAs integration potential.

The aim of this paper is to propose a methodology of estimating the employability potential of MRAs in selected European countries (namely the Czech Republic, Denmark, Greece, Switzerland and the United Kingdom economies). In the analysis the labour market characteristics of examined countries are taken into account, in order to identify the employability potential of MRAs in the different countries socio-economic contexts. The quantitative analysis is also presented based on two composite indicators<sup>2</sup>, i.e. SIRIUS 1 and SIRIUS 2. SIRIUS 1 and SIRIUS 2 are used to identify the sectors and the occupations, respectively, of an economy which have simultaneously high growth potential and required educational attainment level compatible to the MRAs educational attainment level. For the construction of both indicators input-output analysis is used, which constitutes a widely used methodology appropriate for this type of investigation. The estimates are disaggregated by sector of economic activity and by occupation for each country and analytical presentations will be offered to assess the current state of integration of international MRAs in the countries under investigation.

## *2. Methodology*

The examination of the labour market characteristics at the country level is a crucial starting point for the integration process of MRAs. The documentation of the integration potential is highly related with the distribution of labour demand across a country's sectors of economic activities and occupations. The high level of heterogeneity across the labour markets of different European countries requires the in-depth approach of their economic and social environment (structural characteristics, sectoral composition, demographic issues and labour force structure), but also the analysis of the impact of the economic crisis on the various economies.

The drivers of the employment features can be found in a number of factors: technological change, capital accumulation, demographic characteristics, climate change, urbanization, government policies etc. In general, the process of labour markets' structural transformation (both regarding the sectoral structure and the distribution of employment across occupations) in developed countries, is characterized by a gradual shift from primary and traditional manufacturing sectors (agricultural production, food industries, textiles industries, etc.) to tertiary activities and/or modern (high-technology and digitalization) manufacturing sectors. The contemporary labour markets of the examined countries show high level of heterogeneity in the productive structure, the labour force and the demographical features, creating a highly differentiated economic and social environment across countries (Belegri-Roboli, Michaelides, Konstantakis, Marinos & Markaki, 2018). The employability potential of MRAs for each economy is determined based on the employment features of the specific economy and the educational attainment level of MRAs.

The proposed methodology includes three stages:

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<sup>2</sup> Both composite indicators are named after the research program acronym: SIRIUS (Skills and integration of migrants, refugees and asylum seekers in European labour markets), see <https://www.sirius-project.eu/>.

- In the first stage, the employment features of the examined economy are approached through two composite indicators, focusing on the sectoral structure of employment and on the occupational structure of employment, respectively.
- In the second stage, the educational attainment level of MRAs is compared with the educational attainment level of the employment of the examined country.
- In the third stage, two composite indicators are employed with respect to sectors and occupations, which - combining the first two stages – allow us to identify the priorities at the sectoral and occupational level to promote MRAs employability. The priorities with respect to sectors and occupations are estimated through two composite indicators, the SIRIUS Indicator for Sectors (SIRIUS 1) and the SIRIUS Indicator for Occupations (SIRIUS 2).

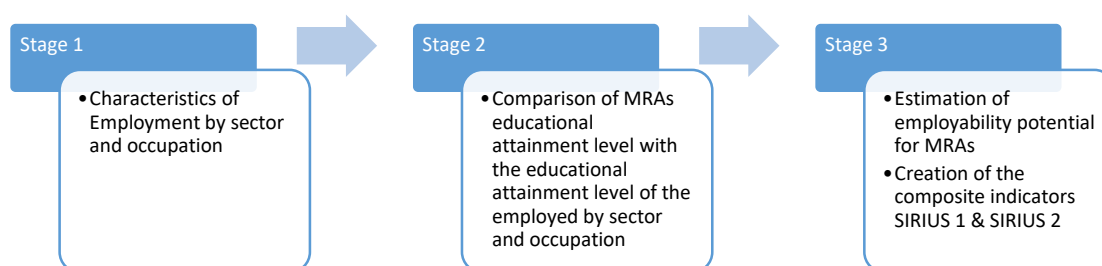


Figure 1: The stages of the proposed methodology

In the literature, composite indicators like the proposed ones, are aggregate measures that are calculated as weighted combinations of selected sub-indicators via the underlying models of the policy domains of interest (OECD and JRS, 2008, p. 51). They are increasingly used by organizations and policy makers to compare the characteristics of different countries or regions in various policy fields.

The analysis below is based on the classification of sectors of economic activity from World Input-Output Database –WIOD (Timmer et al., 2016, 2015) and covers 54 sectors of economic activity according to ISIC Rev. 4 (or equivalently NACE Rev. 2, digit 2) listed in Table 1. The analysis of employment by occupation is based on the ISCO 08 classification available in Table 2 (for the 2-digit classification). The analysis of the employment structure by educational attainment level is based on the ISCED aggregation of Table 3. Analytically, the categories of educational attainment level are listed in Table 4. Data on the job vacancy rate<sup>3</sup> are available from Eurostat by sector of economic activity (1-digit analysis in NACE Rev. 2 classification), for all the examined countries except Italy. The job vacancy rate measures the proportion between the annual average number of vacancies and the total annual average number of jobs (occupied and vacancies). Note that an occupied post means a paid post within the organization to which an employee has been assigned.

<sup>3</sup> The official definition of a job vacancy is included in Article 2 of Regulation (EC) No 453/2008 and is used by EUROSTAT: “A job vacancy shall mean a paid post that is newly created, unoccupied, or about to become vacant: a) for which the employer is taking active steps and is prepared to take further steps to find a suitable candidate from outside the enterprise concerned, and b) which the employer intends to fill either immediately or within a specific period of time. A vacant post that is only open to internal candidates is not treated as a ‘job vacancy’.”

## 2.1. SIRIUS Indicator for Sectors (SIRIUS 1)

The SIRIUS Indicator for Sectors (SIRIUS 1) is a composite indicator intending to express the employability potential of MRAs in the sectors of economic activity of each country. SIRIUS 1 consists of seven (7) components and an indicator, the indicator Sectoral Structure Similarity (SSS).

The components of SIRIUS 1 are:

- The participation rate of a sector to the total employment
- The percentage change of a sector's employment
- The backward multiplier of a sector
- The percentage change of the backward multiplier of a sector
- The forward multiplier of a sector
- The percentage change of the forward multiplier of a sector
- The job vacancy rate of the sector

If  $k$  is the number of indicators determined by the criteria defined above ( $k = 1, \dots, 7$ ),  $i$  is the number of sectors ( $i = 1, \dots, 54$ ) and  $j$  is the number of counties ( $j = 1, \dots, 7$ ), set  $s_{ij}$  the sector  $i$  of the country  $j$  and  $m_k(s_{ij})$  the value of indicator  $m_k$  for each  $s_{ij}$ .

In order to transform the different units and ranges of the individual indicators into comparable ones, each indicator is normalized before combining to one composite indicator. Within the normalization step, a normalization function is used to transform the indicator values  $m_k(s_{ij})$  of each sector  $i$  of the country  $j$ ,  $s_{ij}$ , into a normalized indicator  $v_k(m_k(s_{ij}))$  on a scale between 0 and 1:

$$v_k \begin{cases} h \rightarrow [1, 0] \\ m_k(s_{ij}) \mapsto v_k(m_k(s_{ij})) \end{cases} \quad (1)$$

A value of 1 represents the highest degree of the normalized indicator and a value of 0 the lowest one. In this research, a linear normalization function is employed, which means that a linear relation between an indicator's value and its normalized value is assumed (Merz et al., 2013, p. 1086). The linear normalization function is defined as

$$v_k(m_k(s_{ij})) = \frac{m_k(s_{ij}) - m_k(s_{ij})_{min}}{m_k(s_{ij})_{max} - m_k(s_{ij})_{min}} \quad (2)$$

, where  $m_k(s_{ij})_{min}$  is the lowest and  $m_k(s_{ij})_{max}$  is the highest value of indicator  $k$ , measured across the  $i$  sectors of the  $j$  economy.

The indicator of Sectoral Structure Similarity (SSS) provides a method to investigate the similarity of the educational attainment level of MRAs with the educational attainment level of employment for each sector of economic activity for the examined country. SSS is constructed as follows:

If the vector  $l_{ij} = [l_{1,ij} \quad l_{2,ij} \quad l_{3,ij}]$  describes the percentage structure of employment for the sector  $i$  and the country  $j$  for the three educational attainment levels of Table 3, and the vector  $l_j^{MRAs} = [l_{1,j}^{MRAs} \quad l_{2,j}^{MRAs} \quad l_{3,j}^{MRAs}]$  describes the percentage structure of MRAs educational attainment level the country  $j$  for the three educational attainment levels of Table 3, then, the distance of the educational attainment level of MRAs from the educational attainment level of the sector  $i$  of the economy  $j$  is defined as:

$$D_{ij} = |l_{1,ij} - l_{1,j}^{MRAs}| + |l_{2,ij} - l_{2,j}^{MRAs}| + |l_{3,ij} - l_{4,j}^{MRAs}| \quad (3)$$

And the Sectoral Structure Similarity of the sector  $i$  of the economy  $j$  is defined as:

$$SSS_{ij} = \frac{1}{1 + D_{ij}} \quad (4)$$

$SSS_{ij}$  is transformed into a normalized indicator in order to be comparable to the indicators of the first stages and to be used in the third stage of the study. Following the methodology analytically described above,  $SSS_{ij}$ , is normalized as follows:

$$V(SSS_{ij}) = \frac{SSS_{ij} - SSS_{ij_{min}}}{SSS_{ij_{max}} - SSS_{ij_{min}}} \quad (5)$$

, where  $V(SSS_{ij})$  is the normalized indicator  $SSS_{ij}$ , measured in a scale between 0 and 1,  $SSS_{ij_{min}}$  is the lowest and  $SSS_{ij_{max}}$  is the highest value of  $SSS_{ij}$ , measured across the  $i$  sectors of the  $j$  economy.

A value of 1 represents the highest similarity degree of the normalized indicator and a value of 0 the lowest one.

Finally, the indicator  $SIRIUS1_{ij}$  of the sector  $i$  of the country  $j$  is defined as follows:

$$SIRIUS1_{ij} = \sum_1^k w'_k \cdot v_k(m_k(s_{ij})) + w_{SSS} \cdot V(SSS_{ij}) \quad (6)$$

, where  $w_k$  importance weight of the normalized indicator  $k$  and  $w_{SSS}$  the weight of normalized indicator  $SSS_{ij}$ . The weights  $w_k$  and  $w_{SSS}$  express the relative importance of the individual indicators. The weight vector  $W = [w_1 \ w_2 \ \dots w_k \ w_{SSS}]$  contains the weights of all individual indicators of the composite indicator model. For  $W'$ , it must be ensured that the following constraints is satisfied:

$$\sum_1^k w_k + w_{SSS} = 1, w_k > 0, \text{ for all } k \text{ and } w_{SSS} > 0 \quad (7)$$

As discussed in Janger, Schubert, Andries, Rammer, & Hoskens (2017, p. 23) the elicitation of weights for the individual indicators is especially important for the quality of the results. It should be noted that the dependencies among the individual indicators  $m_k(s_{ij})$  of the composite indicator  $SIRIUS1_{ij}$  may lead to distorted results (Dočekalová and Kocmanova, 2016, p. 6), particularly if we consider the additive form of the aggregation. This dependencies can lead to the overestimation or to the underestimation of the growth indicator. Nevertheless, given that all selected indicators describe an aspect of employment by sector of economic activity, it is not possible to select completely independent indicators (OECD and JRS, 2008, p. 22).

## 2.2. SIRIUS Indicator for Occupations (SIRIUS 2)

The SIRIUS Indicator for Occupations (SIRIUS 2) is a composite indicator intending to measure different aspects of the occupational structure with respect to employment for each economy. SIRIUS 2 consists of four (4) components and an indicator, the indicator Occupational Structure Similarity (OSS).

The components of SIRIUS 2 are:

- The participation rate of an occupation to the total employment
- The percentage change of an occupation in employment
- The multiplier of the occupation
- The percentage change of the multiplier of an occupation

If  $r$  is the number of indicators determined by the criteria defined above ( $r = 1, \dots, 4$ ),  $n$  is the number of occupations ( $n = 1, \dots, 40$ ) and  $j$  is the number of counties ( $j = 1, \dots, 7$ ), set  $s_{nj}$  the occupation  $n$  of the country  $j$  and  $m_r(s_{nj})$  the value of indicator  $m_r$  for each  $s_{nj}$ .

In order to transform the different units and ranges of the individual indicators into comparable ones, each indicator is normalized before combining into one composite indicator. Within the normalization step, a normalization functions is used to transform the indicator values  $m_r(s_{nj})$  of each occupation  $n$  of the country  $j$ ,  $s_{nj}$ , into a normalized indicator  $v_r(m_r(s_{nj}))$  on a scale between 0 and 1:

$$v_k \begin{cases} h \rightarrow [1, 0] \\ m_r(s_{nj}) \mapsto v_r(m_r(s_{nj})) \end{cases} \quad (8)$$

A value of 1 represents the highest degree of the normalized indicator and a value of 0 the lowest one. In this research, a linear normalization function is employed, which means that a linear relation between an indicator's value and its normalized value is assumed. The linear normalization function is defined by:

$$v_r(m_r(s_{nj})) = \frac{m_r(s_{nj}) - m_r(s_{nj})_{min}}{m_r(s_{nj})_{max} - m_r(s_{nj})_{min}} \quad (9)$$

, where  $m_r(s_{nj})_{min}$  is the lowest and  $m_r(s_{nj})_{max}$  is the highest value of indicator  $k$ , measured across the  $n$  occupation of the  $j$  economy.

The indicator of Occupational Structure Similarity (OSS) provides a method to investigate the similarity of the educational attainment level of MRA with the educational attainment level of each occupation for the examined country. OSS is constructed as follows:

If the vector  $l_{nj} = [l_{1,nj} \quad l_{2,nj} \quad l_{3,nj}]$  describes the percentage structure of employment for the occupation  $n$  and the country  $j$  for the three educational attainment levels of Table 3 and the vector  $l_j^{MRAS} = [l_{1,j}^{MRAS} \quad l_{2,j}^{MRAS} \quad l_{3,j}^{MRAS}]$  describes the percentage structure of MRAs educational attainment level the country  $j$  for the three educational attainment levels then, the distance of the educational attainment level of MRAs from the educational attainment level of the occupation  $j$  of the economy  $j$  is defined as:

$$D_{nj} = |l_{1,nj} - l_{1,j}^{MRAS}| + |l_{2,nj} - l_{2,j}^{MRAS}| + |l_{3,nj} - l_{4,j}^{MRAS}| \quad (10)$$

And the Occupational Structure Similarity of the sector  $i$  of the economy  $j$  is defined as:

$$OSS_{nj} = \frac{1}{1 + D_{nj}} \quad (11)$$

$OSS_{ij}$  is transformed into a normalized indicator in order to be comparable to the indicators of the first stages and to be used in the third stage of the study. Following the methodology analytically described above,  $OSS_{ij}$  is normalized as follows:

$$V(OSS_{nj}) = \frac{OSS_{nj} - OSS_{nj_{min}}}{OSS_{nj_{max}} - OSS_{nj_{min}}} \quad (12)$$

, where  $V(OSS_{nj})$  is the normalized indicator  $OSS_{nj}$ , measured in a scale between 0 and 1,  $OSS_{nj_{min}}$  is the lowest and  $OSS_{nj_{max}}$  is the highest value of  $SSS_{ij}$ , measured across the  $n$  occupations of the  $j$  economy.

Finally, the indicator  $SIRIUS2_{ij}$  of the occupation  $n$  of the country  $j$  is defined as follows:

$$SIRIUS2_{nj} = \sum_1^r w_r \cdot v_r(m_r(s_{nj})) + w_{oss} \cdot V(OSS_{ij}) \quad (13)$$

, where  $w_r$  is the importance weight of the normalized indicator  $r$  and  $w_{oss}$  is the weight of the normalized indicator  $OSS_{ij}$ . The weights  $w'_r$  and  $w_{oss}$  express the relative importance of the individual indicators. The weight vector  $[w_1 \ w_2 \ \dots w_r \ w_{oss}]$  contains the weights of all individual indicators of the composite indicator model. It must be ensured that the following constraints are satisfied:

$$\sum_1^r w_r + w_{oss} = 1, w'_r > 0, \text{ for all } r \text{ and } w_{oss} > 0 \quad (14)$$

### 2.3. Assignment of Weights

Assigning weights is a key procedure and, therefore, it should be approached in the direction of achieving maximum level of objectivity. In general, statistical methodologies, as well as experts evaluation methodologies can be used to consider the relationship among the individual indicators and setting suitable weights (analytically in Becker, Paruolo, Saisana, & Saltelli, 2016; OECD & JRS, 2008; Tangian, 2007). Although a number of methodologies, such as Factor Analysis, Data Envelopment Analysis, Analytic hierarchy Process, etc. can be used to assign weights to individual indicators, this approach was not applied in this study. As discussed in Saisana and Tarantola (2002, p. 60) the weights assigned only on the basis of statistical analysis do not necessarily reflect the actual relationships between the indicators.

It is important to note that most composite indicators rely on equal weighting, i.e. all variables are given the same weight. Moreover, if variables are grouped into dimensions and those are further aggregated into the composite indicator, then applying equal weighting to the dimensions may imply an unequal weighting of the variables (OECD and JRS, 2008, p. 31).

In the case of  $GIO_{nj}$  the dimension of the economic structure is defined by the variables  $v_1(m_1(s_{nj}))$  and  $v_2(m_2(s_{nj}))$ . The sum of their weight equals 0.5. The dimension of the multiplying effect is defined by the variables  $v_3(m_3(s_{nj}))$  and  $v_4(m_4(s_{ij}))$  and the sum of their weights is also 0.5. For both dimensions, we also consider that the variables expressing a percentages change are less important than the variable expressing the current value of a measure. As a result, the weights of the variables  $v_2(m_2(s_{ij}))$  and  $v_4(m_4(s_{ij}))$  are set to 0.1. Then, all the weights of the composite indicator  $GIO_{nj}$  are defined.

For the estimation of the weights of  $SIRIUS1_{ij}$  we consider that the importance of the seven components and of  $V(SSS_{ij})$  is equal, so the weight of each one of them is equal to 0.5. The weights of seven components of  $SIRIUS1_{ij}$  are determined based on the assumptions that the structure of employment and the multiplying effect that this structure



creates are two dimensions of equal importance. The determination of the weights is represented in Table 5.

For the estimation of the weights of SIRIUS $2_{nj}$  we consider that the importance of four components and of  $V(OSS_{nj})$  is equal, so the weight of each one of them is equal to 0.5. The weights of seven components of  $SIRIUS2_{ij}$  are determined based on the assumptions that the structure of employment and the multiplying effect that this structure creates are two dimensions of equal importance. The determination of the weights is represented in Table 5.

Based on Table 5, SIRIUS $1_{ij}$  and SIRIUS $2_{nj}$  are formulated as follows:

$$SIRIUS1_{ij} = 0.225 \cdot v_1(m_1(s_{ij})) + 0.025 \cdot v_2(m_2(s_{ij})) + 0.075 \cdot v_3(m_3(s_{ij})) + 0.075 \cdot v_4(m_4(s_{ij})) + 0.025 \cdot v_5(m_5(s_{ij})) + 0.025 \cdot v_6(m_6(s_{ij})) + 0.05 \cdot v_7(m_7(s_{ij})) + 0.5 \cdot V(SSS_{ij}) \quad (15)$$

$$SIRIUS2_{ij} = 0.25 \cdot v_1(m_1(s_{nj})) + 0.05 \cdot v_2(m_2(s_{nj})) + 0.15 \cdot v_3(m_3(s_{nj})) + 0.05 \cdot v_4(m_4(s_{nj})) + 0.5 \cdot V(OSS_{nj}) \quad (16)$$

The data used in the research are:

- The input-output tables, that come from the WIOD (<http://www.wiod.org/home>).
- Data on the structure of employment by sector and occupation at the 2-digit level
- Data on job vacancy rate by sector of economic activity were collected from Eurostat's Database, at the 1-digit level for all the examined countries except Italy.

The analysis covers the period 2011-2017 for all countries, with the exception of Denmark, where the last year with available data is 2016.

### 3. Results and Discussion

In Table 6 the rank of sectors based on SIRIUS 1 and SIRIUS 2 are listed for the Czech Republic, Greece, Denmark, the United Kingdom and Switzerland. For each country, the occupations with the 10 highest value are highlighted.

Based on Table 6, the employability potential for MRAs was identified in a wide range of sectors and occupations among the examined countries. Analytically, MRAs potential for integration:

- in the Czech Republic are concentrated in two industrial (Manufacture of motor vehicles, trailers and semi – trailers & Printing and reproduction of recorded media) and eight services sectors (Retail trade, except of motor vehicles and motorcycles, Arts, entertainment and recreation and other service activities, Wholesale trade, except of motor vehicles and motorcycles, Administrative and support service activities, Warehousing and support activities for transportation, Electricity, gas, steam and air conditioning supply, Public administration and defense, compulsory social security, Accommodation and food service activities). The occupations with high employability potential are in the categories of elementary occupations, craft and related trades workers and clerical support workers.
- in Denmark are concentrated in three industrial (Manufacture of machinery and equipment n.e.c., Manufacture of basic metals, Manufacture of other transport equipment) and seven services sectors (Public administration and defense, compulsory social security, Human health and social work activities, Water transport, Retail trade, except of motor vehicles and motorcycles, Administrative and support service activities, Wholesale trade, except of motor vehicles and motorcycles, Manufacture of other transport equipment, Accommodation and food service activities). The occupations with high employability potential can be found in a wide range of occupations such as craft and related trades workers, clerical support workers, service and sales workers.
- in Greece are concentrated in three primary (Crop and animal production, hunting and related service activities, A03; Fishing and aquaculture, A02; Forestry and logging), three industrial (Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials, Manufacture of motor vehicles, trailers and semi – trailers, Manufacture of textiles, wearing apparel and leather products) and four services sectors (Retail trade, except of motor vehicles and motorcycles, Construction, Accommodation and food service activities, Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services). The occupations with high employability potential are in the categories of skilled agricultural workers, plant and machine operators and assemblers and elementary occupations.
- in Switzerland are concentrated in three industrial (Manufacture of basic metals, Manufacture of food products, beverages and tobacco products, Manufacture of wood and of products of wood and cork, except furniture, manufacture of articles of straw and plaiting materials) and seven services sectors (Arts, entertainment and recreation and other service activities, Human health and social work activities, Construction, Administrative and support service activities, Accommodation and food service activities, Retail trade, except of motor vehicles and motorcycles, Wholesale trade, except of motor vehicles and motorcycles). The occupations with high employability potential are in the categories Clerical support workers, Plant and machine operators and assemblers and Elementary occupations.
- in the United Kingdom are concentrated in one industrial (Manufacture of machinery and equipment n.e.c) and nine services sectors (Human health and social work

activities, Public administration and defense, compulsory social security, Water transport, Other professional, scientific and technical activities, veterinary activities, Advertising and market research, Arts, entertainment and recreation and other service activities, Activities auxiliary to financial services and insurance activities, Retail trade, except of motor vehicles and motorcycles, Motion picture, video and television program production, sound recording and music publishing activities, programming and broadcasting activities). The occupations with high employability potential are in the categories of professionals, technicians and associate professionals and clerical support workers.

*For the evaluation of the results and for the comparative examination of the MRAs employability among the SIRIUS countries we employ the Spearman rank correlation coefficient (rho coefficient).<sup>4</sup> The results are included in*

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<sup>4</sup> Spearman rank correlation coefficient, commonly referred to as Spearman's rho coefficient, is a statistic used to measure the ordinal association between the rankings of two variables. It assesses how well the relationship between two variables can be described using a monotonic function. A rho test is a non-parametric hypothesis test for statistical dependence based on the tau coefficient. The Spearman rank-correlation coefficient ranges from -1 to 1. A rho coefficient near 1 indicates a strong positive association between the ranks for the two variables, while a rho coefficient near -1 indicates a strong negative association between the ranks for the two variables. A rho coefficient of 0 indicates no association between the ranks for the two variables.

Table 7. The rho of SIRIUS 1 shows in general that the rank of countries is not similar, with the exception of Denmark and the United Kingdom, and Denmark and Switzerland which show high rank similarity in SIRIUS 1. Furthermore, the rho of SIRIUS 2 shows, in general, that the rank of the countries is not similar, with the exception of Denmark and the United Kingdom, Denmark and Switzerland and the Czech Republic and Switzerland, which show relatively high rank similarity in SIRIUS 2. In conclusion, the examined countries show small to medium association among the occupations' rank order. Namely, the differences of the sectoral and the occupational structure of employment in the examined countries lead to diverse ranking based on both the composite indicators. For the interpretation of this important finding, we should keep in mind should the differences of MRAs educational attainment level between the countries. The above findings indicate that MRAs integration policies which will focus on the increase of their employability in the host country labour market, should focus in different sectors and occupations for each country. Or, in other words, that the integration policies in a cross country level could cover a wide range of sectors and occupations, giving the ability of integrations to MRAs with different characteristics.

Finally, in Table 8 the required tasks for the 1<sup>st</sup> priority occupations are presented, based on the taxonomy of Eurofounde (2016) and the Cedefop (2016), available in: <https://skillspanorama.cedefop.europa.eu/>. The results show:

- the high diversity among the required skills of 1<sup>st</sup> priority occupations for the examined countries.
- the physical (dexterity and strength) show low importance for the 1<sup>st</sup> priority occupations in all countries, and
- the intellectual skills (especially creativity & resolution) are rather important in the majority of the 1<sup>st</sup> priority occupations.

#### *4. Conclusion*

The aim of this part of the research is to develop a methodology to estimate the employability of migrants, refugees and asylum seekers (MRAs) for the economies of Czech Republic, Denmark, Greece, Switzerland and the United Kingdom. The significant diversity among the sectors and the occupations of the examined countries that boost economic growth was evident. This diversity is driven by the countries' different specialization patterns and structural characteristics, which are present in the labour market features.

Furthermore, the employability potential for MRAs was identified in a wide range of sectors and occupations among the examined countries. For each examined economy the most dynamic sectors and occupations are determined and the MRAs integration potential is approached based on the similarity of their educational attainment level with the educational attainment level's demand, at the sectoral and occupational levels, respectively.

## Tables

Table 1: Classification of Sectors – NACE Rev. 2, 2– digit

ID	Name
A01	Crop and animal production, hunting and related service activities
A02	Forestry and logging
A03	Fishing and aquaculture
B	Mining and quarrying
C10 - C12	Manufacture of food products, beverages and tobacco products
C13 - C15	Manufacture of textiles, wearing apparel and leather products
C16	Manufacture of wood and of products of wood and cork
C17	Manufacture of paper and paper products
C18	Printing and reproduction of recorded media
C19	Manufacture of coke and refined petroleum products
C20	Manufacture of chemicals and chemical products
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
C22	Manufacture of rubber and plastic products
C23	Manufacture of other non - metallic mineral products
C24	Manufacture of basic metals
C25	Manufacture of fabricated metal products, except machinery and equipment
C26	Manufacture of computer, electronic and optical products
C27	Manufacture of electrical equipment
C28	Manufacture of machinery and equipment n.e.c.
C29	Manufacture of motor vehicles, trailers and semi - trailers
C30	Manufacture of other transport equipment
C31_C32	Manufacture of furniture, other manufacturing
C33	Repair and installation of machinery and equipment
D35	Electricity, gas, steam and air conditioning supply
E36	Water collection, treatment and supply
E37 - E39	Sewerage, waste collection, treatment and disposal activities, and other waste
F	Construction
G45	Wholesale and retail trade and repair of motor vehicles and motorcycles
G46	Wholesale trade, except of motor vehicles and motorcycles
G47	Retail trade, except of motor vehicles and motorcycles
H49	Land transport and transport via pipelines
H50	Water transport
H51	Air transport
H52	Motion picture, video and television program production, sound recording and music
H53	Postal and courier activities
I	Accommodation and food service activities
J58	Publishing activities
J59_J60	Motion picture, video and television program production, sound recording and music publishing activities, programming and broadcasting activities
J61	Telecommunications
J62_J63	Computer programming, consultancy and related activities, information service activities
K64	Financial service activities, except insurance and pension funding
K65	Insurance, reinsurance and pension funding, except compulsory social security
K66	Activities auxiliary to financial services and insurance activities
L68	Real estate activities
M69_M70	Legal and accounting activities, activities of head offices, management consultancy
M71	Architectural and engineering activities, technical testing and analysis
M72	Scientific research and development
M73	Advertising and market research
M74_M75	Other professional, scientific and technical activities, veterinary activities
N	Administrative and support service activities
O84	Public administration and defense, compulsory social security
P85	Education
Q	Human health and social work activities
R-S	Arts, entertainment and recreation and other service activities

Source: Eurostat and WIOD

Table 2: Classification of Occupations – ISCO - 08, 2-digit

<b>ID</b>	<b>Name</b>
<b>11</b>	Chief executives, senior officials and legislators
<b>12</b>	Administrative and commercial managers
<b>13</b>	Production and specialised services managers
<b>14</b>	Hospitality, retail and other services managers
<b>21</b>	Science and engineering professionals
<b>22</b>	Health professionals
<b>23</b>	Teaching professionals
<b>24</b>	Business and administration professionals
<b>25</b>	Information and communications technology professionals
<b>26</b>	Legal, social and cultural professionals
<b>31</b>	Science and engineering associate professionals
<b>32</b>	Health associate professionals
<b>33</b>	Business and administration associate professionals
<b>34</b>	Legal, social, cultural and related associate professionals
<b>35</b>	Information and communications technicians
<b>41</b>	General and keyboard clerks
<b>42</b>	Customer services clerks
<b>43</b>	Numerical and material recording clerks
<b>44</b>	Other clerical support workers
<b>51</b>	Personal service workers
<b>52</b>	Sales workers
<b>53</b>	Personal care workers
<b>54</b>	Protective services workers
<b>61</b>	Market-oriented skilled agricultural workers
<b>62</b>	Market-oriented skilled forestry, fishery and hunting workers
<b>63</b>	Subsistence farmers, fishers, hunters and gatherers
<b>71</b>	Building and related trades workers, excluding electricians
<b>72</b>	Metal, machinery and related trades workers
<b>73</b>	Handicraft and printing workers
<b>74</b>	Electrical and electronic trades workers
<b>75</b>	Food processing, wood working, garment and other craft and related trades
<b>81</b>	Stationary plant and machine operators
<b>82</b>	Assemblers
<b>83</b>	Drivers and mobile plant operators
<b>91</b>	Cleaners and helpers
<b>92</b>	Agricultural, forestry and fishery labourers
<b>93</b>	Labourers in mining, construction, manufacturing and transport
<b>94</b>	Food preparation assistants
<b>95</b>	Street and related sales and service workers
<b>96</b>	Refuse workers and other elementary workers

Source: Eurostat

Table 3: Eurostat's Aggregation of Educational Attainment Level based on ISCED

Description	Level
Less than primary, primary and lower secondary education	Levels 0-2
Upper secondary and post-secondary non-tertiary education	Levels 3-4
Tertiary education	Levels 5-8

Source: Eurostat

Table 4: ISCED Aggregation of Educational Attainment Level

Level	ISCED 2011	Description
0	Early childhood Education (01 Early childhood educational development)	Education designed to support early development in preparation for participation in school and society. Programmes designed for children below the age of 3.
0	Early childhood Education (02 Pre - primary education)	Education designed to support early development in preparation for participation in school and society. Programmes designed for children from age 3 to the start of primary education.
1	Primary education	Programmes typically designed to provide students with fundamental skills in reading, writing and mathematics and to establish a solid foundation for learning.
2	Lower secondary education	First stage of secondary education building on primary education, typically with a more subject - oriented curriculum.
3	Upper secondary education	Second/final stage of secondary education preparing for tertiary education and/or providing skills relevant to employment. Usually with an increased range of subject options and streams.
4	Post - secondary non - tertiary education	Programmes providing learning experiences that build on secondary education and prepare for labour market entry and/or tertiary education. The content is broader than secondary but not as complex as tertiary education.
5	Short - cycle tertiary education	Short first tertiary programmes that are typically practically - based, occupationally - specific and prepare for labour market entry. These programmes may also provide a pathway to other tertiary programmes.
6	Bachelor or equivalent	Programmes designed to provide intermediate academic and/or professional knowledge, skills and competencies leading to a first tertiary degree or equivalent qualification.
7	Master or equivalent	Programmes designed to provide advanced academic and/or professional knowledge, skills and competencies leading to a second tertiary degree or equivalent qualification.
8	Doctoral or equivalent	Programmes designed primarily to lead to an advanced research qualification, usually concluding with the submission and defense of a substantive dissertation of publishable quality based on original research.

Source: UNESCO

Table 5: Assignment of weights

	<b>Indicator</b>	<b>Symbol</b>	<b>SIRIUS <math>1_{ij}</math></b>
<b>Composite Indicators for Sectors</b>	Participation rate	$v_1(m_1(s_{ij}))$	0.225
	Percentage change of employment	$v_2(m_2(s_{ij}))$	0.025
	Backward multiplier	$v_3(m_3(s_{ij}))$	0.075
	Forward multiplier	$v_4(m_4(s_{ij}))$	0.075
	Percentage change of backward	$v_5(m_5(s_{ij}))$	0.025
	Percentage change of forward	$v_6(m_6(s_{ij}))$	0.025
	Job vacancy rate	$v_7(m_7(s_{ij}))$	0.05
	Sectoral Structure Similarity (SSS)	$V(SSS_{ij})$	0.5
<b>Composite Indicators for Occupations</b>	Indicator	Short Name	SIRIUS $2_{nj}$
	Participation rate	$v_1(m_1(s_{nj}))$	0.25
	Percentage change of employment	$v_2(m_2(s_{nj}))$	0.05
	Occupational multiplier	$v_3(m_3(s_{nj}))$	0.15
	Percentage change of occupational	$v_4(m_4(s_{nj}))$	0.05
	Occupational Structure Similarity (OSS)	$V(OSS_{nj})$	0.5



Table 6: Sectors' rank for SIRIUS 1 and Occupation's rank for SIRIUS 2

	SIRIUS 1							SIRIUS 2				
	Czech Republic	Greece	Denmark	United Kingdom	Switzerland			Czech Republic	Greece	Denmark	United Kingdom	Switzerland
A01	45	1	52	52	23	11	28	29	15	19	26	
A02	53	9	53	51	48	12	24	24	7	18	23	
A03	41	7	50	48	44	13	23	30	1	4	11	
B	36	16	37	50	39	14	8	9	32	26	33	
C10-C12	18	11	23	37	9	21	30	20	11	15	15	
C13-C15	32	10	24	32	13	22	15	21	10	5	3	
C16	43	2	28	35	10	23	36	40	40	38	40	
C17	37	18	32	42	22	24	33	36	12	10	27	
C18	10	22	33	28	20	25	38	39	28	24	39	
C19	14	41	40	34	45	26	32	25	17	3	18	
C20	47	53	11	13	35	31	11	28	6	12	17	
C21	44	48	14	12	41	32	35	32	26	11	29	
C22	28	26	38	38	37	33	31	35	21	8	28	
C23	39	17	42	53	32	34	5	18	8	17	14	
C24	33	24	7	29	5	35	34	33	13	9	35	
C25	15	20	35	46	28	41	20	38	16	1	7	
C26	42	49	26	16	34	42	7	22	23	23	24	
C27	34	32	48	45	51	43	6	26	3	2	9	
C28	25	43	5	3	15	44	1	37	33	28	19	
C29	5	8	30	43	21	51	13	11	24	22	20	
C30	22	15	9	25	11	52	14	34	34	29	12	
C31_C32	20	13	25	36	24	53	19	27	4	6	8	
C33	27	45	47	31	40	54	16	31	14	16	13	
D35	7	33	29	27	19	61	40	5	39	36	38	
E36	23	34	46	33	46	62	37	3	37	39	32	
E37-E39	40	6	41	49	33	63	21	6	25	33	25	
F	11	4	13	26	3	71	22	16	36	27	37	
G45	13	25	39	41	31	72	25	23	35	34	36	
G46	3	27	8	14	8	73	2	2	2	14	2	
G47	1	3	4	9	7	74	27	13	30	31	22	
H49	26	14	36	44	27	75	26	17	31	25	30	
H50	17	39	3	4	12	81	29	12	29	35	31	
H51	31	42	49	39	43	82	9	7	9	21	6	
H52	6	28	27	21	16	83	17	10	18	20	1	
H53	21	29	44	40	42	91	39	1	38	40	34	
I	9	5	10	23	6	92	10	4	20	37	4	
J58	52	52	19	18	47	93	3	8	27	30	21	
J59_J60	35	35	17	10	30	94	12	19	5	7	10	
J61	50	47	18	15	38	95	4	14	22	32	5	
J62_J63	51	46	34	24	52	96	18	15	19	13	16	
K64	46	51	21	19	29							
K65	24	36	20	20	26							
K66	16	44	22	8	25							
L68	29	38	51	47	49							
M69_M70	48	40	31	22	50							
M71	49	31	43	30	53							
M72	54	54	54	54	54							
M73	38	37	12	6	18							
M74_M75	19	30	15	5	17							
N	4	12	6	17	4							
O84	8	19	1	2	14							
P85	30	50	45	11	36							
Q	12	21	2	1	2							
R_S	2	23	16	7	1							

Table 7: Spearman rank-correlation coefficient SIRIUS 1 and SIRIUS 2

SIRIUS 1					SIRIUS 2				
	Greece	Denmark	United Kingdom	Switzerland		Greece	Denmark	United Kingdom	Switzerland
<b>Czech Republic</b>	0.35	0.393	0.28	0.655	<b>Czech Republic</b>	0.192	0.362	0.126	0.66
<b>Greece</b>		0.03	-0.367	0.503	<b>Greece</b>		-0.161	-0.479	0.112
<b>Denmark</b>			0.799	0.731	<b>Denmark</b>			0.791	0.677
<b>United Kingdom</b>				0.435	<b>United Kingdom</b>				0.451



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