

The Low-Skilled Immigrants' Integration Process: a Mathematical Analysis

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Abstract

In this manuscript, the authors analyze the problem of integrating the low-skilled immigrants by adopting both a quantitative methodology and the marketing perspective. More precisely, they propose a mathematical model aiming at describing the economic consequences of this phenomenon and, after that, try to frame it through the Service Science (SS), the Service Dominant Logic (SDL) and the Viably System approach (VSa). The authors point out actors, steps and outcome of an effective integration process. Their results are particularly useful for policy makers and experts in the field of migration flows management and integration.

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1. Introduction

Immigration from developing countries is one of the main problems faced by Western political decision makers, social scientists and civil society. In fact, in the XXI century, immigration from low-income countries is a massive phenomenon mainly concerning Western countries, in particular the North American and European ones. According to the data of the European Union (EU), in 2019 the main countries from which the asylum applications came from were Syria, Afghanistan, Iraq, Pakistan, Turkey, Bangladesh, Venezuela, Nigeria, Somalia, Georgia,

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Morocco, Colombia, Albania, Guinea and Eritrea³. Indeed, integrating people from low-middle income countries into the arrival ones represents a very hard task for the public sector. In fact, scholars have proved that immigrants choose their destination countries based on several factors, such as institutional quality. For example, Tran (2021) carried out a study on Vietnamese expats discovering that those ones with a higher perceived institutional quality of the destination countries are less willing to come back. Moreover, Vietnamese expats in New Zealand are available to accept a reduction in their income in exchange of an increase in institutional quality in their home country as far as they become indifferent between living in Vietnam or in New Zealand (2019). Even in this regard, evidences coming from France, Germany, UK, USA, European Union countries, North Africa and Middle-East demonstrate that institutional factors like union coverage, education system, health system, welfare state (such as unemployment benefit) and history of the origin countries (for example past colonial links) boost immigration and that generous pension systems deter it (Borjas, 1999; Bertocchi and Strozzi, 2008; Geis et al., 2013; Ferwerda and Gest, 2020; de Jong et al., 2021; Adedoyin et al., 2021). As underlined in the paper by Roupakias and Dimou (2021), who analyses 130 different countries, it seems that massive immigration makes trouble for the institutions, in the sense that it weakens their efficiency. Not surprisingly, immigration from developing countries is seen as dangerous from the citizens of the host ones. However, the attitude of the locals towards the immigrants is not homogeneous and depends on the skill level of the latter ones. In this regard, Boucher and Cerna (2014) highlight that low-skilled immigrants are perceived as competitors by natives because of their higher dependence upon the national welfare and then they encounter general hostility from the natives. The high-skilled immigrants, instead, are expected to be less dependent on welfare and so their inclusion process occurs more readily. Evidence collected from Shachar (2006) and Cerna (2011) on the approach of United States, Canada, Australia, United Kingdom and Netherlands to the migration of high-skilled workers point out that governments have been targeting migration policies to attract and retain this kind of foreign workers due to the positive economic consequences of their presence, such as increase in productivity and economic growth. Moreover, the two authors note that in EU countries the competition among the member states have led most of them to slacken the legal constraints for high skilled foreign workers. The effective integration of the immigrants significantly varies across the arrival places, but the literature suggests that in many cases (including in countries generally considered most inclusive such as Sweden) it is a failure, especially in terms of participation in the labor market and cultural assimilation (Favell, 2003; Hum and Simpson, 2004;

³ https://ec.europa.eu/info/strategy/priorities-2019-2024/promoting-our-european-way-life/statistics-migration-europe_it

Wiesbrock, 2011; Barou, 2014). In compliance with the contributions cited above, only the high-skilled immigrants seem to have good chances to effectively integrate (Cerdin et al., 2014). Then, it is fair to ask whether and to what extent other actors such as private companies can contribute to the integration of low-skilled immigrants. Unfortunately, little attention has been paid to the role of these subjects in the integration process until now. In fact, authors engaged in the research field of immigrants' integration have mainly focused on the entrepreneurship aspect of immigration, namely the ability of the immigrants to start and run their own businesses (Halkias et al., 2009; Brzozowski et al., 2014; Efendic et al., 2015; Brzozowski, 2019). Others, instead, have shown that it is hard to integrate the low-skilled immigrants into the local labor markets, because companies find it difficult to hire refugees due to their suboptimal job performance (Lundborg and Skedinger, 2016). This manuscript deals with the issue of immigration (and more in particular of low-skilled immigration) in a completely new fashion. In fact, it represents an attempt to address this problem by identifying the conditions, means, steps and outcomes of an effective integration process, in particular from the perspective of the Marketing. In more general terms, instead, the goals of this paper are: *i*) understanding how low-skilled immigrants can be made part of the value co-creation process in the host countries and *ii*) extending to the Marketing, with the help of the Mathematics, the study of a practical and actual problem faced by the government, namely immigration. The manuscript is organized as follows: the first section includes the introduction to the topic under scrutiny; the second one includes the mathematical model proposed by the authors to describe the effects of the low-skilled on the general economic equilibrium; the third one consists in an extension to the Marketing of the issue of low-skilled immigration; the fourth one goes in depth on the same argument looking at the integration process from the Service Science (SS), Service Dominant Logic (SDL) and Viable System approach (VSa) points of view; the fifth section describes the immigrants' role in the host countries according to the operand-operant resource dichotomy; the sixth one draws the integrated immigrants' H-Shaped and T-Shaped profiles; the eighth section holds the concluding remarks. Finally, a detailed bibliography at the end of the paper is provided.

2. A mathematical model of skill-biased labour augmenting technological progress

In this paragraph, the authors propose a theoretical model consisting of a modified version of Solow endogenous growth model with labor augmenting technological progress and human capital with the aim of explaining the economic effects of low-skilled immigration on the convergence process of a given economy toward its steady-state equilibrium⁴. More precisely, the innovation brought by the authors to

⁴ Equilibrium models are widely used in many economic fields and in particular in Macroeconomics (Ferrentino and Vota, 2019; 2020; 2021; 2022).

the Solow model consists in introducing the skill bias, namely in assuming that low-skilled immigration reduces the marginal productivity of the factors of production in the destination countries due to the fact that, as documented in the literature, individuals coming from developing countries have, for reasons linked to the contexts of origin, a lower marginal productivity compared to the natives (Korkmaz and Korkmaz, 2017). To achieve this result, the authors consider a closed and perfect competition economy in which four factors of production are used (labor, physical capital, human capital and technology) and formulate the following hypotheses:

- I) The technology is given by:

$$A_t = A_0 e^{gt}$$

where $A_0 = 1$ and g is a constant indicating the marginal productivity of technology ($\frac{\hat{A}}{A_t}$):

$$\frac{\hat{A}}{A_t} = g$$

- II) The production function is a Cobb-Douglas

$$Y_t = K_t^a H_t^b [N_0 e^{(g+n+\gamma)t}]^{1-a-b}$$

where:

Y_t is the national gross domestic product at time t ;

$K_t = k_t N_0 e^{(g+n+\gamma)t}$ is the stock of physical capital at time t ;

$H_t = h_t N_0 e^{(g+n+\gamma)t}$ is the stock of human capital at time t ;

$N_t = N_0 e^{(g+n+\gamma)t}$ is the stock of labor under the hypothesis of labour augmenting technological progress;

$a \in (0,1)$ e $b \in (0,1)$ are two constants;

n is the birth rate (constant over time, for simplicity);

γ is a constant expressing the effect of the low-skilled immigration on the marginal productivity of the factors of production, namely the skill bias.

- III) Investments in physical capital I_t^K and human capital I_t^H are given, respectively, by:

$$I_t^K = \hat{K} + \lambda K_t$$

and:

$$I_t^H = \widehat{H} + \lambda H_t$$

where $\lambda \in (0,1)$ is the depreciation rate (for simplicity equal for both physical and human capital).

IV) The part of aggregate saving in physical capital S_t^K is given by:

$$S_t^K = s_k K_t^a H_t^b [N_0 e^{(g+n+\gamma)t}]^{1-a-b}$$

where $s_k \in (0,1)$, while the part of aggregate saving in human capital S_t^H is given by:

$$S_t^H = s_H K_t^a H_t^b [N_0 e^{(g+n+\gamma)t}]^{1-a-b}$$

with $s_H \in (0,1)$.

V) The financial market equilibrium condition is:

$$S_t^K + S_t^H = I_t^K + I_t^H.$$

Given these five assumptions, the steady-state equilibrium can be found by solving the following system of two differential equations:

$$\begin{cases} \widehat{k} = s_k k_t^a h_t^b - k_t(n + g + \lambda + \gamma) \\ \widehat{h} = s_H k_t^a h_t^b - h_t(n + g + \lambda + \gamma) \end{cases}$$

where \widehat{k} and \widehat{h} are, respectively, the growth rate of the per worker physical capital and the growth rate of the per worker human capital.

The solution of the model proposed by the authors under the hypotheses I-V is the following:

$$k^*(h_t^*) = \left(\frac{s_k}{n + g + \lambda + \gamma} \right)^{\frac{1}{1-a}} \quad (1)$$

that, because of the presence of the term γ at the denominator, is less than the steady-state physical capital of the traditional Solow model.

The human capital in steady-state $h^*(k_t)$, instead, is given by:

$$h^*(k_t^*) = \left(\frac{s_h}{n + g + \lambda + \gamma} \right)^{\frac{1}{1-b}} \quad (2)$$

that, also in this case, is lower than the steady-state human capital of the traditional Solow model, again due to the presence of γ at the denominator.

Therefore, the results (1) and (2) obtained by the authors show that low-skilled immigration causes a reduction in the steady-state physical capital and human capital compared to the original Solow model. More precisely, (1) and (2) indicate that low-skilled immigration has a negative impact on the steady-state equilibrium, because of the consequent reduction of the marginal productivity of the factors of production (capital, labor and technology).

To contrast these negative implications, countries exposed to low-skilled immigration should undertake appropriate investment plans which are aimed at integrating and raising the level of skills and knowledge of immigrants. Unfortunately, economic theory provides very little guidance on how to structure and manage such investment plans.

For this reason, in this paper, the authors try to address this question by adopting a different perspective from the strictly economic one. In fact, in the following paragraphs of this paper, they try to identify the actors, steps and outcomes of an appropriate integration process of low-skilled immigrants according to the tenets of Marketing.

3. The immigrants' integration process from the Marketing perspective

In this section, the authors look at the issue of immigrants' integration from the Marketing point of view and they explain how government, private companies and tertiary sector can contribute to the integration process from the holistic and relational perspectives of Marketing. First, it is important to observe that Marketing has two different dimensions: a philosophical one, according to which the firm should put at the center of its attention the customer, and an operative one, consisting in a set of critical activities that should be taken into account by the company in formulating its strategy. However, many definitions of Marketing have been provided over time, because of the historical evolution of this discipline. The first stage of Marketing range between the second half of XIX century and the first half of XX century and is known as "production-oriented". In this period, the firm's aim is the optimization of the production through technology. The second stage starts in 1950s and is characterized by the market-oriented approach, namely a special attention to demand management and commercial function. The third stage begins after WWII and represents the period in which the modern marketing is developed. In fact, during those years, company puts the customer at the center of its interest. In other words, companies try to intercept and influence the needs of the consumers. Marketing can be considered a revolution just as it has implied the shift from the transactional approach to the service approach, i.e., the focus became the

relationships of the management of the company with the natural, social and economic environments. In fact, currently Marketing is understood both as a holistic science (integration of resources, skills and competences finalized to the value co-creation) and a relational science (value co-creation through the exchange relationship). These two perspectives can be exploited to address a relevant and urgent question such as immigration with the involvement of three actors: public sector (central and local government, public school and university, government agencies for immigration and so on), third sector (non-governmental organizations and non-for-profit associations) and private firms. In fact, both approaches (the holistic one and relational one) should be developed and adopted by these three bodies as a tool to favour the immigrants' integration process. More in particular, according to the holistic science view, public sector, tertiary sector and private firms should undertake together investment plans to endow the low-skilled immigrants with all the competences and expertise necessary to make them active part of the value co-creation process. These joint investment programmes could represent a valid alternative to the full-public initiatives, such as active labour market policies and affirmative actions, which are often hindered by locals for political and cultural reasons and, in many cases, turn out to be counterproductive. In fact, some scholars have proved that natives object immigration because of the cultural transmission mechanism across immigrants' generations, Bloemraad (2008) underlines the public fear over multiculturalism, while Coate and Loury (1993) find that hiring quotas for minorities (such as immigrants from developing countries) risks having a disincentive impact on the investment in education of people benefiting from affirmative actions. However, enhancing the immigrants' skill level following the indications of the holistic view is not sufficient to achieve an effective integration. Indeed, the relational view of Marketing suggests that the parties should also work to make the immigrants member of the social net in the arrival countries, namely establish ties with natives and strengthen them over time. In fact, economic integration itself does not prevent immigrants to be subject to different kinds of discrimination (Esses, 2021). Then, the joint investment plans should also include interventions to spur the social and cultural integration, such as promoting the immigrants' access to public services like public health and transport, cultural exchange between immigrants and natives, immigrants' political involvement and so on. The integration process according to both holistic science view and relational science view has been sketched in the Figure 1 below using the Triple Helix Model (Etzkowitz, 1993; Etzkowitz and Leydesdorff, 2000):

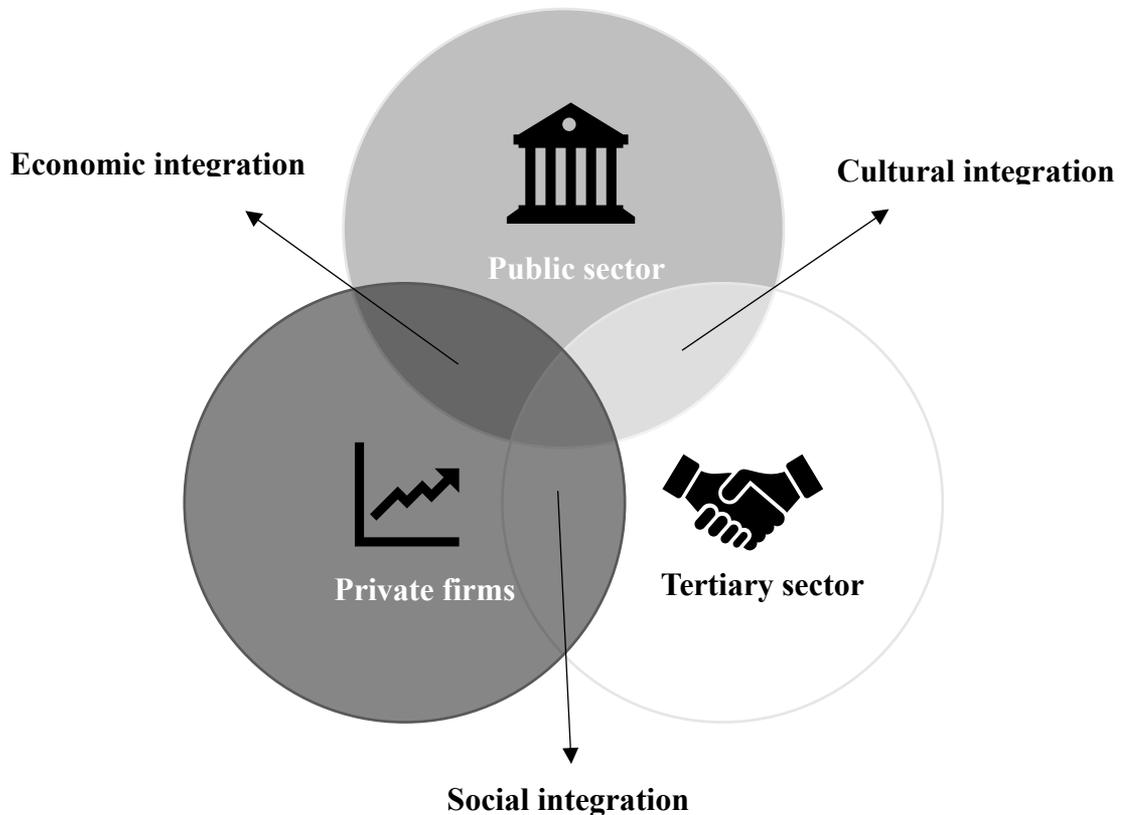


Figure 1: Triple Helix representation of the three actors involved in the immigrants' integration process

The diagram above displays the roles of the three different interactions among the parties: economic integration happens thanks to the joint work of public sector and private firms, while cultural integration and social integration are carried out, respectively, by the common work of public sector and tertiary sector and by the joint work of private companies and tertiary sector

4. The three steps of an effective integration process through the Service Dominant Logic (SDL), the Service Science (SS) and the Viable System approach (VSa)

In the previous section, the authors analyzed the issue of low-skilled immigrants' integration using Marketing view. In this paragraph, they go in depth on this topic by summarizing the Service Dominant Logic (SDL), Service Science (SS) and Viable System approach (VSa) and explaining how these three perspectives can contribute to achieving the three steps of a good integration process: *i*) economic inclusion (namely promoting the immigrants' participation to the labour market and investing on their skills), *ii*) social inclusion and *iii*) identifying common objectives for immigrants and natives.

The SDL is a framework postulating an approach to Marketing based on service system, namely the function of the items provided by firms. In particular, managers are advised to adopt a relational perspective and to focus on the dynamics of the economic system instead of its structural characteristics in order to better understand how the process of value co-creation works. SDL looks at this process from a dynamic point of view and represents an evolution compared to the previous Goods Dominant Logic (GDL), that considered the value co-creation mainly a good-production process and highlighted the structural features of the economic system. However, SDL does not put in contrast services and goods, but instead detect a vertical relationship between these two categories. In fact, the SDL states that experience and perception are fundamental to value determination, in the sense that resources, skills and expectations of companies and customers fundamentally contribute to appreciate the value of all items. Immigration can be addressed using SDL just because of its focus on the dynamics of the economic systems. It is a matter of fact that immigration is a dynamic phenomenon changing the stock of labour and human capital and then the fundamentals of an economy (Dustmann et al., 2008; Ehrlich and Kim, 2015). In fact, literature suggests that immigration significantly affects economic growth of the host countries, but the sign and the size of its effect depends on the skill level of the immigrants: the higher the human capital of the immigrants relative to the natives, the lower the negative effect of immigration on economic growth (Dolado et al., 1994). Consequently, what can be deduced from the SDL about immigrants' integration is that it is important to encourage their participation to the labour market and invest on their skills. In other words, the first fundamental element of an effective integration process is the economic inclusion. As concerns instead the SS, it adopts the same perspective of the SDL adding some new elements to the Marketing science. In particular, the SS tries to satisfy the need of the society of tomorrow paying attention to what is defined as "the parties", namely the object of the analysis is no longer the function as in the SDL, but the role of the components of the system (what each of them do and why). The change in perspective of the SS consists in shifting from a static view, which focuses on single elements and relations, to a dynamic one based on the service interaction process. Further, Spohrer et al. (2007) stress the importance of the SS by highlighting that in USA services accounts for the largest part of the national economy, that many important sectors, such as education, banking, healthcare, insurance, engineering and IT, play a relevant role in modern economies. Just for this reason, Spohrer and his co-authors write that scholars should pay more attention to the SS and try to formalize it considering some important factors neglected in the previous research (like the human behavior and the potential noncompliance of people to laws and policies) and invite to contribute to the SS by proposing new applications of the same to the problem of the modern economies. It is possible to take up the challenge launched by Spohrer and his co-authors by implementing the SS to immigration. More precisely, it seems clear that the SS can be useful in facing the low-skilled immigration problem just because of its focus on interaction: integrating immigrants means helping them in getting outside the social isolation

and interacting with natives in the most constructive way (again with the aim of value co-creation). This means that the SS approach postulates the immigrants' social integration as a second fundamental element of an effective integration process.

Finally, The Viable System approach (VSa) represents the link between the static view of the SDL (focus on single elements of relations) and the dynamic one of the SS (focus on the service interaction process) (Golinelli et al., 2012). In fact, the VSa points out that the SDL and the SS are two aspects of the same phenomenon because the value co-creation process can be properly understood looking at the services only if the function is role contextualized. In other words, the value generated by each item can be assessed only considering its function for customers. Moreover, the novelty of the VSa is the distinction between the service structure (static) and the service system (dynamic). More precisely, according to the VSa, the structure is only the set of the parties of a system, while the system is the net of the parties cooperating for common goals. The importance of the structure-system perspective is that it just allows to identify the convergence among the SDL, the SS and the VSa. From the VSa can be inferred the third fundamental step of a successful integration process is just the identification of objectives shared from both immigrants and natives. The value co-creation definitely represents one of these objectives, but it is not the unique. In fact, also social harmony and cultural exchange should be essential aims of an effective immigrants' integration process.

5. Making immigrants operant and operand resource

In the previous sections, the authors summarized the responsible actors, the steps and the goals of an effective integration process. Here, they describe the first of the two expected outcome of a proper integration process, namely making low-skilled immigrants both an operant and operand resource in the host countries. The dichotomy between operant and operand resources is a main concept in Marketing (and more in particular in the SDL). It consists in dividing in two broad categories the economic resources. The first one is the category of operant resources and consists in the complex of the value co-creators, namely all the actors and people who can put knowledge into action. The second one, namely the operands, includes all these resources that the operants can employ in the process of value co-creation (goods, materials, information etc.). Then, operand and operant are two relational concepts which meaning depends on the nexus between the person/actor and the resource/object. As pointed out by Golinelli et al. (2010), people can be both operant and operand resources. This section looks at the immigrants' interaction with public sector, private firms and tertiary sector in order to prove that, in the process of value co-creation, they are both an operand and operant resource. The Figure 2 below, sketches the interaction between the immigrant and each of the three actors involved in the integration process. The black rows indicate the contribution that the operant (immigrant) can make to the process of value co-creation through the operand (each of the three actors involved in the integration process). On the contrary, the grey

rows tell the contribution to the process of value co-creation that the operant (each of the three actors responsible for integration) gives through the operand (immigrant):

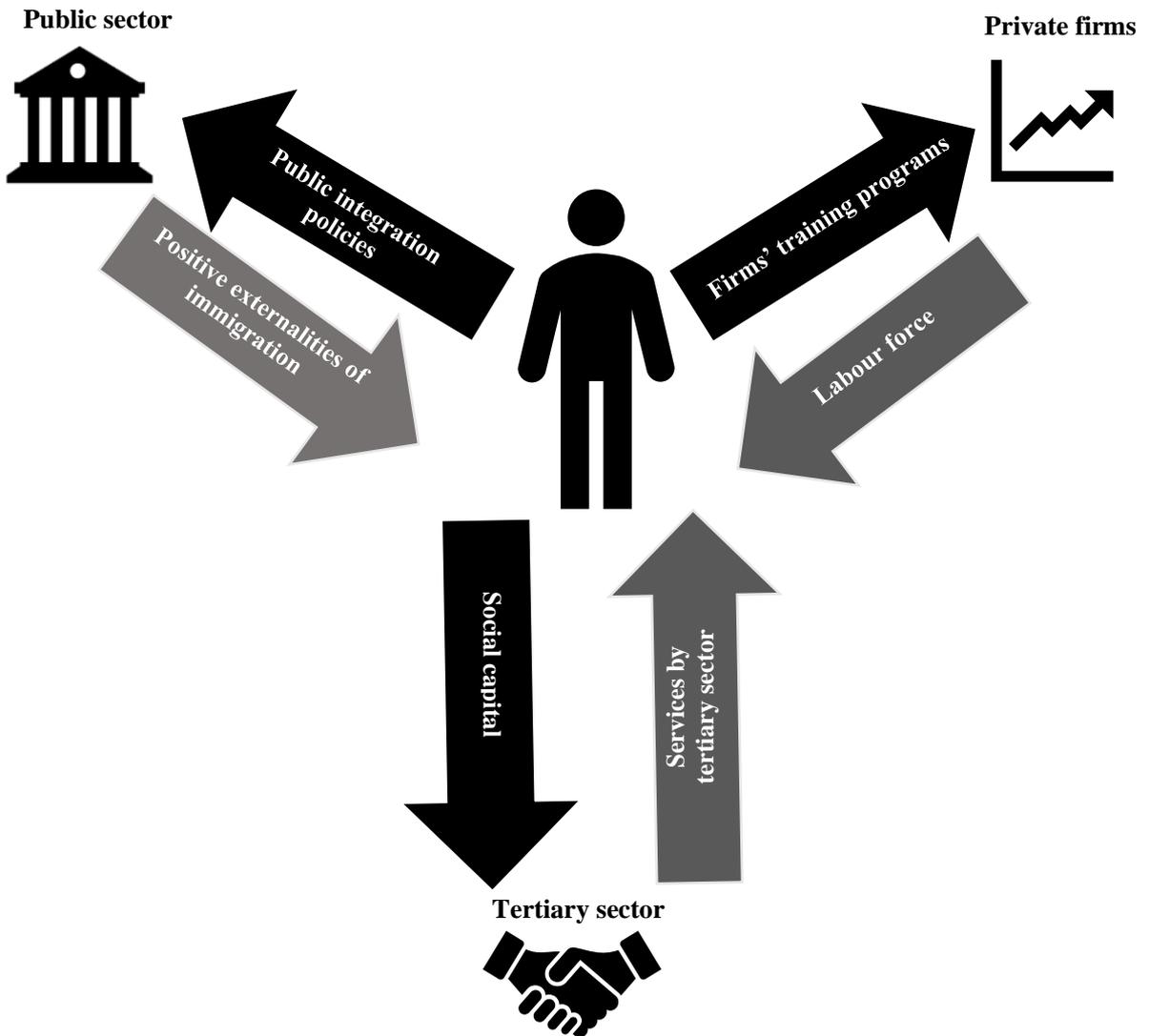


Figure 2: Immigrants as operand and operant resource

The scheme above shows that the integrated immigrants can improve the institutional quality of the arrival countries. The immigrants' collective cultural and political engagement in the arrival countries is well documented (Moya, 2007; Tillie, 2007; Predelli, 2008). Indeed, the economic literature suggests that it happens under the condition that the coming immigrants are high-skilled and well-integrated in the destination territories (Clark et al., 2015). In other words, a good integration is such that the immigrants contribute to the process of value co-creation through the local institutions. At the same time, the institutions can exploit the positive externalities

of immigration, such as increases in birth rate, human capital, labour force, cultural variety and so on. However, these social benefits are possible only whether the effort exerted by institutions to properly integrate immigrants succeeds. As concerns the relationship between immigrants and private firms, immigrants contribute to the process of value co-creation through the rise in workforce coming from their hiring by companies (in fact, in an economy the greater the labour force, the higher the output). Conversely, private companies contribute through immigrants to the process of value co-creation by training them and then increasing the endowment of human capital of the economy in which they operate. Again, the interaction between immigrants and firms supports the process of value co-creation only if the immigrants are well integrated. Finally, tertiary sector contributes to the process of value co-creation in two ways. The first one consists of providing to immigrants some basic services, such as helping them to reach the country they intend move to and find a new accommodation and job (Carella et al., 2007; Cullen, 2009). This activity by nonprofit organizations is fundamental because it reduces the costs borne by immigrants before and during the early times of their arrival. The second one, is the enhancement in social capital coming from the immigrants' integration onto the host communities (Huntoon, 2001). Integrated immigrants, instead, contribute to the process of value co-creation by joining to the voluntary associations of the arrival countries (Voicu and Serban, 2010) and then fostering the local social capital. However, evidence show that participation to tertiary sector of immigrants is possible only when the latter ones are socially integrated (Fong and Shen, 2016).

6. Building up the immigrants' H-Shaped and T-Shaped profile through integration

This section is intended to explain what the second desirable outcome of a proper integration process is, namely building the immigrants' H-Shaped and T-Shaped profile. As well known, The H-Shaped profile is a more traditional way to draw a professional profile considering three elements: *i*) the disciplines of expertise, *ii*) the sectors to which such disciplines are applied and *iii*) the regions (continents, countries, cities and so on) in which the individuals' competences can be spent. The T-Shaped profile has been proposed in literature in more recent years (Demirkan and Spohrer, 2015; Gardner and Estry, 2017; Piciocchi et al., 2017; Demirkan and Spohrer, 2018) just as an updated version of the H-Shaped profile. What the T-Shaped profile adds to the H-Shaped one is the nexus between the disciplines, the sectors and the regions. More precisely, it identifies the factor(s) allowing the individual to use her/his competences in the different regions and sectors. The Figure 3 below graphically represents the immigrants' H-Shaped profile:

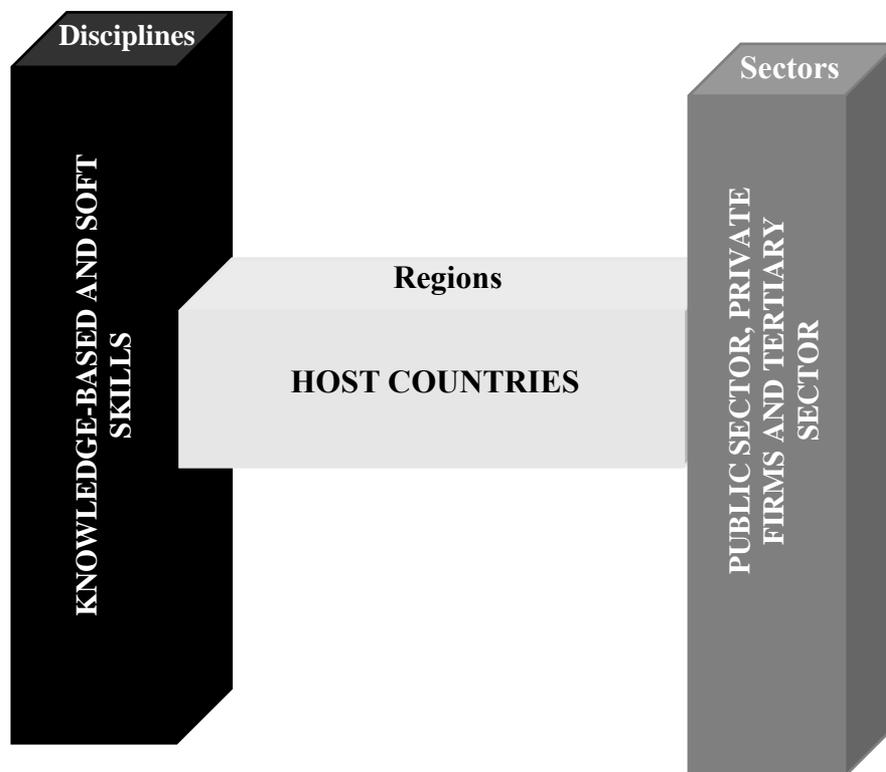


Figure 3: Immigrants' H-Shaped profile

The black pillar of this first sketch (disciplines) suggests that immigrants need both knowledge-based (namely technical) and soft skills (consisting in the complex of individual's relational abilities). In fact, the first ones are necessary to get a job, while the second ones make able the immigrants to establish durable relationships with the public and private organizations and the people of the arrival countries. The grey pillar, instead, reports the actors with whom the immigrants have to interact public sector, private companies and tertiary sector, namely the three ones responsible for their integration. As seen in the previous section, these actors contribute to the formation of immigrants' human capital endowment and then take advantage of it. Of course, the places in which immigrants join to the process of value co-creation by putting their skills to the service of the three sectors are the host countries (white pillar). At this point, it is fair to ask: what is the factor by which the integration process succeeds and immigrants become stable part of the society in which they settled down? To provide an answer, it is necessary to look at the immigrants' T-Shaped profile in the following Figure 4:

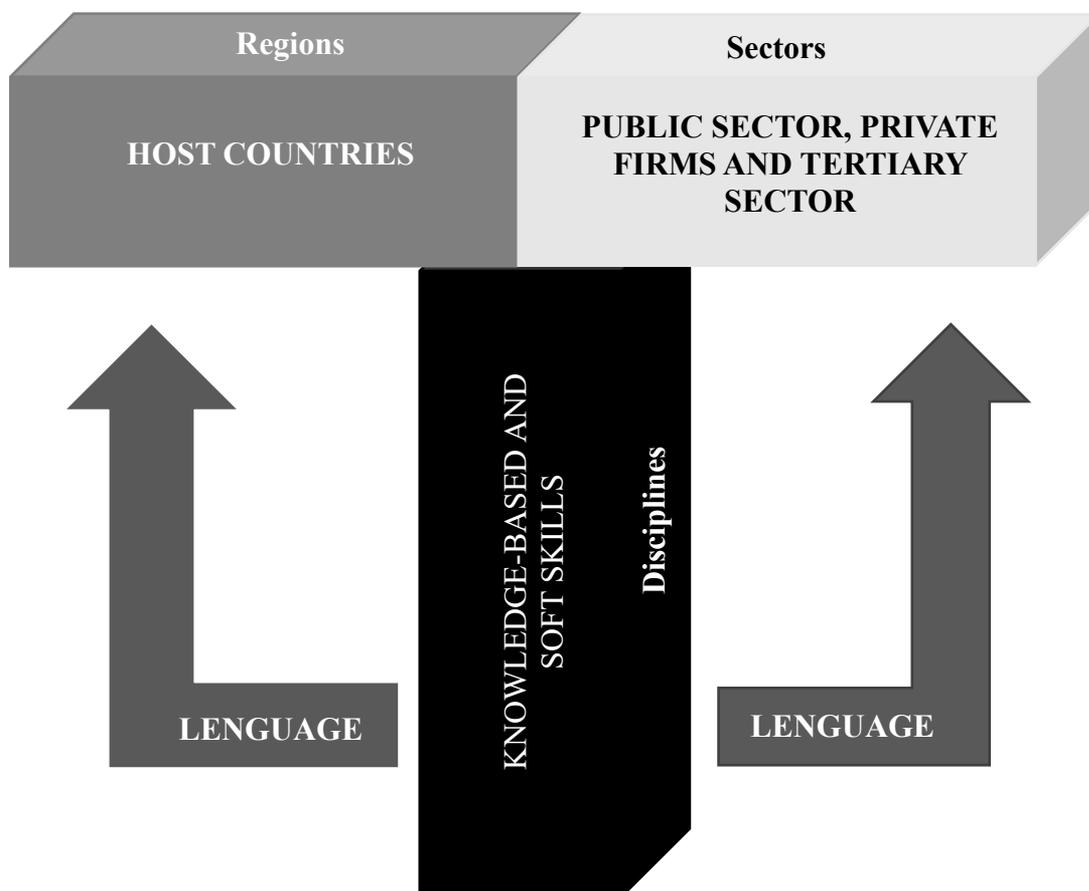


Figure 4: Immigrants' T-Shaped profile

This second sketch includes the factor determining the good end of an effective integration process, namely learning the language of the host country. In other words, immigrants can acquire new skills, use them in finding a job and interact with the natives and the institutions of the destination countries only whether they become able to speak the local language. Otherwise, the connection between disciplines, sectors and host places never realizes and they are excluded from the value co-creation process. The role of language proficiency and experience in the integration process has been stressed a lot in literature (Delander et al., 2005). In fact, Graauw (2016) has documented how in USA 41 million foreign-born citizens are harmed in their rights and opportunities because of the non-acquisition of the English language, while Lochmann et al. (2019) have found that the language training in France significantly increases the immigrants' labour force participation.

7. Concluding remarks

This manuscript has addressed the issue of immigrants' (and in particular low-skilled immigration) integration process by the Marketing perspective. What

emerged from this contribution is that the three actors responsible for this process are public sector, private companies and tertiary sector. Then, it has been pointed out that the three steps of an effective integration process are the economic, cultural and social inclusion. As concerns immigrants, instead, it has been shown that they represent for the society of the destination countries both an operand and operant resource. Finally, the immigrants' H-Shaped and T-Shaped profiles have been drawn, arguing that learning the language of the host places is a necessary condition for integration.

The original contribution of this paper is given by its innovative approach to the issue of immigration and it is intended to provide useful guidelines about immigrants' integration process to government, firms and voluntary associations. The authors hope that their contribution will spur the scholars involved in the field of Marketing to undertake new research on the topic of immigration management.

Publication Ethics Statement

This manuscript complies with the ethical standards for publication.

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