



Lato Sensu Postgraduation: how to align regional demands and the vocation of higher education institutions?

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Abstract

A Higher Education Institution (HEI) must develop its activities and direct actions to comply with the current educational legislation, the guidelines established in its Institutional Development Plan and its functions, to meet the expectations and demands of the region in which it is inserted, aiming at regional development. The structuring of information on regional demands is necessary for the Higher Education Institution to elaborate and consolidate its Institutional Development Plan and, consequently, its Pedagogical Course Projects. In this context, the objective of this article is to present a model of systematization of information that relates the regional demands to the knowledge objects of HEIs, to guide the creation and updating of lato sensu postgraduate courses. It is understood that this information relates to the internal and external environment of the HEI, having for example the educational and professional legislation, infrastructure and strategic plan of HEI, social, political, cultural, and geographic contexts, and expectations of local organizations. As a main result, the model enables HEIs to delineate their knowledge object portfolios associated to the lato sensu graduate courses, facilitating the management of the information for the construction of the Pedagogical Project of these courses, considering the regional demand and the knowledge objects to be attended to.

Keywords: Higher Education. Regional Development. Lato sensu graduate degree.

Pós-Graduação Lato Sensu: como alinhar as demandas regionais e a vocação das instituições de ensino superior?

Resumo

Uma Instituição de Educação Superior (IES) deve desenvolver suas atividades e direcionar as ações de forma a atender a legislação educacional vigente, as diretrizes estabelecidas no seu Plano de Desenvolvimento Institucional e suas funções, atender as expectativas e demandas da região na qual se insere, visando o desenvolvimento regional. A estruturação da informação referente às demandas regionais é necessária para que a Instituição de Ensino Superior elabore e consolide seu Plano de Desenvolvimento Institucional e, conseqüentemente, seus Projetos Pedagógicos de Curso. Neste contexto, o objetivo deste artigo é apresentar um modelo de sistematização de informações que relacione as demandas regionais com os objetos de conhecimento das IES, para orientar a criação e a atualização de cursos de pós-graduação lato sensu. Entende-se que essas informações dizem respeito ao ambiente interno e externo à IES, tendo como condicionantes, por exemplo, a legislação educacional e profissional, infraestrutura e plano estratégico da IES, contextos social, político, cultural e geográfico, e expectativas das organizações locais. Como principal resultado, o modelo habilita as IES a delinearem seus portfólios de objetos de conhecimentos associados aos cursos de pós-graduação lato sensu, facilitando o gerenciamento das informações para construção do Projeto Pedagógico desses cursos, contemplando a demanda regional e os objetos de conhecimentos a serem atendidos.

Palavras-chave: Educação Superior. Desenvolvimento Regional. Pós-Graduação Lato Sensu.

Estudios De Postgrado Lato Sensu: ¿cómo alinear las demandas regionales y la vocación de las instituciones de educación superior?

Resumen

Una Institución de Educación Superior (IES) debe desarrollar sus actividades y acciones directas con el fin de cumplir con la legislación educativa vigente, los lineamientos establecidos en su Plan de Desarrollo Institucional y sus funciones, satisfacer las expectativas y demandas de la región en la que opera, con el objetivo de desarrollo regional. La estructuración de la información sobre las demandas regionales es necesaria para que la Institución de Educación Superior elabore y consolide su Plan de Desarrollo Institucional y, en consecuencia, sus Proyectos de Curso Pedagógico. En este contexto, el objetivo de este artículo es presentar un modelo de sistematización de la información que relacione las demandas regionales con los objetos de conocimiento de las IES, para orientar la creación y actualización de posgrados lato sensu. Se entiende que esta información concierne al entorno interno y externo de las IES, teniendo como condiciones, por ejemplo, la legislación educativa y profesional, infraestructura y plan estratégico de las IES, contextos sociales, políticos, culturales y geográficos, y expectativas de los locales. Organizaciones. Como resultado principal, el modelo permite a las IES delinear sus portafolios de objetos de conocimiento asociados a los posgrados lato sensu, facilitando la gestión de la información para la construcción del Proyecto Pedagógico de estos cursos, contemplando la demanda regional y los objetos de conocimiento a ser atendidos.

Palabras clave: Educación superior. Desarrollo regional. Post-graduación Lato Sensu.

Introduction

Brazil is marked by significant differences in education across regions, whether it be primary, secondary, or higher education. And the country's development primarily relies on the empowerment of individuals, intellectual capital, and advancements in the field of education.

In Neves' (2007) perspective, the country needs intelligent and viable solutions in education which manage to equalize and expand the conditions of access to quality education, involving qualified and skilled professors, state-of-art structure, and diverse courses that ensure better job opportunities to the egresses. The author also highlights the need for a more significant stimulus to scientific and technological research.

It is understood that there is an essential relation between the HEIs and the environment in which they are inserted, providing the improvement of the social, economic, and political conditions. Based on the market information it is possible to identify contents that develop competencies to be rectified by the *lato sensu* graduation courses. It is necessary to establish more efficient ways to manage the information and generate knowledge to get to know the demands of the society related to the HEIs and standardize the course offering. However, the Institutions have difficulty to process and organize all the necessary information for the elaboration of the documents required and the elaboration of the Pedagogical Projects of Courses (PPCs), such as law and market needs, hampering the management of such information to convert them into structured PPCs.

In this context, the Ministry of Education (MoE) highlights issues to be observed by the HEIs in the constitution of a course, however generically. Oliveira (1995) affirms that regardless of the number of significant publications regarding the graduate level education, the works related to *lato sensu* graduate level education are still scarce. There is, therefore, the need to collect data from the MoE enabling the information of the situation of the *lato sensu* graduate courses in Brazil.

Medeiros (2010) refers to the visible lack of monitoring of the *lato sensu* graduate activities by the Brazilian state, considering, among other aspects: the global unfamiliarity with the policies for the sector; the facilities and difficulties imposed by the appropriate legal mechanisms as well as their unfamiliarity and/or lack of observation; the numberless valid criteria for selections of students and professors; and the qualifications required for teaching and coordination activities.

The concern is not expressed in the same extent when it comes to *lato sensu* postgraduate programs compared to *stricto sensu* postgraduate programs. On the other hand, the provision of courses without knowledge of the demands and regional context, as well as the knowledge objects addressed by the HEIs and its competencies, results in courses that do not meet the needs of society, as they may be disconnected from regional requirements. Therefore, structuring information regarding regional demands is necessary for HEIs to develop and consolidate their Course Pedagogical Projects (CPPs) and, based on these definitions, their Institutional Pedagogical Plan (IPP) and Institutional Development Plan (IDP).

Regarding this scenario, the article has the aim of presenting a modeling for systematization of information that relates the regional demands to the objects of knowledge of the HEIs to guide the creation and updating of *lato sensu* graduate courses.

The model has as premise the organization of information and different sources, such as the law, the expectations of clients, mainly the demands of companies that promote the regional economic development, the developed sectors, and the regional sectors holders of the future, the strategic guidance provided by the ISP, and the areas of competence of the HEI itself.

The Higher Education and the Social Growth

In contemporary society, higher education faces challenges reflected in the educational debate that highlights issues in academic training, compromising curricular, pedagogical, epistemological, and sociocultural characteristics, as well as institutional concerns themselves. According to Bernheim and Chauí (2008), among other tasks, these challenges involve: i) quantitative expansion to comply with the growing number of enrolments in the higher education, without losing quality; ii) relevance and relevancy of the studies; iii) quality; iv) improvement of the higher education management, optimizing resources and capacities; and v) generation of knowledge.

Canterle and Favaretto (2008) see the university as an institution of services and as a space of generation and dissemination of knowledge for society through research, teaching, and extension. In their understanding, the university needs to comply with the scientific and academic labor world with quality. When it fails to do so, society questions its legitimacy. This undoubtedly creates a demand for rethinking the establishment of new universities.

Santos (2011) regards the university as a public good related to the country's development project. In order to fulfill its social role, it should be endowed with financial and institutional resources. The author also highlights the need for the university to assume its role and be responsive to social demands.

Zabalza (2004), when mentioning the acceleration of changes and the criticality of society, advocates for a profound change in the internal structures of universities, involving content and operational dynamics, with the aim of effectively addressing the challenges that society faces.

In the face of this context, it is necessary for the HEIs to meet the regional demands quickly, systematically and neatly. In Brazil, the accreditation of a HEI can happen as university, college, or university center, according to the physical structure and the personnel it has, resulting in different academic prerogatives, according to the Federal Decree n. 9.235, of December 15, 2017 (Brasil, 2021).

In Brazil, according to the Ministry of Education and National Institute for Educational Studies and Research Anísio Teixeira (2013), the HEIs had a significant growth from 2001 to 2012. In 2001, there were 1,391 HEIs, and in 2012 this number rose to 2,416. It represents a growth rate of 73.69% in that period. The highest growth (110.61%) happened in the academic organization University Centers, followed by Colleges, with 78.83%, Federal Institutes of Education, Science and Technology (Ifets) and Federal Centers for Technological Education (Cefets) with 53.85%, and finally the Universities, which showed a growth rate of 23.72%. According to the same source, the increasing number of higher education institutions (IES) offering courses in various fields and levels resulted in Brazil having 6,379,299 enrollments in higher education in 2010, considering both face-to-face and distance learning.

When comparing the data from 2011 to 2019, the following panorama emerges. In 2011, there were 2,365 HEIs, which increased to 2,608 in 2019, representing a growth rate of 10.27%. The highest growth occurred in the academic organization of University Centers, with a growth rate of 124.42%, followed by Colleges, with a growth rate of 3.6%, and Universities, which grew by 4.2%. During this period, there was no increase in the number of Federal Institutes of Education, Science, and Technology (Ifets) and Federal Centers for Technological Education

(Cefets). According to this source, the increasing number of HEI offering courses in various fields and levels led to a total of 8,603,824 enrollments in higher education in Brazil in 2019, considering both face-to-face and distance learning (Brasil, 2021).

The expansion of higher education in the first decade of the 2000s was a result of a policy aimed at democratizing access through public programs, such as the University for All Program (ProUni) and the Student Financing Fund for Higher Education (Fies); increased vacancies in the federal network; promotion of distance education; implementation of affirmative action policies; and the Support Program for Restructuring and Expansion Plans of Federal Universities (Reuni), among others. This viewpoint is supported by Queiroz et al. (2013, p. 366-7) when they state:

Public policies play a fundamental role in adjusting demand and supply, as there is evidence that income is a major inhibitor of filling vacancies and success rates. Therefore, expanding public sector vacancies, particularly through the establishment of IES in more remote areas, granting scholarships and providing easy credit for students enrolled in the private sector are adjustment mechanisms that aim to enable more Brazilians to pursue and complete their undergraduate studies. It is worth highlighting the importance of REUNI as a program for the modernization of federal HEIs and, above all, for the expansion of Brazilian higher education.

In the second decade of the 21st century, the expansion of higher education was not as significant. Several factors contributed to this, such as the economic crisis, which led to a reduction in government funding and hindered students' ability to afford tuition fees. Approximately 75% of enrollments were concentrated in the private sector. The crisis also resulted in budget cuts for public higher education institutions and the suspension or elimination of various inclusion programs in higher education. More recently, the effects of the COVID-19 pandemic have further exacerbated the situation. This combination of factors goes against the goals set by the National Education Plan for the 2014-2024 period, which aimed to expand access to higher education.

According to the Law of Directives and Bases of National Education (LBD), there are two levels in Brazilian Education System, the Basic Education and the Higher Education (Brasil, 1996). The Higher Education encompasses the undergraduate courses, extension, and subsequent courses. The postgraduate courses, also pertaining to this level, are divided into *lato sensu* and *stricto sensu*. *Lato sensu* embraces specialization courses, further education, and residencies, whereas *stricto sensu*, ruled by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), is composed of Professional Master, Master and Ph.D. degrees. According to Sampaio (2011), due to their autonomy the private HEIs increase and decrease the number of vacancies, based on the market demands. They are always attentive and agile to the changes and exigencies of the market in the different levels and possibilities of education.

Lato Sensu postgraduation

The *lato sensu* postgraduate programs experienced a significant increase following the Resolution No. 01/2007, which was later replaced by Resolution No. 01/2018. Both resolutions were issued by the Higher Education Chamber of the

National Council of Education (CNE/CES) and established regulations for the operation of lato sensu courses at the specialization level.

Historically, however, the legal instruments related to the post-graduation began in 1965. According to Medeiros (2010), the *lato sensu* postgraduate courses had different phases, and the following periods should be highlighted: 1965 to 1977, implantation; 1977 to 1983, standardization and institutionalization; 1983 to 2001, consolidation and tendencies, and finally 2001 to 2008, regulation.

The Ministry of Education still does not have a database that consolidates information about lato sensu postgraduate courses, unlike the data collection process for stricto sensu postgraduate courses carried out by CAPES through the Sucupira platform. However, in 2014 the Ministry of Education published the Resolution CHE/NEC¹ No. 2, of 12 February, 2014, which institutes the national registry of *lato sensu* post-graduation courses offering (specialization) of the HEIs certified by the Federal Education System. In that record, which must be done based on all the courses offered since 2012, at least the following information must appear: i) title; ii) course load; iii) modality of classroom or distance education offering; iv) periodicity of the offering (regular or eventual); v) offering place; vi) number of vacancies; vii) number of egresses; ix) data about the teaching staff.

With the registration process, it is possible to obtain data, albeit limited, on lato sensu postgraduate programs.

Methodological Procedures

The idea is to present the model and the five steps followed for its construction, which are: (1) analysis of secondary data sources; (2) sample definition; (3) data collection; (4) data analysis and treatment; and (5) consolidation and application of the model to systematize the Course Pedagogical Project CPP information.

Analysis of secondary data

For the research development, information from secondary data sources was consulted, including the following institutions: Ministry of Labor and Employment in the Annual List of Social Information (Brasil, 2013d), Ministry of Labor and Employment in the Brazilian Classification of Occupations (Brasil, 2013e), Ministry of Education in the National Institute for Educational Studies and Research (Brasil, 2013c), Santa Catarina Association of Educational Foundations (ACAFE, 2013), and Federation of Industries of the State of Santa Catarina (FIESC, 2013a, 2013b, 2013c, 2013d, 2013e, 2013f, 2013g). The data related to Santa Catarina were used to run the model and obtain the outputs for validation purposes.

Definition of the primary source

The unity of analysis and main source of empirical data defined is a HEI. Just as the data primary source, managers representing the Business Association of the

¹ In the original: Resolução CNE/CES n. 2 (Brasil, 2014).

selected region are interviewed in order to collect the market demands and, regarding the understating about the courses, administrators of courses of the HEI chosen as study unit. In the state of Santa Catarina, there is a group of HEIs affiliated with the State Council of Education (CEE), which serves as the regulatory body for Higher Education and, consequently, for *lato sensu* postgraduate programs as well. The CEE provides guidelines for IES, which may be the same or similar to those of the National Council of Education (CNE). Starting from 2010, some of the HEI regulated by CEE/SC transitioned to the Federal Education System.

Data Collection

The data collection envisages three moments, defined as follows:

a) **First moment:** To obtain secondary data from the federal and state bodies previously referred, on information related to the of Higher Education Censuses as well as the number of employees corresponding to each job, classified by the National Registration on Economic Activity (NREA). Therefore, this moment of data collection external to the HEI may be characterized as a mapping of the context.

Based on primary sources, a structured questionnaire is applied in the interview to the experts. It is requested to the representatives of the Business Association of the region selected for the study to prioritize, according to their perception, the most important industrial sectors and the Future Holder Sectors (FHS). The sectors that are annually contributors to the development of the region are understood as essential. The most promising industrial sectors in the next years are understood as the FHS.

For this study, experts that represent the managers of the areas, occupying positions related to the presidency or executive board in companies and business associations in the region, are consulted.

b) **Second moment:** It is sought the object of knowledge of the undergraduate courses contemplated in the Decrees of the National Student Proficiency Exam (Enade), obtained through the Ministry of Education (2013). In the same step, the list of undergraduate courses of the HEI selected to the study.

c) **Third moment:** The data are organized in a framework to guide the HEIs that are interested in using the proposed model. In this model, due to the accessibility to the objects of knowledge of the undergraduate courses, they are associated with the undergraduate courses and later they are translated to *lato sensu* graduate courses.

Data Analysis and Treatment

The data analysis and treatment are organized in two steps. The first one involves the acquisition of the regional demand obtained by the number of employees related to each occupational family of the National Registration on Economic Activity according to the important sectors and the FHS, with the aim of presenting the existing reality in the moment in the region. With the prioritization of the FHS for the region by the experts, it is also possible to estimate which guidelines need to have the essential knowledge to develop the prioritized occupational families. The second one goes through the identification of the objects of knowledge relevant to the *lato sensu* graduate courses. It is accomplished through the association of the *lato sensu*

graduate courses with the undergraduate courses. This association follows these criteria: i) definition of the objects of knowledge of the lato sensu graduate courses from the ones present in the undergraduate courses offered by the HEIs; ii) perception of the course administrators regarding the importance of specific object of knowledge for the corresponding lato sensu graduate course.

Model Building

The model is created from an external information database, in sources of primary data (governmental laws that regulate the lato sensu graduate courses), statistics related to stricto sensu graduate courses and the regional workforce. Qualitative and quantitative information was obtained with experts as additional sources. Besides, internal subsidies were searched in the researched HEI, in its institutional documents and with its undergraduate course administrators.

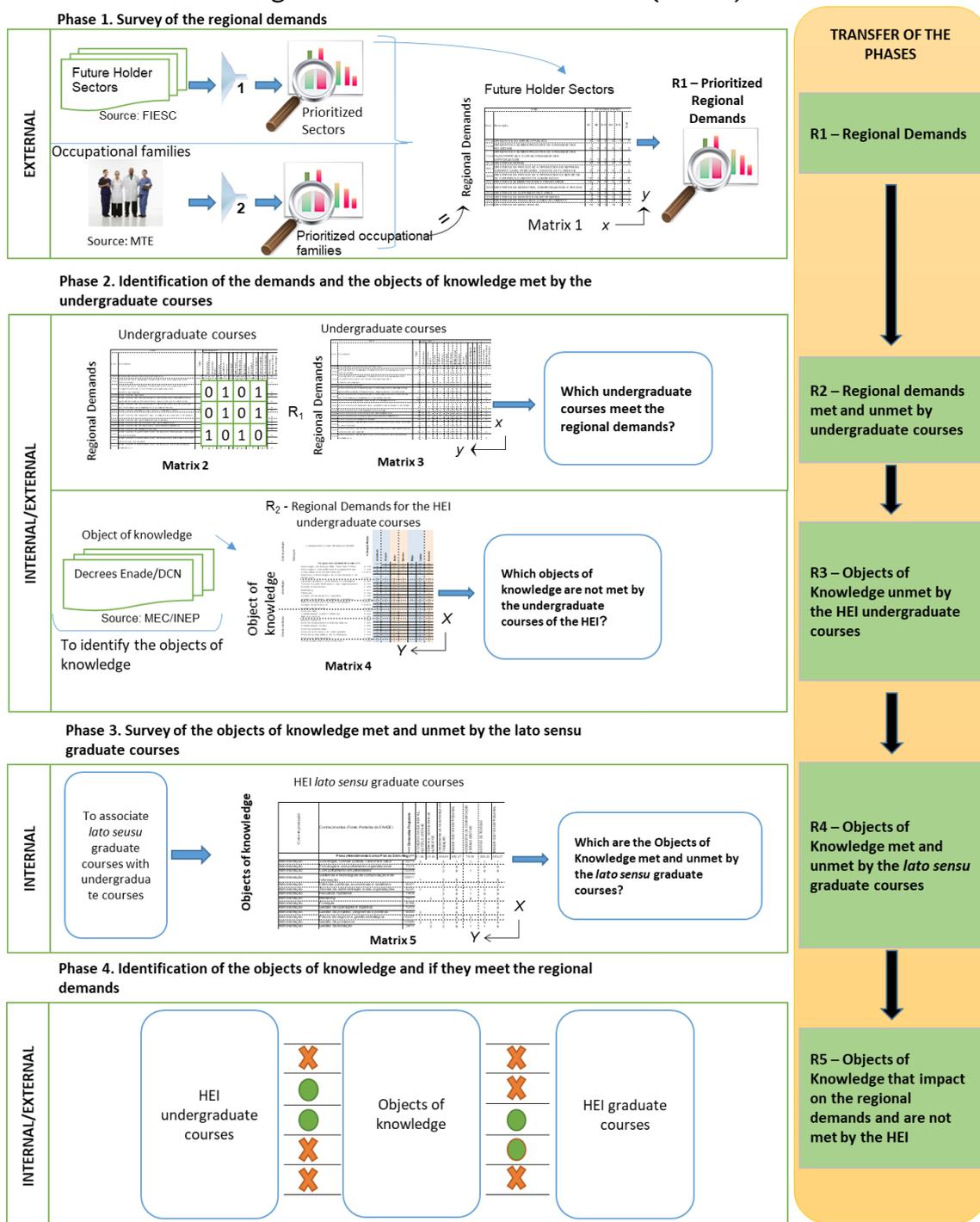
General Presentation of the Model (MIPLS)

The model that systematizes the information for the PPCs of the lato sensu graduate courses (MIPLS) is structured in four phases: 1) Survey of the regional demands; 2) Identification of the demands and objects of knowledge met by undergraduate courses; 3) Survey of the objects of knowledge met and unmet by the lato sensu graduate courses; 4) Identification of the objects of knowledge and their fulfillment of the regional demands.

The model does not envisage a computerized system that controls these variables but presents the needs for the design of this information system. Model 1 (Figure 1) encompasses two filters. The filters represent a selection of data according to predefined criteria, constituting prioritization criteria according to the study scope (area, region, etc.).

Each phase of the model has a result (transfer), which is the input of another phase. This logic guarantees the information flow between the regional demand and the planning of the portfolio of the courses aligned to the PPD of the Institution. In order to present the model, some matrices were filled to clarify the phases, making the presentation more didactic.

Figure 1. Framework of the Model (MIPLS)



Source: the authors.

Phase 1: Survey of the regional demands

The objective of this phase is to identify the regional demands of the FHS for the region selected for the study. Therefore, the first item to determine the regional demands is the definition of these sectors which present tendencies of growth identified by the Brazilian Industry Federation.

This phase uses data and information from external sources, according to: a) data related to the education level and experience required by the occupational families are found on the Portal of Job and Employment (Brasil, 2013e); b) frequency

of the occupational families (Brasil, 2013d); c) information about the FHS; d) convergence chart of the National Classification of Economic Activities for FHS; e) instrument and prioritization of the FHS to experts of the Business Associations.

This phase is constituted of three steps and two filters, detailed from now on.

Stage 1: To prioritize the essential sectors and the future holder sectors for the region.

This stage aims at the prioritization of the most important and future holder sectors for the microregion. Experts, such as the ones responsible for the Business Associations that have Business Directors and folders, accomplish this prioritization. The experts are requested due to their knowledge about the evolution and perspectives of each business and sector concerning development and growth. An instrument (Filter 1) is proposed to select the sectors (Figure 1). In this item, there are also experts of the government and data and information of growth tendencies and sectors in which the region could be an excellence center.

Filter 1: Each expert, in their perception, commands, among the sectors, the five future holder sectors, using a scale of 1 to 5, with 1 being the most promisor, and 5 the least promisor, according to Figure 2. After the answers, a prioritization (P_{sector}) is obtained through the sum of the inverses, resulting in the importance order of the future holder sectors for the region. This procedure is referred to the first filter, according to Equation 1. The cut-off in five sectors is arbitrary and can be modified following the perspectives and capacities of the HEI.

$$P_{\text{sector}_j} = \sum_i \left(\frac{1}{n_{ij}} \right) \quad \text{Equation 1}$$

In which:

Sector 1 ... n

Expert 1 ... k

n_{ij} = priority degree given by the expert i to the sector j .

Lines 1 to n are filled according to the experts' ranking. The prioritization index is calculated through Equation 1, constituted of the total value of the weighting assigned to each sector.

Stage 2: To identify the regional demands through the occupational families.

The information of the Ministry of Labour and Employment (MoLE) totalizes 68 regulated professions since in the Brazilian Occupation Classification (Brasil, 2013e) there are 2,422 occupations conceptualized by the MoLE as "the aggregation of similar employments or work situations regarding the activities performed." (Brasil, 2013d). These occupations comprise 7,258 synonyms. Because it is a broader and more systematic study, the model includes the occupations that, in this case, due to the significant number (2,422), were grouped into occupational families, totalizing 596 according to the MoLE.

Filter 2: In the MIPLS proposal, occupational families that require higher education are taken into consideration. Therefore, Filter 2 consists of selecting the occupational families from the CBO (Brasil, 2013e) that require higher education.

In this section all the occupational families with a code beginning with number 3 were removed, once digit 3 identifies the required education in medium technical level. After, they determined the occupational families that indicate the requirement of undergraduate level in the field education and experience. For the families not included in the two previous stages, the connection process to an undergraduate course was made individually, according to the education and experience analysis exposed in the Brazilian Occupation Classification. Thus, from the 596 existing occupational families, only the ones that require undergraduate level remain.

There can still be cases in which a particular occupational family may be assumed by professionals from more than one undergraduate course. In that case, the frequency of the occupational family was replicated to all the courses that can perform the occupational family. As a result, to identify which occupational families are associated to the FHS, they were associated in the form of a matrix.

Stage 3: To associate the regional demands (occupational families) to the future holder sectors.

The occupational families resulting from the previous phase are called regional demands. The regional demands are arranged in lines (i), whereas the FHS of prioritized future are arranged in the columns of the matrix (j).

The matrix is filled with the description of the regional demands, which from now on are called regional demands, arranged in lines i , the column frequency of the regional demands, field (fDi), and the five prioritized future holder sectors, arranged in the subsequent columns j .

The cells of the matrix are filled according to the number of solicitations of the regional demand i distributed among the prioritized sectors, according to Equation 2. Therefore, the sum of the lines is the frequency of the demand.

$$PRegdem_i = \sum_{j=1}^J fDi_j \quad \text{Equation 2}$$

In which:

$PRegdem$ = prioritization of the Demand i

fDi = frequency of the regional demand i to the sector j

J : number of sectors

Therefore, the result of Phase 1 is the regional demands, associated with the sector (R_1). The model may support the number of FHS necessary for the user, increasing or decreasing the prioritized regional demands. In that moment, the inputs coming from the process described in Figure 1, Filter 1, were used. From the scale, a prioritization ranking was calculated (Favretto, 2014).

Phase 2: Identification of the regional demands and the objects of knowledge met by the undergraduate courses

In this phase, the aim is to identify if the regional demands are met by the undergraduate courses registered in MoE, also if the objects of knowledge are met by the undergraduate courses. In order to obtain the results, the construction of three matrixes is necessary: a) matrix of assignment of the undergraduate courses to the regional demands (Matrix 2); b) matrix of the regional demands and

undergraduate courses (Matrix 3); and c) matrix of the objects of knowledge and regional demands for the undergraduate courses of the HEI (Matrix 4).

a) Matrix of assignment of the undergraduate courses to the regional demands

Matrix 2 (Figure 2) is built arranging the regional demands resultant from Phase 1, presented in Figure 6 by (R1) in the lines (i), and the undergraduate courses necessary to meet the regional demands, in columns (j). The critical question for the fulfillment of the matrix is: the course j (X) can meet the regional demand i (Y).

Figure 2. Matrix (2) Regional Demands and Undergraduate Courses

Regional demands	Undergraduate courses				
	Course1	Course2	Course3	...	Course _n
RegDem1					0
RegDem2	1	1	1		1
⋮	⋮	⋮	⋮	⋮	⋮
RegDem _n	1	0	1		0
SDCourse	2	1	3		1

Source: the authors.

The fulfillment of Matrix 2 (Figure 2) was done considering the contribution of one or more undergraduate courses for the fulfillment of the regional demands. In order to complete this matrix, the following scale is used: the zero value (0) for the regional demand does not require graduation in the course; one (1) for the regional demand requires graduation in the course. In cases in which more than one course can meet the same regional demand, the value one (1) is replicated to the other undergraduate courses. At the end of the fulfillment, the number of demands that the course contributes to meet is summed up. This sum was named SDCourse (sum of the demand of the course) (see Equation 3).

$$SDcurso_j = \sum_{i=1}^D curso_j \quad \text{Equation 3}$$

In which:

SDCourse_j = total of times that the course j meets the Regional Demands i.

D: no. of regional demands.

$$curso_j = \begin{cases} 0 & \text{the regional demand does not require graduation in the course} \\ 1 & \text{the regional demand requires graduation in the course} \end{cases}$$

b) Matrix of the regional demands and undergraduate courses

From Matrix 2 (Figure 2), a new matrix is built, the regional demands and undergraduate courses matrix. The undergraduate courses were arranged in columns (j) and the regional demands in lines (i) in order to draw up Matrix 3 (Figure 3). By the fulfillment of this matrix (Matrix 3), the cells are replaced where there is the value one (1) (Matrix 2) by the regional demand (fDi), according to Equation 2.

Figure 3. Matrix (3) Regional demands and undergraduate courses

Regional Demands	Undergraduate Courses				
	Course1	Course2	Course3	...	Course _n
RegDem1	15	25	29		
RegDem2	35	20	10		
⋮	⋮	⋮	⋮	⋮	⋮
RegDem _n					
SRegDem _j ²	50	45	39		

Source: the authors.

$$P_{course_g HEI} = P_{regdem_i} \times course_j \quad \text{Equation 4}$$

In which:

$P_{course_g HEI}$ is the demand met by the undergraduate courses of the HEI.

The cell $SRegDem_j$ is the sum of the frequency of the demands met by the undergraduate course. This phase presents the second result for the model (R_2), which are the regional demands to be met.

c) Matrix of the objects of knowledge and regional demands for the undergraduate courses of the HEI

For the construction of Matrix 4, of the objects of knowledge and regional demands for the undergraduate courses of the HEI (Figure 4), two variables were included: 1) objects of knowledge, arranged in lines; and 2) regional demands for the undergraduate courses of the HEI with the results obtained in the previous phase ($SRegDem_j$).

Figure 4. Matrix (4) of the Objects of Knowledge related to the undergraduate courses of the HEI

		Regional demands for the undergraduate courses of the HEI				
		Course1	Course2	Course3	...	Course _j
Objects of Knowledge	Frequency >					
	Result					
ObjKnow1						
ObjKnow2						
ObjKnow3						
⋮	⋮	⋮	⋮	⋮	⋮	⋮
ObjKnow _i						
Total						

Source: the authors.

² $SRegDem_j$ = sum of the regional demands per undergraduate courses.

The objects of knowledge arranged in the lines of the matrix i are defined by Ministry of Education and National Institute for Educational Studies and Research Anísio Teixeira (Brasil, 2013c) as the contents evaluated by Enade which must be developed with the students in the undergraduate courses. In this model, only the objects of specific knowledge envisaged by the decrees of Enade were considered.

The undergraduate courses of the HEI arranged in columns j are those offered by the HEI. In this case, the key question for fulfillment is: in what extent the object of knowledge i (X) is met by the undergraduate course j (Y). The answer to this question is given by the scale of 0, 1, 3, and 9, in which: 0 (not related), 1 (weak relation, the object of knowledge is met accessorially, defined by Experts), 3 (moderate relation, the object of knowledge is met complementarily, defined degree by Experts), 9 (Mandatory, the object of knowledge is entirely met, according to the Enade Decree and by Experts).

The fulfillment of the matrix is executed by the administrators of the undergraduate courses of the HEI, who identify the association between the objects of knowledge (i) and the undergraduate courses (j) ($Rok_i c_j$).

The matrix structure also has the column that brings the field Result, obtained through the variables: i) regional demand associated with the undergraduate course of the HEI; and ii) weight (0, 1, 3, 9) assigned by the course administrator. After the calculation, it is possible to organize the objects of knowledge met and unmet by the courses, according to Equation 5.

$$Pok_{i(graduation)} = \sum_{j=1}^C (SRegDem_j \times Roc_i c_j) \text{ Equation 5}$$

In which:

Pok_i = how much the object of knowledge line i is met by the course j .

C = number of the courses analyzed of the HEI.

$SRegDem_j$ = sum of the regional demand associated to the course j (result of the matrix 3).

$Rok_i c_j$ = relationship degree (0, 1, 3, 9) of the object of knowledge i and of the course j .

Phase 2 gives two important results for the model: the first result, R_2 – Regional demands met and unmet by the undergraduate courses, enables to identify which courses are necessary to meet the regional demands, not observing if they are or are not offered by the HEI. The second result of the Phase, R_3 – Objects of Knowledge met by the undergraduate courses of the HEI, was obtained based on the information of the regional demands and the weights assigned by the course administrators. It is observed that in some cases the answers of the administrators suggest that depending on the emphasis given to the course, a specific object of knowledge can be elected as complementary or supplementary. It enables, even not being study object and not being analyzed, to compare the mandatory objects of knowledge, defined by Enade, with the answers given by the course administrators who can indicate them as complementary or supplementary.

Phase 3: Survey of the regional demands and objects of knowledge met and unmet by the *lato sensu* graduate courses

Phase 3 has the aim of identifying objects of knowledge met and unmet by the *lato sensu* graduate courses, and the data were obtained through: i) lists of graduate courses of the HEI that meet these criteria: 1) offered in the region, in cases in which the HEI is multicampus, it is sought the contribution of the courses in the region/microregion of the campus; 2) linked to the undergraduate courses, it means the undergraduate course that originated the *lato sensu* graduate course; 3) the class beginning during the selected period – between 2009 and 2012; and ii) objects of knowledge unmet by the undergraduate courses (R3).

In this phase, it is necessary to associate the undergraduate courses to the graduate ones. It is highlighted that the development of the method up to this phase was carried out considering undergraduate courses, because for them it was possible to associate the objects of knowledge of Enade and other decrees. However, up to now, the *lato sensu* graduate courses do not have definitions regarding objects of knowledge and areas, in other words, there is no standardization of the contents to be approached. Therefore, the objects of knowledge of the undergraduate courses were adopted since they are detailed and systematized.

Associating the *Lato Sensu* Graduate courses to the undergraduate courses

In case the HEI has an active coordinator in the *lato sensu* graduate course, they will be the responsible for Phase 3. Otherwise, the coordinator of the undergraduate course to which the *lato sensu* program is linked may be responsible for filling in the information.

The *lato sensu* graduate courses that are not linked with undergraduate courses are not considered for the following phase.

Identifying which objects of knowledge are met and unmet by the *lat sensu* graduate courses of the HEI

In order to construct Matrix 5, two variables were necessary: 1) objects of knowledge, which are arranged on the lines i (Y); 2) list of the *lato sensu* graduate courses offered by the HEI, met on the criteria of the previous stage, arranged on columns j (X), according to Figure 5.

Figura 5. Matrix (5) of the objects of knowledge and the *lato sensu* graduate courses of the HEI

Objects of knowledge	Lato sensu graduate courses					Poki(pg)
	Graduate Course 1	Graduate Course 2	Graduate Course 3	...	Graduate Course j	
ObjKnow1						
ObjKnow2						
ObjKnow3						
...						
ObjKnow i						

Source: the authors.

The matrix of Figure 5 is fulfilled by the course administrators and considers how much the objects of knowledge (Y) are met by the *lato sensu* graduate courses (X), using the same scale of Phase 2, in which 0 (has no relation), 1 (Supplementary Knowledge, relation defined by Experts), 3 (Complementary Knowledge, relation defined by Experts), and 9 (Mandatory knowledge, relation defined by Experts).

Later, the field $Pok_{i(g)}$ (Equation 6) is calculated, which means how much the objects of knowledge are met by the *lato sensu* graduate courses.

The values obtained in $Po_{i(g)}$ indicate how much the object of knowledge is met by the *lato sensu* graduate course.

$$Pok_{i(pg)} = \sum_{j=1}^J \frac{Rok_{i}pg_j}{MaxRok_i} \times 100 \quad \text{Equation 6}$$

In which:

$Rok_{i}gc_i$ = degree of relation between the objects of knowledge i and the *lato sensu* graduate courses j .

J = number of *lato sensu* graduate courses

$MaxRok_i = 9 \times J$

The results of Phase 3 are objects of knowledge met and unmet by the *lato sensu* graduate courses – R_4 . In this phase, it is considered the graduate courses, the objects of knowledge, and the value assigned by the administrators to identify objects of knowledge that may be developed, encouraging different approaches in future *lato sensu* graduate courses.

Phase 4: Identification of the objects of knowledge and their fulfillment to the regional demands

The objective of Phase 4 is to identify the objects of knowledge that meet the regional demands, met and unmet by the HEI (*lato sensu* undergraduate and graduate courses).

For this purpose, six columns were arranged: the first column describes the name of the undergraduate course; the second one lists the objects of knowledge; the third column points to the field $Pok_i(g)$; the fourth one informs if the field $Pok_i(g)$ meets or not the demand, considering if its value is above or below the median; the fifth column presents the field $Pok_i(gc)$; the sixth column has as response options if the graduate courses meet or not the established percentage.

The structuring of the model goes through the definition of the *lato sensu* graduate courses, considering two matters: future holder sectors and regional demands. Based on this description it is possible to define the objects of knowledge in need of being better met considering the regional demands.

As results of the model, the objects of knowledge are identified: a) met on graduation and met on post-graduation; b) met on graduation and unmet on post-graduation; unmet on graduation and met on post-graduation; unmet on graduation and unmet on post-graduation, considering the regional demands. The result of Phase 4 highlights the objects of knowledge that affect the regional demands, but are not met by the HEI – R_5 in *lato sensu* undergraduate and graduate courses. This information provides the creation of new courses in the *lato sensu* post-graduation modality which can contribute to the regional development offering training to the

higher level personnel who seeks to be prepared to act in the important sector and FHS of the region.

Conclusion

The model presented in this article, nominated MIPLS, enables the systematization of information that connects regional demands to objects of knowledge of the HEIs in order to guide the creation and updating of *lato sensu* graduation courses.

Regarding the advantages of the application of the model it can be highlighted: a) focus on the sectors defined as future holders for the microregion; b) consideration of the regional demands, based on a significant occupation sample of these sectors. On the other hand, among the obstacles there are: a) the attribution of the undergraduate courses to the regional demands are done subjectively, in the cases that were not indicated by Ministry of Labor and Employment and Brazilian Classification of Occupations (Brasil, 2013e); b) attribution of weight by the administrators with different interpretations between them; c) prioritization of the future holder sectors based on the individual perception of the experts.

The proposal of the model is to become a reference adjustable to each case, and this is the first research level for the organization of the information of the demand by schooling, based on data and information available that can be submitted to a quantitative treatment. The automation of the model is the next level aiming to ease its use, as well as detailing the construction of the course portfolio (courses that must be created, kept, updated, and discontinued), considering objects of knowledge that meet the regional demand. The portfolio, in turn, will enable the establishment of the PPCs of *lato sensu* courses. It is hoped that the model directs people's training according to the needs of the society, consequently promoting the development of the region.

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