

Interactive model of the role of higher education institutions for regional development: an analysis from the state of Alagoas, Brazil

FILHO, Augusto Ferreira Ramos

 [0000-0001-8375-4024](https://orcid.org/0000-0001-8375-4024), Universidade Estadual de Alagoas. Arapiraca, AL, Brasil. Email: augusto.filho@uneal.edu.br

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ABSTRACT

This article proposes the evaluation of an interactive model of the role of higher education institutions for regional development involving strategic articulations and regional innovation systems. The model proposes to establish methods of articulation between higher education institutions, the business and governmental environments. This dynamic occurs through the strategic articulation of the outputs of higher education institutions to the regions where they are installed. This qualitative research had the state of Alagoas, Brazil, as the geographical scope. Eighteen interviews were conducted with people linked to higher education institutions, government and companies. The results reveal the leading role of higher education institutions in the dynamics of regional development. The verification of the model from the perspective of the academic, business and governmental environment found validation having from the respondent's suggestions, the inclusion of a social organization as a mediator of the articulation between the spheres and the addition of social products.

RESUMO

Este estudo propõe a avaliação de um modelo interativo do papel das instituições de ensino superior para o desenvolvimento regional envolvendo articulações estratégicas e sistemas regionais de inovação. O modelo propõe estabelecer métodos de articulação entre as instituições de educação superior, os ambientes empresarial e governamental. Essa dinâmica ocorre por meio da articulação estratégica dos produtos das instituições de ensino superior às regiões onde estão instaladas. Esta pesquisa qualitativa teve como escopo geográfico o estado de Alagoas, Brasil. Foram realizadas 18 entrevistas com pessoas ligadas a instituições de educação superior, governo e empresas. Os resultados revelam o protagonismo das instituições de ensino superior na dinâmica do desenvolvimento regional. A verificação do modelo na perspectiva do meio acadêmico, empresarial e governamental encontrou validação tendo, a partir das sugestões dos respondentes, a inclusão de uma organização social como mediadora da articulação entre as esferas e a adição de produtos sociais.

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Introduction

The relationship between Brazilian higher education institutions and regional development is undermined by the lack of engagement among the parties involved. The promotion of regional development occurs through interaction among various actors (D'Avila et al., 2015), that is, through reciprocal communication among institutional facilitators—namely industry, commerce, government, and higher education institutions—with the potential to develop a region (Lendel, 2010).

However, development in general is hindered by the absence of communication among these actors (Audy, 2017). More specifically, in many cases, actors focus on isolated issues and fail to assess the contributions that other actors can make to the process of developing ideas and/or opportunities. The lack of engagement results in university outputs not contributing effectively to regional development.

The theoretical foundations of this article led to the construction of an interactive model of the role of higher education institutions in regional development. The model proposed by Lendel (2010) was used as a basis. However, it is observed that the university outputs proposed by the author are insufficient to measure the phenomenon of higher education institutions' contributions to regional development. They are insufficient because they represent endogenous movements—outputs without control and without communication with the region. In order to support the main themes, the inclusion of logistical processes, networks, and articulation (Salamzadeh, Salamzadeh & Daraei, 2011) is proposed as complementary elements to better understand how university outputs promote regional development.

Furthermore, based on the literature, four variables were identified—here referred to as interactive elements of university outputs and regional development—based on the model of Hoff, Martin, and Sopena (2011): (1) Influence on the cultural environment; (2) Influence on the business environment; (3) Stimulation of regional economies; and (4) Modification of local infrastructure. The authors developed a model of direct and indirect impacts; however, university outputs are related only to indirect impacts. These elements were identified and incorporated into the interactive model as mechanisms for explaining regional development through university outputs.

The proposal of an interactive model using university outputs and their contributions to regional development was based on Lendel (2010), but was not limited to it, since the author restricted the analysis to understanding the relationship of university outputs through technological elements. To address this limitation, the model of direct and indirect impacts of higher education institutions on regional development proposed by Hoff, Martin, and Sopena (2011) was adapted and incorporated.

Measuring the contribution of higher education institutions through their outputs makes it possible to stratify how regional development is promoted, based on categories that can be measured and monitored in an integrated manner. Thus, an interactive model that can be distributed, replicated, and monitored may measure, over time, the role of higher education institutions in regional development.

Building on the interactive model developed by Ramos Filho and Cândido (2024) regarding the role of higher education institutions in regional development, this study seeks to advance the investigation through an empirical analysis in the state of Alagoas, testing and refining the theoretical proposal.

Therefore, it can be inferred that the quantity and quality of university outputs generated by higher education institutions, as well as their combinations, promote regional development when mediated by an interactive model that strategically articulates the interests of different social actors through a regional innovation system.

Accordingly, the objective that guided this investigation was to verify the proposed interactive model from the perspective of higher education institutions, the business environment, and the governmental sector.

This article is structured as follows: this introduction is followed by the materials and methods necessary for the investigation, the results, and the final considerations.

Methodology

This is a qualitative study that sought to investigate the proposed interactive model of higher education institutions' contributions to regional development.

The study was divided into three strata: academic, business, and governmental. Respondents in the academic stratum consisted of rectors and/or vice-rectors; in the governmental stratum, state government leaders holding positions related to state development; and in the business stratum, companies that had established some form of partnership with higher education institutions in addressing their business challenges.

A total of 18 interviews were conducted, amounting to 15 hours, 32 minutes, and 12 seconds of recorded interviews, which were transcribed and imported into the N-VIVO Pro 12 software for data organization and handling. The analysis followed the assumptions of qualitative research, based on content analysis (Bardin, 1977). Complementary and exploratory procedures were also employed, including clustering techniques (cluster analysis) and measures of lexical similarity based on the Pearson correlation coefficient—not for inferential statistical purposes, but as auxiliary visualization and interpretative tools to support the identification of patterns of semantic proximity among categories and codes.

Data collection was guided by the search for responses to verify the interaction of university outputs with regional development, based on the proposed model and its possible refinement.

To better identify university outputs, the interviews were supported by a card-based methodology borrowed and adapted from Gueiros (2007). Accordingly, nine cards presenting the university outputs and their meanings were developed. This approach ensured that interviewees did not require additional clarification regarding the concepts. Specifically, the card methodology enabled a standardized understanding among respondents regarding the meanings of university outputs, thereby reducing interpretative bias concerning the central concepts of this study. Operationally, the cards were presented to participants for reading, followed by the interview questions. For example, after reading the meaning of the output “technology diffusion,” respondents were asked about its existence or their perception of it. Whether the response was positive or negative, the interview script was followed in order to collect the relevant data.

The categories concerning the model’s validity and suggestions for the interactive model of the role of higher education institutions in regional development were used for data interpretation through the content analysis method according to Bardin (1977), that is, transcription, coding, categorization, and analysis grounded in the literature.

The research was approved by the Research Ethics Committee under CAAE # 97064718.1.0000.5175.

Discussion of Results

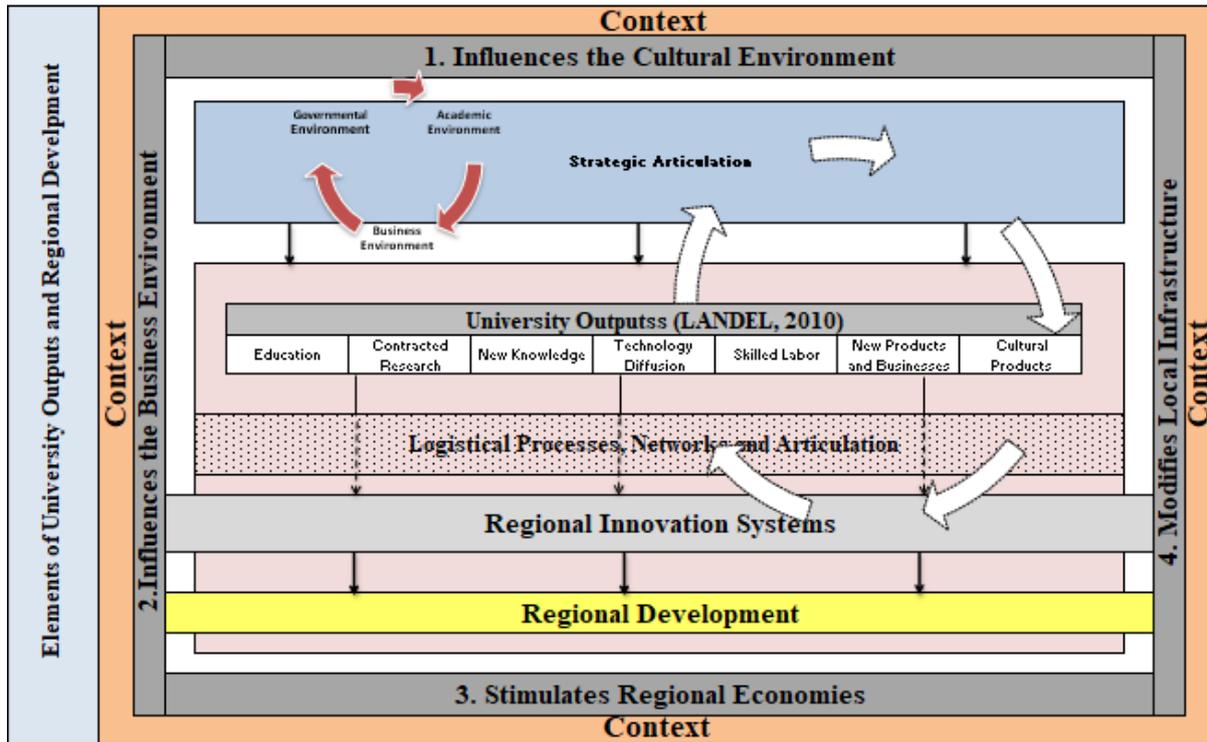
During the process of constructing the theoretical framework of the interaction model between higher education institutions for regional development, the need for the participation of social actors in knowledge construction became evident, as highlighted by Malerba (1999, 2002, 2005) in his studies on innovation systems, as well as the need for coordinated communication between higher education institutions and productive sectors, regional development funding agencies, and governments at their different levels, as proposed by Etzkowitz and Leydesdorff (2000).

The studies by Goddard and Vallance (2011) showed that the articulation between higher education institutions and their surrounding environment was compromised by a lack of engagement, a finding corroborated by Gimenez and Bonacelli (2015). Finally, the institutional facilitators—namely industry, commerce, government, and higher education institutions—presented by Lendel (2010) should engage in dialogue, since coordination is hindered by the absence of regional engagement (Rolim & Serra, 2009).

Motivated by this evidence, the researcher decided to share the interactive model of the role of higher education institutions in regional development with the study participants, with the aim of making scientific production participatory and, more importantly, of understanding

the model from the perspective of those who must articulate efforts for its application. In other words, the intention was to understand how the different social actors interviewed perceived and could implement the model for the development of the state of Alagoas, Brazil. Thus, the model, presented in Figure 1, was shown to all respondents.

Figure 1.
Interactive model of the role of higher education institutions in regional development¹

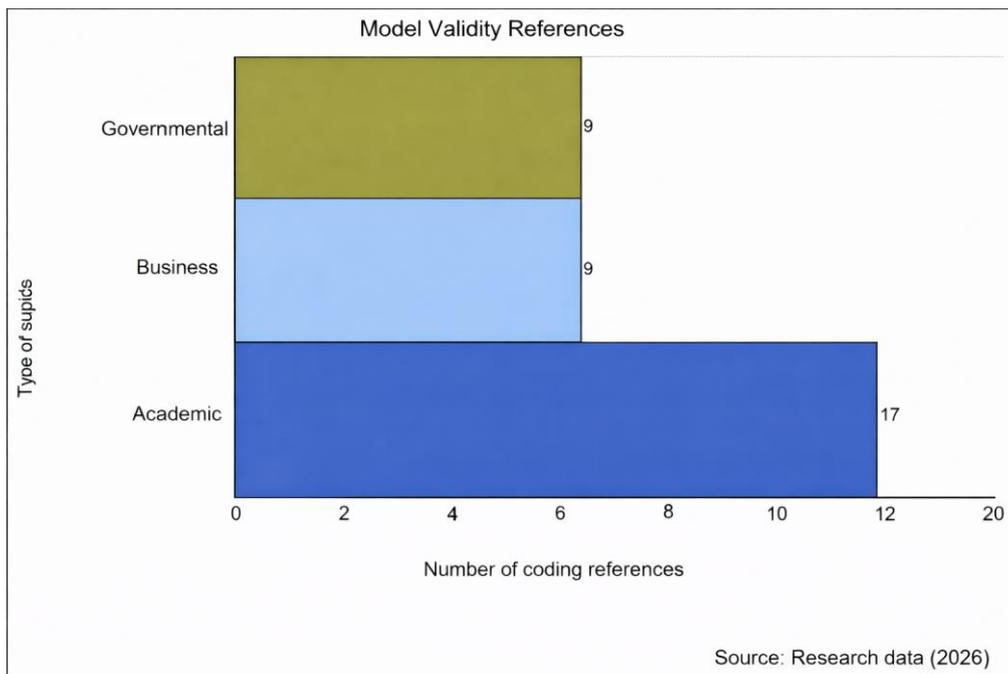


The presentation of the model to the respondents had two objectives: (1) to determine whether the model was viable; and (2) to seek contributions for improving the proposal. The first objective was coded as “model validity,” while the second was coded as “suggestions for the model.”

“Model validity” received 35 references, of which 9 came from the governmental environment, 9 from the business environment, and 17 from the academic environment, representing 25.71%, 25.71%, and 48.58% of the total, respectively, as shown in Graph 1.

¹ Source: Ramos Filho e Cândido (2024).

Graph 1.
Model Validity References²



All respondents stated that the proposed model is viable and can be applied with the objective of developing a region. Among the references, the following stand out: “I think it’s really great to systematize this dynamic” (Interviewee 1); “for me, what you point out here in this table makes a lot of sense” (Interviewee 2); “it makes complete sense; I think that if you change this sequence, it becomes much more difficult, and if you suppress one of these items as well” (Interviewee 3); “it makes a lot of sense, you are absolutely right” (Interviewee 4); “yes, it does” (Interviewee 5); “it makes a lot of sense” (Interviewee 6); “of course, and it makes even more sense” (Interviewee 7); “totally, and it’s what we’ve been doing since we arrived here” (Interviewee 8); “totally, totally” (Interviewee 9); “without a doubt, without a doubt” (Interviewee 11); “yes, it makes sense” (Interviewee 12); “this chart, this flowchart is very well represented” (Interviewee 13); “I fully agree” (Interviewee 14); “I believe it is an excellent model for us to move forward” (Interviewee 15). Interviewee 10 effectively understood what was proposed in the model:

Excerpt (01)

I think this model is exactly that, the foundation of a strategic vision that can permeate an institution, or a region, or a state, and if it were effectively implemented, it would bring great progress to society and to where we are heading; this model is a very interesting one (Verbal information).

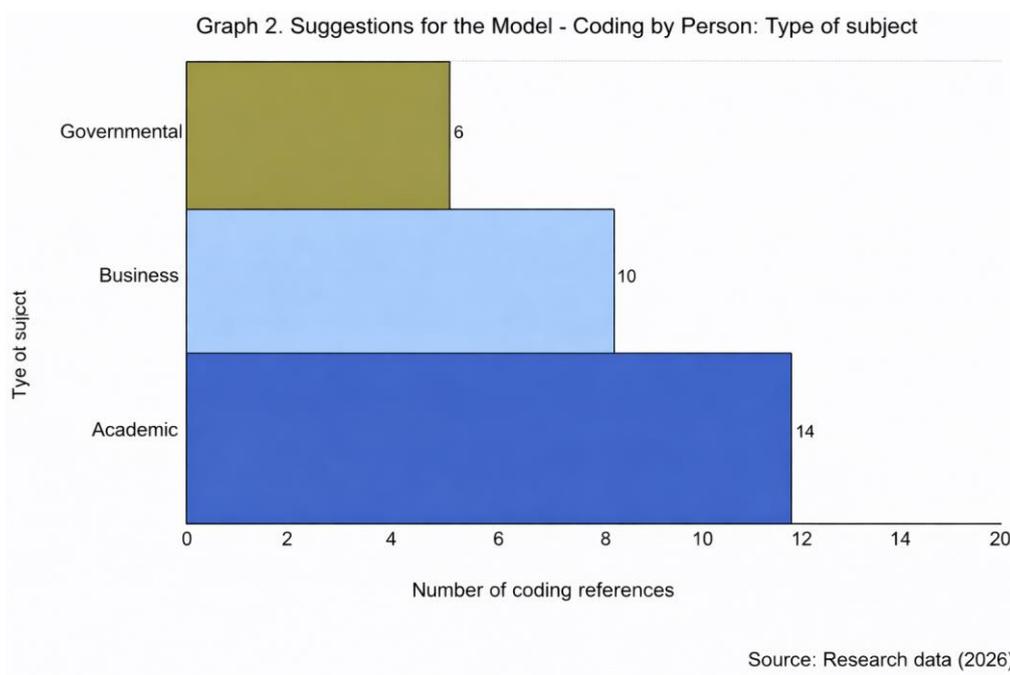
² Source: Research data (2026).

In Excerpt (O1), Interviewee 10 discusses the effectiveness of the proposed model. For him, the model is the “foundation of a strategic vision.” In fact, the first stage of the model, as shown in Figure 1, is strategic articulation. That is, it refers to the ability of academic, business, and governmental spheres to engage in dialogue with the purpose of creating fronts for the development of the state of Alagoas. In the lexical choice “if it were effectively implemented, it would bring great progress to society,” the interviewee recognizes that the model is a proposal. By using the conditional particle “if,” the interviewee points to the model’s potential effectiveness, stating that it “would bring great progress.” However, such progress can only be achieved if there is articulation among higher education institutions, the productive sector, and the government in an interdependent relationship, as proposed by the Triple Helix model (Etzkowitz, 2003).

“Suggestions for the model” received 30 references, of which 6 came from the governmental environment, 10 from the business environment, and 14 from the academic environment, representing 20.00%, 33.33%, and 46.67% of the total, respectively, as shown in Graph 2.

Graph 2.

References to Suggestions for the Model³



³ Source: Research data (2026).

The suggestions for the model can be divided into two categories: (1) suggestions that were already incorporated into the model; and (2) new suggestions for the model. Table 1 presents the suggestions related to the first category.

Table 1.
Suggestions Already Incorporated into the Model⁴

| Interviewee | Suggestion | Equivalent in the Model |
|--------------------|--------------------------------------|--------------------------------|
| Interviewee 1 | Listening to regional actors | Articulation |
| Interviewee 2 | Role of society | Environments |
| | Socio-territorial context | Context |
| | Historical context | Context |
| | Entrepreneurial spirit | Context |
| Interviewee 4 | Communication | Articulation |
| Interviewee 5 | Communication | Articulation |
| Interviewee 6 | Communication | Articulation |
| | Create a regional innovation system | Regional Innovation System |
| | Regional innovation system | Regional Innovation System |
| Interviewee 7 | Context | Context |
| | University strategy | Articulation |
| | Regional or local innovation system? | Regional Innovation System |
| Interviewee 8 | Strategic planning | Articulation |
| Interviewee 9 | Role of society | Environments |
| Interviewee 12 | Innovation environment | Regional Innovation System |
| Interviewee 15 | Articulation of all actors | Articulation |

In Table 1, 17 suggestions mentioned by the interviewees were already incorporated into the model. The suggestions that interviewees failed to identify as already present corresponded to four elements: environments, articulation, context, and regional innovation system. These elements are significant, as they show that the spheres need to articulate within a regional innovation system, respecting the context—that is, the characteristics and vocations of the regions in which they are located.

The new suggestions for the model can be observed in Table 2. In total, there were 13 suggestions with potential for incorporation. All spheres, academic, business, and

⁴ Source: Research data (2026).

governmental, contributed to improving the model. Social products, identified during the exploration of university outputs, were mentioned three times. Social organizations were mentioned five times, while foundations and development funding agencies received only one mention. Language was cited three times. Although language could be interpreted as communication and, therefore, articulation, it was understood that in this case the issue of language referred to the model itself rather than to the social actors who must associate for regional development. Finally, “implementation” was more an expression of the interviewee’s desire to witness the model in operation than a concrete suggestion.

Table 2.
Suggestions for the Model⁵

| Interviewee | Suggestion |
|--------------------|---|
| Interviewee 1 | Too theoretical |
| | Adapt the information to other environments |
| | Adapt the language |
| Interviewee 2 | Social products |
| Interviewee 3 | Implement |
| Interviewee 9 | Social organization |
| | Social organizations as articulators |
| Interviewee 13 | Social organization, council |
| | Social products |
| | Social organization for debureaucratization |
| Interviewee 15 | Social products |
| | Foundation, development funding agency |
| | Social organization |

The most recurring suggestion was the creation of a social organization that could mediate the articulation among the academic, business, and governmental environments. Manaf and Silva, citing Law No. 9,637/1998, define social organizations as “private legal entities, non-profit in nature, whose statutory activities are directed toward education, scientific research, technological development, environmental protection and preservation, culture, and health” (Manaf & Silva, 2017, pp. 191–192).

⁵ Source: Research data (2026).

Regarding the model, Interviewee 13, inspired by the management model of the Digital Hub in Recife-PE, suggests:

Excerpt (02)

That's what I'm telling you about having a council and a specialized company to manage this, so it doesn't become too dependent, because the state is slow when it comes to purchasing and bidding processes; in no time, bidding almost becomes a curse word. If you have a social organization, where the state gradually withdraws over time, slowly stepping back from what it is funding, it has to set up a system in which in the first year it leaves this, in the next year that; it cannot withdraw immediately. When it leaves, it leaves management, but it will still be fostering and participating on the council (Verbal information).

In Excerpt (02), Interviewee 13, from the governmental environment, suggests another organization to mediate articulation actions. Like him, Interviewees 9 and 15 expressed the same understanding. By using the lexical choice “manage this,” Interviewee 13 suggests that a “social organization” be created to manage articulation and all interaction actions among the academic, business, and governmental environments for the development of the region of Alagoas.

One of the reasons for creating a social organization is the temporality of the environments, that is, the different timeframes required to respond to regional challenges. By using the lexical choice “the state is slow when it comes to purchasing,” the interviewee points to one of the limitations of the governmental environment regarding time. Since public procurement is governed by bidding procedures and legal requirements must be respected, Interviewees 13, 9, and 15 suggest that a socially qualified organization could integrate the timelines of articulation among social actors, making regional development more agile and attractive to the parties involved.

In the interviewee's view, the government should gradually withdraw from the articulation process over time, delegating this activity to the social organization. He expresses this by using the lexical choice “gradually withdraw.” What the interviewee means, as explained during the interview, is that the government should initially finance projects that promote state development through interaction with the productive and academic sectors during the early stages of articulation. He expects that the social organization will eventually achieve independence by seeking partnerships and resources from other sources, with a view to developing the state.

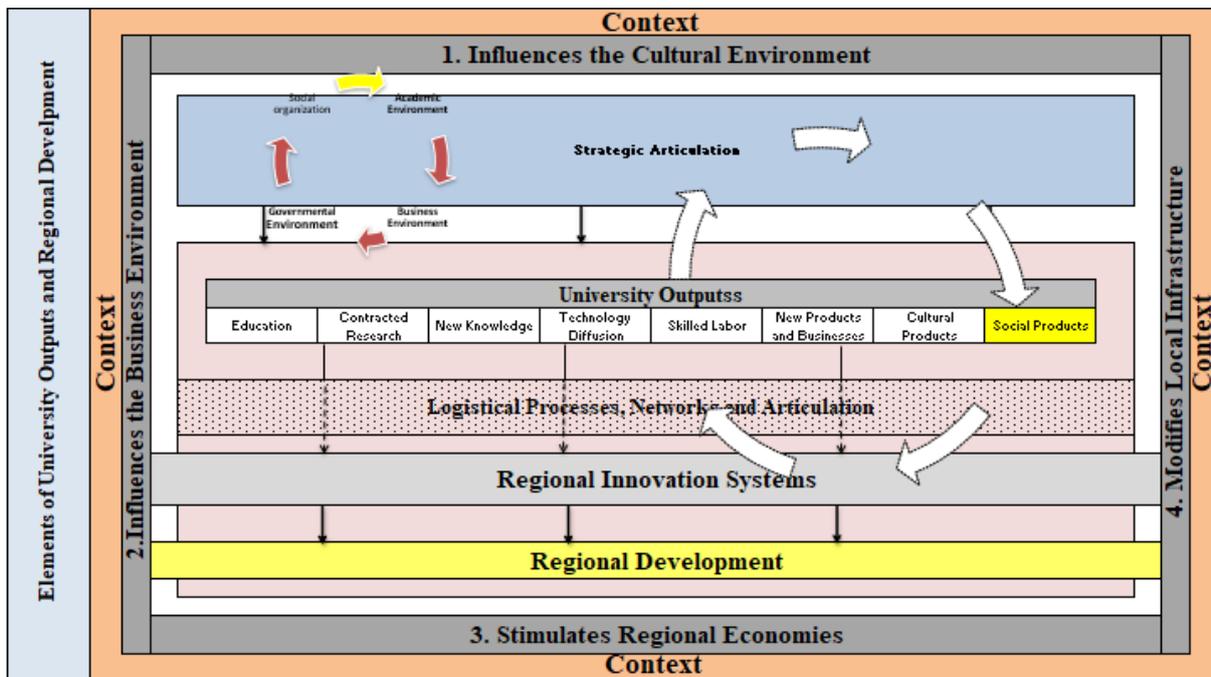
This idea appears to be corroborated by Interviewee 9 when he suggests “social organizations as a way to help where the government perhaps would not need to be present.” Reinforcing the argument, Interviewee 13 states that “the state cannot withdraw immediately.” The suggestion is that the government finance interaction among the academic, business, and

governmental environments in projects that promote state development and, over time, reposition itself in other roles within the articulation process.

Based on the arguments presented above, it was decided to incorporate a social organization into the interaction model of higher education institutions for regional development, with the aim of better articulating the environments and promoting the political, economic, social, and cultural advancement of the state of Alagoas. In addition, social products, which emerged in this research as a university output, were included in the model. The modified model can be observed in Figure 2 (see highlights in yellow).

Figure 2.

Updated interactive model of the role of higher education institutions in regional development⁶



Furthermore, Interviewee 1 suggested adapting the interactive model into simpler language for other readers. Considering that development may be hindered by communication, as pointed out by Audy (2017), and also taking into account the examples of communication failures among the academic, business, and governmental environments, it was decided to create a simplified version of the model, which can be seen in Figure 3.

⁶ Source: Adapted from Ramos Filho and Cândido (2024).

Figure 3.
Simplified version of the interactive model of the role of higher education institutions in regional development⁷

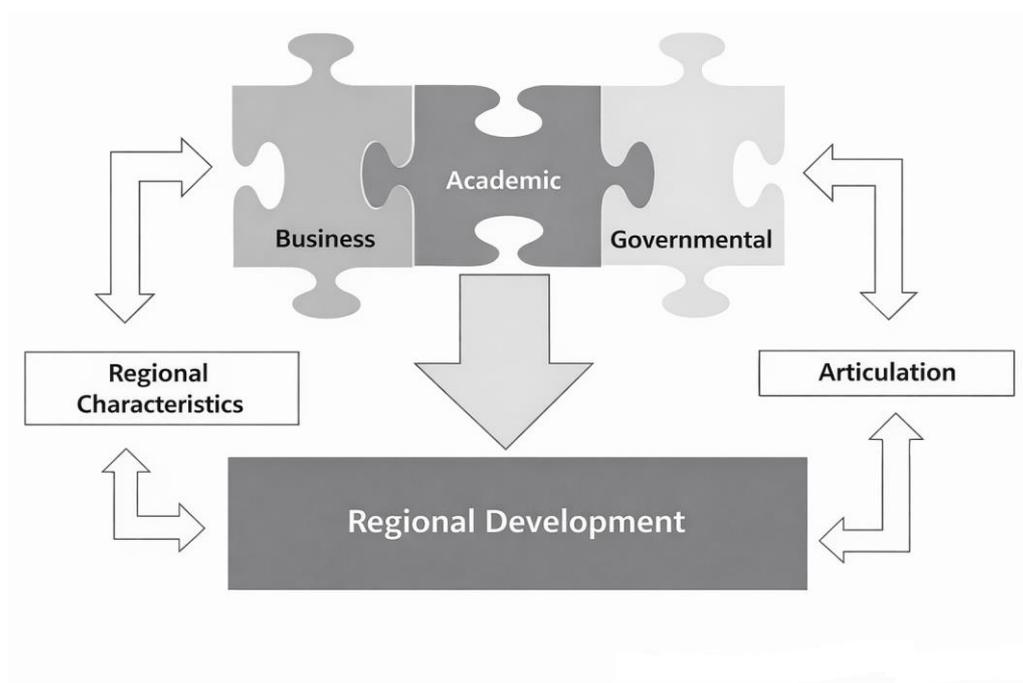


Figure 3 shows the business, academic, and governmental environments stylized as puzzle pieces. The academic environment is positioned at the center, connecting the business and governmental environments, as it was identified as the protagonist in this dynamic. In addition, the puzzle pieces allow for other possible connections, since each environment has its own idiosyncrasies and interests beyond regional development. The combined outputs of these environments generate regional development, as indicated by the gray arrow, mediated by the elements of articulation and regional characteristics.

Finally, the elements of the interactive model of the role of higher education institutions in regional development were examined using Pearson's correlation based on word similarity, as shown in Graph 3.

⁷ Source: Author's own elaboration (2026).

Graph 3.
Correlation of the elements of the interactive model⁸

Graph 3. Correlation of the elements of the interactive model



All correlations were above 0.9. The strongest correlation was between contributions to regional development and articulation (0.99361), and the weakest was between social products and technology diffusion (0.906809). However, the cluster graph above shows interesting patterns among the elements of the model. It can be observed that technology diffusion appears more distant within the cluster, indicating a more distant relationship, although still strongly correlated with the other elements.

Observing the first cluster, from bottom to top, there is a very close relationship between the dimensions influence on the cultural environment and influence on the business environment, which energizes regional economies. Articulation and contributions to regional development promote the output education. Specialized labor, new products and businesses, new knowledge, and contracted research are very close to one another, indicating a strong relationship; however, in this dynamic, they appear in individual clusters. Social products and the dimension modifies local infrastructure are configured within a single cluster. Cultural products and technology diffusion form individual clusters, although they are strongly correlated.

Based on the interviewees' responses and the analyses of the codings, the interactive model of the role of higher education institutions in regional development demonstrates not only feasibility, from the perspective and experience of the interviewees, but also consistency, based on the behavior of the codings and considering Pearson's correlation by word similarity.

⁸ Source: Research data (2026).

Final Considerations

The verification of the model from the perspective of the academic, business, and governmental environments made it possible to assess its feasibility and gather suggestions. All respondents believe that the model is viable. In total, 30 suggestions were provided, which were divided into two categories: incorporated suggestions and new suggestions. Of these, 17 suggestions were not adopted, as they addressed elements already covered in the model. However, 13 suggestions, which focused on the inclusion of a social organization and social products, presented the possibility of incorporation into the model. Another suggestion was to adapt the language for a diverse audience interested in the research.

The respondents' suggestions gave rise to a new version of the model, which incorporated social organizations into the academic, business, and governmental environments. Additionally, social products were included among the university outputs. Finally, a simplified version of the model was developed to facilitate understanding by social actors interested in collaborating for the development of the state of Alagoas, but who are not familiar with academic language.

The examination of the interactive model of the role of higher education institutions in regional development through Pearson's correlation based on similarity of responses reveals a strong correlation among its constituent elements.

It is recommended that the model be applied in other regions of the Northeast of Brazil and other territories in order to promote comparative analyses that broaden its external validity and enable contextual adjustments.

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