Electrification in Remote Regions: An Analysis of the More Light for Amazonia Program

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Article

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Abstract: (1) Background: The objective of this study was to analyze the More Light for the Amazon Program (MLA) to identify the role of each of the parties involved in the concession process and the limitations faced for the success of the program. (2) Methods: Content analysis was used to study the Program's Operationalization Manual, the Terms of Commitment, journalistic materials, and notes from the concessionaires, among other documents. (3) Results: The results pointed out that the government assumes the role of inducer of actions, of objective and norms that guide the private sector, but that the government faces challenges in establishing an effective concession system, control measures and prevention of corruption in the concessions. (4) Conclusions: The utilities take on the role of implementers, but local contexts create constraints on the delivery and maintenance of the electric power system in the communities. These elements are found to be challenges for policy implementation in remote regions in the Amazon.

Keywords: public administration; electrification; concessions

1. Introduction

The introduction should briefly place the study in a broad context and highlight why it is important. It should define the purpose of the work and its significance. The current state of the research field should be carefully reviewed and key publications cited. Please highlight controversial and diverging hypotheses when necessary. Finally, briefly mention the main aim of the work and highlight the principal conclusions. As far as possible, please keep the introduction comprehensible to scientists outside your particular field of research. References should be numbered in order of appearance and indicated by a numeral or numerals in square brackets—e.g., [1] or [2,3], or [4–6]. See the end of the document for further details on references.

The electric power universalization program in Brazil is a project started in 2003 by the federal government aiming to offer the benefit of electric power to the whole country through the use of the electric grid. So far, the project has resulted in an improvement in people's quality of life, mainly in the municipalities that joined the initiative.

However, the universalization of electric power in Brazil is still an incipient process, and the problems related to electric infrastructure are some of the main obstacles to the success of the project. In the Amazon region, there are still great difficulties in connecting the population to the electric grid, a possible explanation are the specificities of these regions that include great distances to consumer centers, logistical difficulties, and high installation costs [1]. Factors such as low demographic density and the dispersion of population in the rural area of the Amazon make access to energy difficult and expensive [2].

This scenario leads to low profitability of productive activity and causes serious economic difficulties for the inhabitants of the interior, who remain in poverty and social exclusion.

Given this problem, the federal government created the More Light for the Amazon Program (MLA) aiming to promote access to electric energy for the Brazilian population located in the remote

regions of the states of the Legal Amazon, aiming at the social and economic development of these communities [3]. To achieve its goals and maximize the use of public resources, the Program provides for the use of renewable technology, as well as decentralized generation systems with or without associated networks [4].

The financing for the program's actions will be provided by resources from private investors, financial resources from the federal government and the states, as well as international funding sources. The federal government will be able to select companies for the execution of electric energy projects in the communities, through public bids. In the Brazil the distribution of the Program's resources is based mainly on the need to mitigate the tariff impacts of the various concession and license areas, regional shortages, and the financial counterpart offered by the Executing Agents[4].

However, the first steps taken towards the Program show that, at least for now, it is limited, in practice, to providing electricity for the minimum needs of the communities, restricted to domestic use [5,6]. When acting via concessions, the federal government uses a partnership model between public and private sectors that allows the management of services, works or public assets for long-term contracts [7,8]. However, the concession of public utility services to private companies, which are the concessionaires of the services, guide the provision of the service by the goal of maximizing profits, unlike the social objectives [9,10].

Although concessions are widely used in developed countries to manage infrastructure projects, public services, and even as a means to stimulate innovation, concessions have also been criticized by those who consider that this form of partnership has not been beneficial to the population. For example, some critics argue that concessions do not generate the expected results and may increase inequality between richer and poorer regions [11,12]. Overall, concessions are a public-private partnership model that can bring significant benefits to society.

It is also important to highlight the risks that concessions can bring, such as lack of transparency in project management and increased inequality between richer and poorer regions. In this sense, the objective of this paper is to conduct an analysis of the Federal Government's More Light for the Amazon Program (MLA) to identify what is the role of each of the parties involved in the concession process and the limitations faced for the success of the program.

Doing this policy analysis is important to understand what the benefits and possible risks of implementing this type of policy are, so policy analyses are fundamental to understanding the benefits and risks involved in the granting process. They allow us to identify what are the roles of each party involved in the process and what are the constraints faced in making the program successful. Thus, this analysis is essential for the concessioning of public services to be carried out in a transparent, efficient and equitable manner.

Given the social inequalities present in the country, the government must seek ways to mitigate these differences and provide better living conditions for society. Points out that such measures occur through policies and programs that, in addition to fighting such disparities, also help boost the development of those who are socially more vulnerable[13]. But the privatization process of the Brazilian electricity sector, occurred from the 1990s, a preponderant factor for the increase in inequality of access to electricity supply between urban and rural areas [13]. That is, among the aspects linked to development, visible in urban areas and lacking in rural areas, is access to electricity.

2. Theoretical framework

Rural electrification in Brazil has a long history of social exclusion and that all the existing obstacles resulted from the lack of an effective political will to implement the necessary measures. The idea that rural services should not impose limits only emerged in the 1990s with the breaking of some paradigms [14].

At the end of this decade was established the National Program of Rural Electrification "Luz no Campo" by the decree of December 2, 1999, aiming to promote the improvement of socioeconomic conditions of rural areas in the country [15]. However, some obstacles, such as the resistance of concessionaires, permissionaires and rural electrification cooperatives, and the cost of financial

participation by the rural consumer (because this Program was not totally free for the consumer), should be overcome for the implementation of this policy [14].

In 2003, armed with existing knowledge and demonstrating political will to put into practice what was already being discussed among specialists on the subject, the National Program for Universalization of Access and Use of Electricity - "Light for All" - LPT was instituted to anticipate the universalization of access in rural households and establishments. In just over six years the program has connected more than two million and one hundred thousand households, many of which could be served otherwise, since more than 60% of these services were in families with family income below one minimum wage [14].

In the urban area, all distributors in the country are universalized. In the rural area, 87 distributors have already completed universalization, while continue to execute their Universalization Plans [16]. The case of the Light for All Program (LPT) is a clear state effort to ensure rural electrification in regions that lacked electric light, therefore, modern means of communication, fundamental presently of social and economic inclusion.

Even with an undeniable advance provided by the LPT there were still communities, located mainly in areas more distant from the distribution networks, which did not have access to electricity service. In this scenario, the public policies developed from the Light for All program were fundamental for the universalization of access to electricity.

Public policy can be summarized as the field of knowledge that seeks, simultaneously, "to put the government into action" and/or analyze this action and, when necessary, propose changes in the course or direction of these [11,17]. The coordination of public policies in Brazil began in the Vargas Era, mainly aiming at urbanization through the construction of state companies that would provide inputs for urbanization and industrialization. Thus, it is observed in this period that the State was a producer of goods and services.

Faced with a scenario of great changes, the Brazilian state ceased to be an interventionist state and sponsor of social welfare and adopted a posture known as managerial public administration. This action would open space for a greater participation of private activity, through privatization processes or concessions, in the field of social welfare and economic activity. It was then sought to implement the minimal state, transferring social and economic activities to private activity, assuming the role of regulatory agent [18].

In concessions a contract is signed between the government (Granting Authority) and a private company (Concessionaire), in which the former delegates to the latter the responsibility for managing a good or service, which was previously under its responsibility. From this contract on, the private company assumes certain risks of the Concession, being involved in all aspects related to the operation and maintenance agreed upon [19]. With the advent of the concession processes there is a greater need to coordinate, supervise and regulate the various interests expressed in the processes, so the government is a coordinating agent, having to stimulate and control the actions done on behalf of the state.

Characterizes the national electricity sector as strategic both for economic and social development, induced by the State, and for the inclusion of popular layers in the dynamics of Brazilian industrial society through the adoption of public policies [2,20]. However, among the materials analyzed to prepare this study, it is possible to observe that before the State intervened in the universalization of electric power, especially in rural areas, there was no interest on the part of the concessionaires to serve the population in more distant points. This scenario had a major change when the Light for All Programs established new technical criteria of service for the concessionaires and permissionaires, which ensured the inclusion of millions of Brazilians, historically placed on the margins of the electricity system, and represented a breakthrough in relations between utilities and consumers [14].

Although electrification programs have many advantages, this alone is not enough to determine rural development, since the success of the development process in the countryside will depend on a set of integrated actions, which involves the implementation of programs in the areas of health, education, and transportation, among others[2,5,21]. Furthermore, the energy concessionaires do

not see rural electrification as an attractive business, because the tariffs are subsidized and some regions of the country no longer demand greater investments in this sector. Therefore, it is necessary to reconcile the interests of federal, state and municipal governments and companies in the electrical sector, making resources available as a source of incentive, thus ensuring the necessary investments for the implementation of rural networks [5,22–24].

In this context, public concession in electrification services is a way to ensure the quality, safety and reliability of the supply of electricity to the populations. It is a strategy adopted by many governments to increase the supply of affordable and reliable electricity services. Public concession involves the granting of concessions to private companies as part of a bidding process.

However, this concession can generate several problems, such as lack of adequate investment in the infrastructure necessary for the service, increase in service costs due to increased demand, infrastructure maintenance problems due to lack of financial resources, and lack of transparency in service management [5,14]. In addition, public concession can also lead to inequality in the quality of services provided, increased prices for services, and loss of public control over service provision.

In this context, Public Policy Analysis provides a way to understand choices, processes, and their consequences [7,11]. First, this interdisciplinary approach, which ranges from economics and public administration, to sociology and philosophy, allows public managers and other stakeholders involved in policymaking to analyze the safety, effectiveness and efficiency of public policies, in order to ensure the achievement of the established objectives and compliance with the general principles of public administration [23]. This tool is important to help public managers identify the problems faced, find effective solutions to solve them, implement, monitor public policies and evaluate changes in political, economic and social contexts. Through public policy analysis, public managers can delve deeper into analyzing and understanding how public policies affect people's lives.

It is a tool that can help public managers identify problems, assess the costs and benefits of public policies, identify key barriers to success, and set short- and long-term goals for implementing public policies. In addition, public policy analysis enables public managers to better understand the impact of policies in terms of cost, time, and outcomes, helping to ensure that policies are implemented more effectively and transparently.

3. Materials and Methods

The study is a Descriptive research study. The descriptive approach is used to describe or explain a problem, or situation. The goal of descriptive research is to provide a more detailed description of a phenomenon or viewpoint, rather than to analyze or explain its causes. This approach involves the collection of qualitative data, such as interviews, questionnaires, observation, and document analysis.

To study the selected documents there was the application of content analysis technical procedures. a group of communication analysis approaches with the goal of obtaining, using methodical and objective procedures to describe the messages' content, indications (quantitative or not) that permit the inference of knowledge about the circumstances surrounding their generation and reception (also known as inferred variables) [25,26].

The material analyzed is from a documental source, which was materialized through official public documents, such as the programs' operationalization manual, monitoring reports and other materials disclosed by the companies on the theme. The documents studied were: the decree No. 10,221, of February 5, 2020 that institutes the More Light for the Amazon program, in view of the provisions of art. 13, item I, of Law No. 10,438, of April 26, 2002 [4] of promoting the universalization of the electric power service throughout the national territory.

In addition, the Program Operationalization Manual was analyzed, which defines the Operational Structure and establishes the Technical and Financial Criteria, Procedures and Priorities that will be applied in the Program [3]; Terms of Commitment between service providers and the Ministry of Mines and Energy [27], made available when monitoring services in the states. In addition to journalistic materials , notes from the utilities , scientific articles that address the theme and support the information presented.

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The data were analyzed and interpreted with the help of the software IRAMUTEQ (Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires). The software performs the analysis from the linguistic characteristics of a text aiming to identify the frequency of words, grammatical forms, vocabulary used, etc., in order to identify from the correlation structure between the words and the explanatory context that appears in the text [28,29].

The method used to capture the correlation structure was the Correspondence Factor Analysis (CFA), which allows us to identify the degree of association between large sets of words and the explanatory context [30]. As well as facilitating the counting via word cloud and the structure of interconnection through similarity analysis. The word cloud groups and organizes them graphically according to their frequency, enabling quick identification of the key words in an analyzed corpus [31].

Similarity analysis is based on graph theory and allows the identification of co- occurrences between words, resulting in indications of connectedness between terms [32] in order to support the following discussions.

3. Results and Discussion

The "More Light for Amazonia" program has contributed to the supply of electric energy to more than 8 million people who live in the Amazon region. The result of this access is the improvement in the quality of life of the residents, improvement in education and health, with the increased availability of electric energy in schools and health centers. As well as increased food security in the region, with the availability of electricity for food production and the promotion of economic development in the region, with the generation of more jobs and income [3,27]. These elements show that the MLA the Amazon has managed to promote important advances in the region.

The More Light for Amazonia Program has been pointed out as an important driver of social inclusion, but little is said about the challenges, what advances: when analyzing the set of documents with its 26 texts, with 567 text segments, 2,370 forms, 13,278 appearances, containing 1,620 lexemes, 1,480 forms in use, there are 39 additional variations, of which form classified 85.9%, it was observed, through Figure 1, that the word program is the central element, because nothing it describes the plan and the objectives to be achieved.

Among the keywords presented through the word cloud are: program, Mais Luz Para A Amazônia, electric energy, community, legal Amazon, system, and government.

The word PROGRAM, in this context, refers to a public policy idealized to supply the lack of access to electricity in communities located in hard-to-access regions of the Legal Amazon, named "More Light for The Amazon". The same was elaborated by the government and contains all its stages defined by the decree no. 10.221, of February 5, 2020 [4].

The program that links the different strategic elements in the understanding of the concession process and implications for the success of the policy. In this way, the public policy expressed in the program aims to promote the development of the region, improve the quality of life of the population, reduce the energy deficit and promote social inclusion. Some actions have been developed to achieve these goals, such as the implementation of low-cost technologies for clean energy generation and the granting of subsidies for low-income families to purchase solar energy equipment.

The central focus of the program is the availability of ELECTRIC to the population and the term refers to the essential service capable of expanding the opportunities for social and economic change in a given region.

The program has brought electric energy to different communities and promoted advances, such as the expansion of electric coverage, clean and accessible energy, improvement in the quality of life of the population, greater energy security, economic and social development in the region, reduction in energy costs, greater social inclusion, and the development of low-cost clean energy technologies. The achievement of these goals is only possible thanks to the most suitable type of generation SYSTEM (grid extension or photovoltaic systems).

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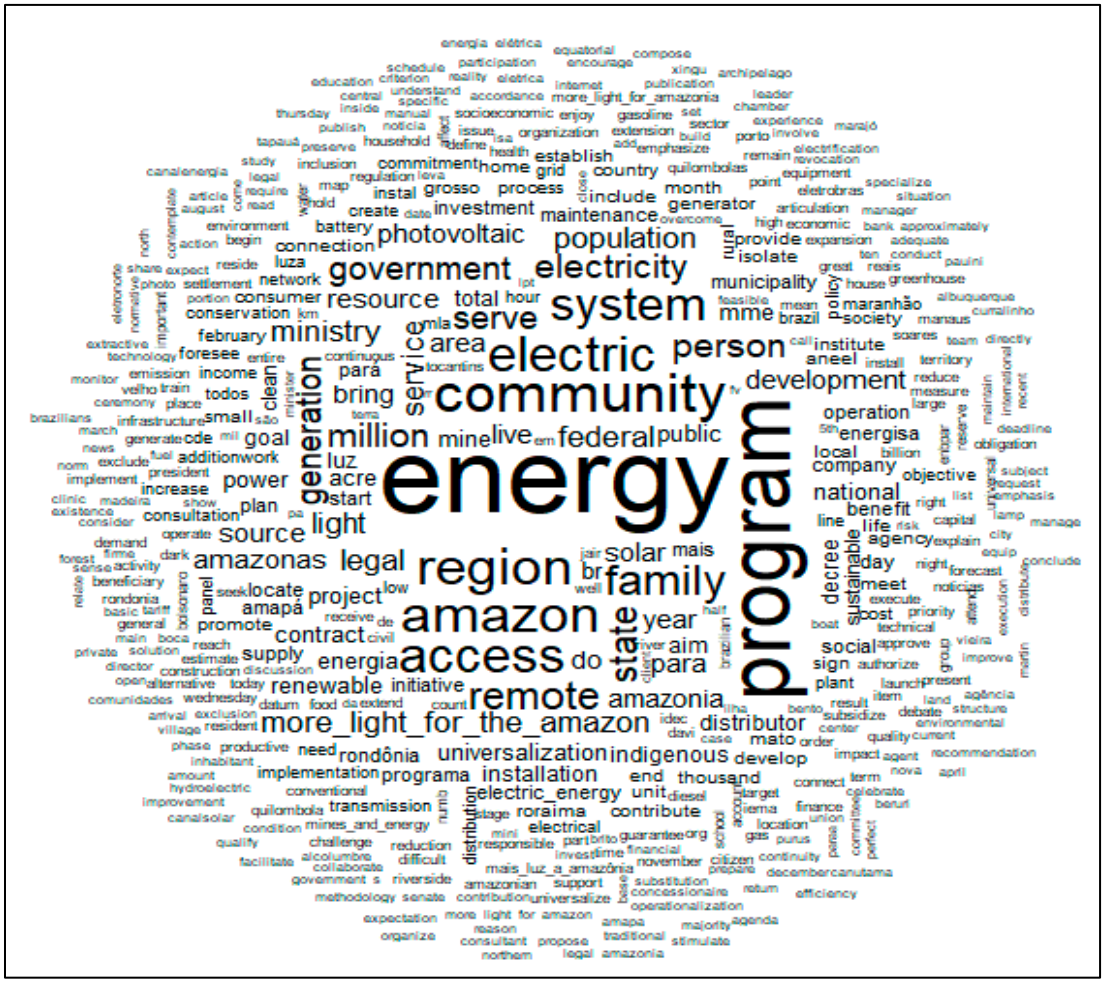

Figure 1. Vocabulary that appeared most frequently in the analyzed corpus.

This system, besides reducing operational costs, enables the implementation of medium and long term projects, such as microgeneration and minigeneration projects and remote locations, here described as the LEGAL AMAZONIA, region where families without access to electricity are found. These families are represented by the word COMMUNITY in highlighted represents the beneficiaries of the MLA program, residing in remote access regions.

These areas include indigenous communities, quilombola territories, rural settlements, and riverside dwellers with difficult access that deprive them of social benefits such as lighting of homes; use of household appliances; use of means of communication; electrification of health posts (which makes it possible to conserve vaccines and purchase equipment); and the lighting and proper ventilation of schools among other benefits generated by the access and use of electricity [13].

Finally, the term GOVERNMENT highlighted in the word cloud represents the agent that induces public policies, responsible for reducing social inequalities. Faced with its incapacity to implement this program, supervise and inspect, it acts through concessions (contracts signed with private companies), guaranteeing greater efficiency and quality in the delivery of these services, and assumes the function of inspector, in order to ensure that its objectives are achieved.

The government has a fundamental role in public service concessions. It must define and delimit the activities to be developed by the concessionaire, establish quality standards and prices, supervise the fulfillment of contracts, inspect compliance with users' rights and guarantee the transparency of the processes [14,20]. In addition, the government must establish effective regulatory systems to ensure that concessions are viable and services are provided according to established standards. When looking at Figure 2, the government takes the central role in the program analysis, MLA, because the government is largely responsible for defining the goals and standards that must be followed by the concessionaires.

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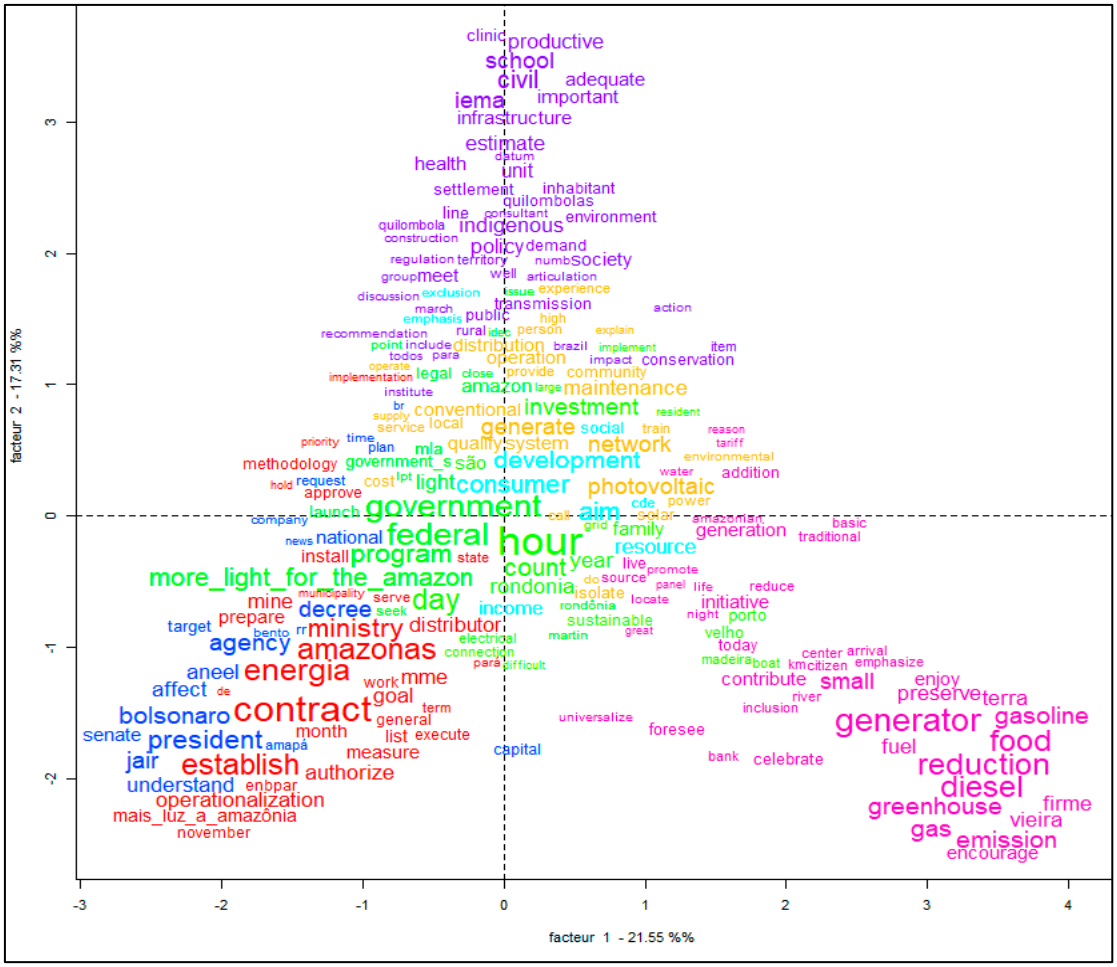

Figure 2. Correspondence factor analysis.

Figure 2 shows a Cartesian plan with the distance between elements in this debate and their connections with the center of the research - the Government's More Light for the Amazon Program. In this program, the government faces several challenges in administering this program to mitigate the precarious infrastructure for energy service in the north of the country. The first challenge is financial. Since the program is financed through state resources, it is necessary that governments make sufficient resources available to finance infrastructure projects.

Another challenge is to establish an effective concession system. This concession must ensure that projects are carried out safely, efficiently and in compliance with legal requirements. In addition, measures must also be taken to prevent and control corruption and fraud in the concessioning of these projects. Finally, there is also an implementation challenge. These projects can be complex and time consuming, requiring effective coordination between different levels of government, and monitoring to verify compliance with the goals established with the concessionaires.

As part of the program, the power utilities have the role of providing energy to these communities, through generation, transmission, distribution, and consumption infrastructure [3,4]. In addition, they are also responsible for performing maintenance of the installed electric power systems, ensuring that energy is available for proper use. Another important role of the electric utilities in the MLA program is to provide information and advice on the proper use of electricity to the residents of these communities [3,4]. This includes providing guidance on equipment installation and maintenance, as well as encouraging the use of electricity in a responsible and efficient manner.

In this way, the government assumes the role of action inducer and the concessionaires of action implementers and the words shown in pink in the figure above, demonstrate the types of fuels used to generate electrification in remote regions that need to be replaced because they bring consequences of their uses. The implementation of the program seeks the substitution of polluting

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means to reduce the consumption of fossil fuel and to help the settlement of traditional communities and environmental preservation.

To serve the beneficiaries of the program, the initiative foresees the use of solar energy generation and the substitution of small generators, which today are the only source of energy for many families living in these regions. These generators are powered by diesel or gasoline, so the new system contributes to reducing the burning of fossil fuels, enables the reduction of greenhouse gas emissions, and encourages the sustainable use of Amazon forest resources.

The sentences in yellon depict the logistics for the implementation of the photovoltaic system in these territories. They highlight: operation, maintenance, distribution, responsibility, normative, established and operation. In art. 5 of the decree establishing the program, the government's participation in the operation and maintenance of the systems is not explicitly mentioned, but it cites that "ANEEL will establish the cost related to the provision of the operation and maintenance service of generation systems, with or without associated networks" ([3,4]. In an article published [33] after the photovoltaic systems are installed, the concessionaire responsible for implementing the program in each region will continue to be responsible for the operation and maintenance of the systems in perfect operation, based on obligations established by ANEEL.

The words contract, conventional, program, system, set, viability and distributor are some of the items highlighted in red. They point out that the government acts through contracts with the concessionaires, the permissionaires and the authorized ones that operate in the Legal Amazon, in order to guarantee that the program reaches the foreseen territories. Since these know the reality in which they are located and can indicate whether the system to be used will be by means of solar panels or conventional connection.

The area emphasized in Violet shows that besides honoring the commitments of universal access to electricity, the program expects that through the use of this resource social and economic development will be generated for the benefited areas. Enabling improvements in education, health, access to information, and the promotion of activities aimed at increasing family income. Thus, highlighting the words: fulfill, productive, articulation, need, important, society, commitment, and community.

As seen previously, the program aims to universalize electricity to remote regions of the Legal Amazon in order to bring about socioeconomic changes for its beneficiaries. Therefore, this group is the central factor in the Cartesian plane, while the others are around it, with different degrees of proximity. It is observed that for the MLA to meet the established goals it is necessary to understand the reality of these families, the most viable way to reach the households and provide this energy (traditional or by photovoltaic system) and to understand how the installation and maintenance of the systems will be carried out. Because of this, the government uses contracts with companies that provide these services in each region.

To guarantee the success of these actions, the electric energy concessionaires in the region, responsible for running the program, face some challenges, among them the implementation of electric energy infrastructure in remote regions. The Amazon covers about 4 million square kilometers, and most areas still lack electric power infrastructure. This means that utilities need to build transmission lines, bridges, transformer stations, and distribution networks to guarantee access to electricity.

The second challenge is the cost of infrastructure works. Most electricity infrastructure works are expensive and require significant financial resources. In addition, some areas of the Amazon are difficult to access, which means that it is necessary to invest in vehicles, equipment and labor to reach these areas. The third challenge is to ensure that rural communities have access to electricity in a safe and efficient manner. This means that utilities must ensure that transmission lines and distribution networks function correctly, preventing accidents and failures.

In addition, communities need to be educated about how to use electricity safely, expressing a direct relationship between the program, the utilities, and society, Figure 3.

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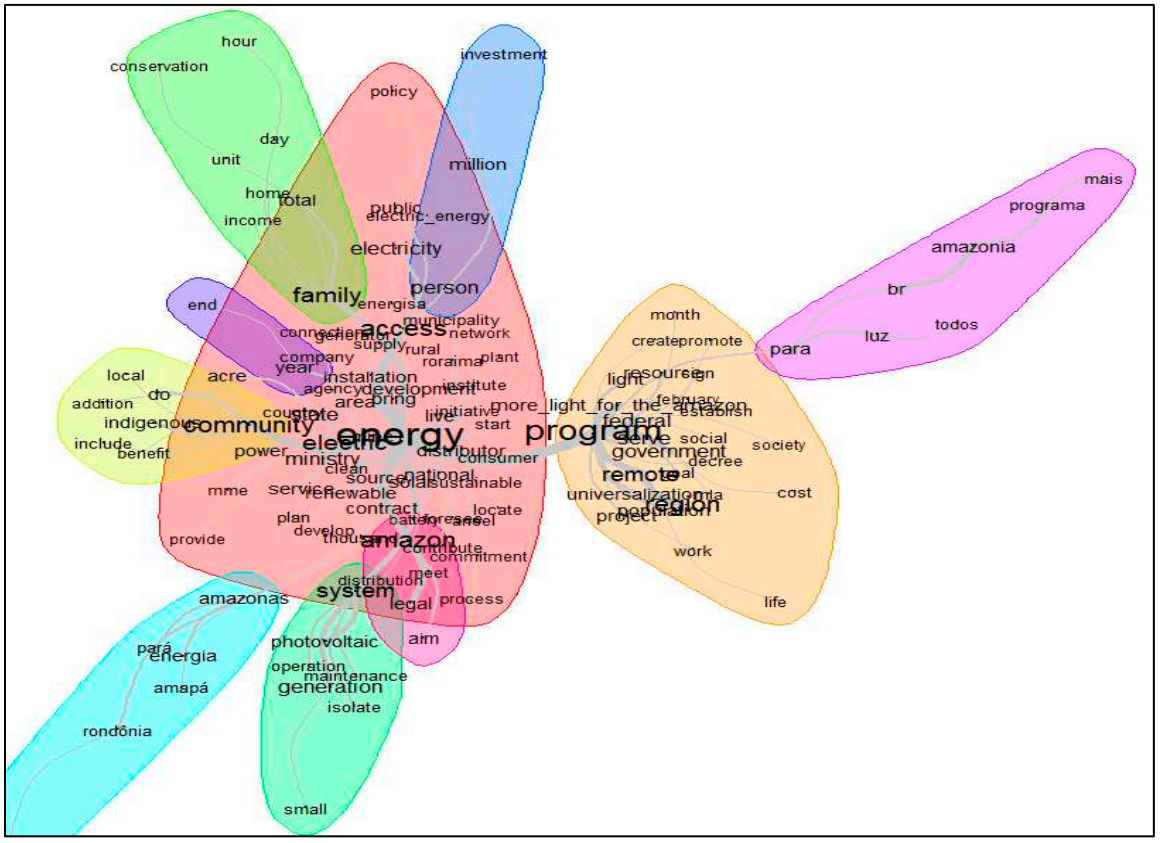

Figure 3. Connection between descriptive elements from the similarity analysis.

The similarity analysis (Figure 3) was used to detect the degree of connection between the elements identified in the analyzed corpus. Through this analysis it is possible to observe that, for the implementation of the MLA Program, the government acts as a central figure of connection between the need for access to electricity presented by families located in remote areas of the Legal Amazon, and the need for concessionaires, permissionaires and those authorized to provide energy installation and distribution services to obtain more customers and/or services. These deficiencies go through the Government's need to reach these families and guarantee the effectiveness of this public policy.

However, the most viable way to guarantee that these needs were met was through contracts. Thus, the companies responsible for each state in the Legal Amazon are responsible for accessing and implementing the most suitable system for each location, as well as meeting the required targets. The population has access to electric energy, be it traditional or through photovoltaic systems, and the government guarantees its function of universalizing this service. Thus, it is possible to generate the expected socioeconomic development in these regions.

5. Conclusions

This research aimed to analyze the More Light Program for the Amazon in order to identify the role of each of the parties involved in the concession process (Government and private companies) and the limitations faced for the success of the program. Through the information presented, we conclude that the government assumes a central role as the agent that induces public policies. It must define and delimit the activities to be developed by the concessionaire, establish quality standards and prices, supervise the fulfillment of contracts, inspect the fulfillment of users' rights and guarantee the transparency of the processes.

To do this, it faces financial challenges, as the program is financed by state resources, as well as difficulties in establishing an effective concession system to ensure that the projects are carried out safely, efficiently and in compliance with legal requirements. In addition, measures also need to be taken to prevent and control corruption and fraud in the granting of these projects. Finally, there is

also a challenge of implementation, caused by delays in the processes and distance from the communities to be served. The role of the utilities is to supply energy to the communities, to maintain the installed systems, and to provide information and guidance on the correct use of the equipment.

This study contributes to an understanding of the importance of public policies aimed at families found in situations of exclusion and without access to products/services essential to social welfare. In addition, it demonstrates the importance of public managers being equipped with information before implementing public policies.

Difficulties were encountered regarding more in-depth information about the program, the way it operates and the dissemination of data through the utilities and official government websites. In this way, it becomes opportune to carry out studies and consultations regarding the viability of operation and maintenance of the energy generation systems by the communities benefited by it.

This section is not mandatory but can be added to the manuscript if the discussion is unusually long or complex.

Author Contributions: Conceptualization, (J.d.S.P.), and (F.I.L.S.); methodology, (M.A.O.S.); software, (M.A.O.S.); validation, Felipe de Lima Bandeira and (M.A.O.S.); formal analysis, (M.A.O.S.); investigation, (J.d.S.P.); resources, (F.d.L.B.); data curation, (J.d.S.P.) and (F.d.L.B.); writing—original draft preparation, (J.d.S.P.) and (F.I.L.S.); writing—review and editing, (M.A.O.S.); visualization, (F.d.L.B.) and (M.A.O.S.); supervision, (F.d.L.B.) and (M.A.O.S.); project administration, (M.A.O.S.); funding acquisition, (F.d.L.B.) and (M.A.O.S.). All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement: The documents studied were: the Decree No. 10.221, of February 5, 2020, which establishes the program More Light for the Amazon, in view of the provisions of art. 13, item I, of Law No. 10. 438, of April 26, 2002 (BRASIL, 2020) to promote the universalization of electric power service throughout the national territory; the Program Operationalization Manual, which defines the Operational Structure and establishes the Technical, Financial, Procedures and Priorities Criteria that will be applied in the Program (MME, 2020); Terms of Commitment between service providers and the Ministry of Mines and Energy (MME, 2020), made available in monitoring the services provided in the states. In addition to journalistic materials and scientific articles that address the topic and support the information presented.

Conflicts of Interest: The authors declare no conflict of interest.

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