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Research article

The contexts of science journalism in the Brazilian Federal Institutes: characterizing realities and possibilities of communication products

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ABSTRACT

A public teaching and research institution can also be recognized for its scientific projection in society, as well as for interfering directly or indirectly in social dynamics through science. In this sense, this study intends to analyze how science communication is inserted in the communication of Federal Institutes of Brazil, characterizing the contexts in which science journalism develops in these places and the possibilities of products for publicizing science. To this end, we conducted a case study with a mixed approach — qualitative and quantitative methods. Interviews were directed to communication managers (n = 2), research managers (n = 5), and research dean (n = 2). We also applied a questionnaire to journalists and communicators (n = 23), research managers (n = 11), student researchers (n = 52), and researcher supervisors (n = 156). The interviews were recorded, transcribed, and analyzed through thematic analysis. We also use inferential statistics for the questionnaires to compare the opinions and assessments of the groups, contextualizing the dissemination of science, as well as drawing perspectives for improvements and the creation of communication products. The main findings indicate that, for science journalism to develop, it is necessary to a) establish guidelines for the dissemination of science, b) recognize and prioritize research publications, c) plan the work of science journalism and create routines, d) improve communication flow, and e) create journalistic products and processes. From these actions, it may be possible improve communication between Brazilian Federal Institutes and society through science.

1. Introduction

The importance of scientific dissemination, as well as science journalism, is well known and discussed within the literature (Rowe and Brass, 2011; Blue, 2019; Guenther, 2019; Entradas et al., 2020; Rose et al., 2020). Nevertheless, the perspective is to expand the communication of science and the dialogue between an educational and research institution with the community, in public spaces for education and research (Galvão et al., 2020). We can consider science journalism in the contemporary world as a specialization beyond the content of the sciences — hard and human — and the objectives of this specialized area. This is because it must follow the precepts, characteristics, and criteria specific to the area while also being applied to themes and particularities of science (Dunwoody, 2008; Peters et al., 2014). The possibilities of interconnection between communication, science, and society are largely materialized through new media, digital, and social networks, including as a strategy for the dissemination of science in several countries (Entradas et al., 2020).

Few studies portray the contexts in which these dissemination actions may occur or suggest the reasoning and assessments of institutional realities of universities and research institutes (Rowe and Brass, 2011; Entradas et al., 2020). Some studies describe the relationship of the communication sectors with the media, or of scientists with the press, but little is deepened in the analysis of internal organizational environments (Rowe and Brass, 2011; Marcinkowski et al., 2014). There is a need to establish communication planning, goals, and objectives to train communication professionals and researchers (Bubela et al., 2009; Besley et al., 2018). Moreover, it is also required that the communication sectors of organizations intensify the efforts of social legitimation of institutions daily (Marcinkowski et al., 2014; Rose et al., 2020), through science.

Therefore, it is important to conceptualize the terms covered in this study, which differ in certain countries. In the United States the term

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"science communication" is used as a meaning that encompasses the dissemination of science to peers, as well as to the lay citizen (Bubela et al., 2009). In China, the term "popularization of science" is also widely used for dissemination actions, events, and initiatives aimed at society (Bucchi and Trench, 2014). In Britain, "public engagement" is a term conceived from the perspective of public communication in several sectors (Bucchi and Trench, 2014). This meaning also permeates issues related to the scope and impact of activities with society. It is also important to mention participation as a concept that implies that audiences or citizens discuss and return to their institutions and science (Bucchi and Trench, 2014).

In this regard, what are the context and reality indicators that contribute to the research dissemination process? Are there internal barriers that restrict journalism and science — areas that are increasingly interdisciplinary (Bubela et al., 2009; Mueller-Herbst et al., 2020) — from intertwining and gaining internal and external repercussions? We ask this because disclosure, like journalism, is one of the fundamental stages of the research production process and one of the institutional responsibilities. Furthermore, it is shown as a commitment of the journalist and researcher to society, in addition to the purpose of developing a communication work to offer the institution visibility (Entradas et al., 2020). These questions permeate this study, which seeks to analyze the circumstances in which science journalism manifests itself in two Brazilian Federal Public Institutes, describing the characteristics and meanings that the groups that comprise the scientific and journalistic scenario attribute to the dissemination of research.

1.1. Theoretical framework

In Brazil, we conceptualize three main terms to our work: (1) scientific communication, (2) scientific dissemination, and (3) science journalism (Burkett, 1973; Dunwoody, 2008). The first covers ways to publicize and circulate information about science, technology, and innovation to specialists. This means dialogue between peers, through scientific journals as well as specialized events. Second, scientific dissemination conveys information to the public; it enlightens people who do not always have in-depth knowledge — the ordinary citizen — and, to be effective, it needs a language transposition to ensure the information is accessible. It is also conceived as the reformulation of scientific language to the discourse of everyday life. Finally, science journalism is a particular case of science communication, as it is aimed at the same audience and uses a similar language. However, science journalism is the result of the unique process of journalistic production, which includes the selection of themes and analysis of the criteria that will determine whether a subject will be news and, thus, receive journalistic treatment (Dunwoody, 2008). Among them, we can mention the following: relevance, with priority for those with public interest and social impact; comprehensiveness; timeliness; factuality; and novelty.

The dissemination of science and science journalism, in this work, are portrayed in the perspective of two federal public educational institutions in Brazil, members of the Federal Network of Professional, Scientific and Technological Education. Established in 2008, this Network consists of more than 1 million students and about 82,200 educators and administrative technicians (MEC, 2019). It is present in all Brazilian states, with 653 units from the Federal Institutes (IFs). Among them, those associated with this study are located in the Brazilian Midwest: the Federal Institute of Goiás (IFG) and the Federal Goiano Institute (IF Goiano). These institutions, also created in 2008, offer public education from basic (high school) to post-graduate (PhD level) education. In this context, they are relatively new institutions; however, combined (IFG and IF Goiano), there are about 35 thousand students within the two researched institutes (MEC, 2019). Simultaneously, in 2008, the communication sectors started the process of professionalization in these places, hiring the first journalists and IFs' communication teams. Thus, this study aims to analyze how the dissemination of research is inserted in the communication of two Federal Institutes of Brazil, characterizing the contexts in which science journalism develops in these places and the possibilities of products for science publication. As both Institutes are relatively new institutions with novel communication teams, to analyze the opinions and evaluations of the groups that dialogue in research and communication — managers in the areas of research and communication, may bring new insight and relevant contributions the entire Federal Network, positively affecting more than 1 million students and their communities.

2. Method

2.1. Nature and type of research

This is an institutional case study, based on qualitative and quantitative research (Creswell, 2003; Creswell et al., 2003; Creswell and Clark, 2017). This umbrella study was named "Science journalism in the Brazilian Federal Institutes" (SciBFI study). The case studies investigate phenomena inserted in which there is no clear demarcation between the phenomenon of study and the context. Thus, in this research, we can conceive an overview of science journalism at IFG and IF Goiano, evaluating characteristics and meanings of scenarios and contexts, elaborating alternatives indicative of project development, and researching publicity methods.

All subjects participated voluntarily in the research, which followed the ethical precepts as the legislation determines. It was approved by the IF Goiano Research Ethics Committees (nº 08501319.0.0000.0036) and IFG (nº 08501319.0.3001.8082). Each research subject received two copies of the Informed Consent Term (ICF), which was read by the researcher and signed by the participant granting the authorization.

2.2. Research subjects

IFG's is composed by a rectory and 14 campuses around the Goiás State. Moreover, IF Goiano is composed by a rectory and 12 campuses also in the same state. From these, we chose evaluate the rectory, due the hierarchy positions, and also chose, by an aleatory selection, two campuses from each Institute. So, our study was carried out at IFG's rectory and campuses, and the IF Goiano rectory and campuses. All are located in Goiás in central Brazil. The provinces are located in the state capital of Goiânia and are the central administrative units. IFG community is comprised of 16,564 students and 2,204 professionals, including educators and administrative staff (MEC, 2019). Similarly, IF Goiano consists of 18,658 students and 1,975 educators and administrative staff (MEC, 2019).

Thus, we simplified considering the subjects involved in the communication and research sectors, as well as the researchers of the institutional programs of scientific initiation and technological development. These were divided into groups by segment and research type with the objective of comparing the evaluations and opinions tracing convergences and discrepancies in the contexts of each one of them (Table 1). We included in our study the following groups: Journalist and Communicator (JC), Communication Manager (CM), Research Manager (RM), Research Dean (RD), Student Researcher (StuR), and Research Supervisors (ReS).

2.3. Data collection procedures

In this study, two data collection procedures were used: (a) structured interview and (b) questionnaire with closed questions.

a) Interview

This step was conducted with nine participants in this study. In the CM group, the subjects are female: 100% (n = 2); they are the same age (45-years-old); one is a journalist, and the other is in public relations. Both hold master's degrees, one of whom has 7 years of experience in the

Table 1. Subjects participating in the research.

Groups	Population[b] N	Participants	
		Qualitative n (IFG + IF Goiano)	Quantitative n (IFG + IF Goiano)
Journalist and Communicator (JC)	50	——	23 (12 + 11)
Communication Manager (CM)	2	2 (1 + 1)	——
Research Manager (RM)	31	5 (3 + 2)	11 (6 + 5)
Research Dean (RD)	2	2 (1 + 1)	——
Student Researcher (StuR)[a]	700	——	52 (22 + 30)
Research Supervisors (ReS)[a]	619	——	156 (85 + 71)

[a] Researchers who are part of the 2018–2019 and 2019–2020 cycles of the scientific initiation and technological development programs.
[b] Population for both IFG and IF Goiano.

IF, and, the other, 8 years. The RD group is formed by a 48-year-old man, with 25 years of experience in the IF, and a 50-year-old woman, with 10 years of experience in the IF, both with doctorate. Among the members of the RM group (n = 5, 100% males with doctorate), academic backgrounds are in veterinary medicine, agricultural sciences, chemistry, industrial chemistry, and history. Most are between 35 and 43-years-old (n = 4); the experience is 9–16 years of work in the IF.

The interviews were recorded performed individually at each location, using a voice recorder and, guided by a structured questionnaire (Galvão et al., 2021). The interview themes were the contextualization of research development within the institutions over the last ten years, both through the eyes of campus research managers and the research deans, and suggestions for products and channels for disseminating institutional research, with indications in the three groups. The justifications for not spreading scientific productions more and better are still described. The answers combined with the quantitative research characterize the current institutional circumstances of science journalism in the two FIs. More information and the full interviews questions can be accessed in our previous SciBFI study (Galvão et al., 2021).

(b) Questionnaire

In total, 242 subjects answered the questionnaire, 23 from the JC group, 52.2% (n = 12) are female. As for academic training, 4.3% (n = 1) have higher education, 52.2% (n = 12) are specialists, and 43.5% (n = 10) hold a master's degree. The average age among them is 35.7 ± 6.9 years, and the average experience in the IF is 5.7 ± 2.2 years. Among the subjects in the RM group (n = 11), 45.5% (n = 5) are female. Regarding academic education, 9.1% (n = 1) are specialists, 45.5% (n = 5) have a master's degree, and 45.5% (n = 5) are doctors. The average age among them is 38.4 ± 9.1 years, and the average experience in the IF is 5.8 ± 6.7 years.

From the StuR group (n = 52), 57.7% (n = 30) are female. As for academic training, 17.3% (n = 9) have incomplete secondary education, 73.1% (n = 38) have incomplete higher education, 7.7% (n = 4) have higher education, and 1.9% (n = 1) are a specialist. The average age among them is 21.4 ± 4.9 years, and the average experience in the IF is 3.2 ± 1.7 years. In the ReS group (n = 156), 41% (n = 64) are female. As for academic training, 1.3% (n = 2) have specialization, 25.6% (n = 40) have a master's degree, and 73.1% (n = 114) are doctors. The average age among them is 40.5 ± 8.1 years, and the average experience in the IF is 8.1 ± 5.6 years.

The questionnaire was designed with 24 closed questions, Of these, six questions related to perception of the groups regarding the 1) importance of research for institutional development, 2) relationship between the creation of communication products for the dissemination of science and the benefits for the professional routine, 3) evaluation of the most efficient channels for scientific dissemination, 4) the most interesting topics to be disseminated 5) the most interesting topics are part of the work routine, and 6) the habits of reading science news. The questionnaire was directed to the following groups: JC, RM, StuR, and ReS. The survey was sent digitally, via *Google Forms*. The Likert scale was utilized, with the following possible answers: 1 = Totally disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, and 5 = Strongly agree. See more in our previous SciBFI study (Galvão et al., 2021).

(c) Validation of research instruments

Instruments have been validated. To analyze the questions of questionnaire, 50 experts were invited to participate as judges (Grant and Davis, 1997; Hermida and Araújo, 2005). The criteria 1) organization, 2) objectivity, 3) clarity, 4) ease of reading, 5) understanding of the content, and 6) pertinence were individually adopted in each item. The Content Validation Index (CVI) was used to evaluated the questions.

The Likert scale was used with a score from 1 to 4, with 1 = not relevant, and 4 = relevant item. The CVI was calculated for each item assessed, dividing the number of responses "3" and "4" by the total number of questionnaire responses. The accepted items had a CVI ≥75% and one item was excluded. More information about the validation procedures and results can be accessed in our previous SciBFI study (Galvão et al., 2021).

2.4. Data analysis

Qualitative analysis data is presented first and then quantitative data. After that, we made a triangulation, comparing qualitative and quantitative results and also discussing it with the literature contents.

2.5. Interviews

The thematic analysis was performed according to the step classification (Franco, 2005; Amado, 2014; Bardin, 2016), after the fully transcribed of data collected in the interviews. This analysis includes the pre-analysis, exploration of the material, and treatment of results. Based on the interviews, we established the thematic categories of analysis (categorization) posteriori, composed of the indicators and the units of records (Amado, 2014; Bardin, 2016). Still, we list common elements in the analyses by group, establishing subcategories to search for patterns (Bogdan and Bicklen, 2013). We consider the themes related to the situations, contextualization, and characterization of science journalism in the evaluated institutions; situation definition referring to the development of science research and communication; and the subjects' thinking about people/objects and the codes of strategy, with suggestions for improvements and creation of actions and products to disseminate science (Bogdan and Bicklen, 2013).

To meet the homogeneity criterion, categorization was conducted separately by groups (Franco, 2005; Amado, 2014; Bardin, 2016). We carried out the thematic analysis, individually exploring the interviews of three groups — CM, RM, and RD — each transcribed in full. The separate analyses were carried out by institution (A and B), considering that the opinions, perceptions, and contexts differed in each analyzed institute.

2.6. Questionnaires

The treatment of statistical data was carried out using the SPSS 27.0 software with descriptive and inferential statistics, after encoding and tabulating the data. The analyze verified the difference between responses comparing the groups with each other, considering: a) participants' perception of the importance of disseminating research to the Institution, b) habits of reading science content in media outlets' communication, c) most relevant topics for life in the institution, d) most relevant topics for dissemination on institutional channels, e) benefits of creating channels of communication from science to the academic-

Table 2. Thematic analysis of the Research Deans: contexts and realities.

Thematic axis	Category	IF	Indicators
Science communication activities	Actions	A	- Creation of specific space: institutional website and/or digital media - Defining audiences, formats, and areas
		B	- Elaboration of videos - Integration with the mass media - Expansion of the dialogue with the press
	Realities and perspectives	A	- Communication performance is extremely broad - Communication is inward - Definition of institutional communication and management priorities - Advance of institutional communication, from general to specialized - Lack of disclosure to the external public - Knowledge transformation product - Promotion of access to information (for society)
		B	- Creation of institutional identity through research - Social recognition through research - Need to show what is developing
Importance of science journalism	Functions	A	- Dissemination of research - Demonstrates the impact of science on people's lives - Broadening the reach of research to a wider audience - Researcher recognition - Dissemination of mass research for institutional enhancement - Institutional visibility
		B	- Development of science communication actions
Research Development	General evaluation	A	- Scientific initiation as a key point - Advances in regulation - Advances in the articulation between groups and areas - Quantitative leap - Consolidation: qualifying scientific production
		B	- Research conquered institutional projection - IF recognition by research - Quality leap already achieved - Evolution - Growth
Research contributions	Educational principle of research	A	- Learning the research production process - Transformation in the teaching and training process - Research curriculum: insertion in the curriculum, changes in the teacher's methodology, assimilation in teaching and extension
		B	- Student involvement - Institutional change - Improvements in teaching - Institutional strengthening - Encouraging group work - Mutual learning through research - Extension project development - Research as raw material for teaching and extension
	Repercussions	A	- Improvement in professional training - Professionals with the ability to adapt - Significant growth - Professional and personal jumping
		B	-Improvement of professionals -Life changes -Possibilities for transforming reality -Changes in living conditions -Impact on state, regional and national research -Local, regional, and national problem solving -Environmental Protection -Elevation of social status

professional daily life, and f) most efficient channels for communicating science to the public.

The data were subjected to homogeneity of variance tests (Kruskal-Wallis) to detect if there was a significant difference between the opinions of the four participating groups (JC, RM, StuR, and ReS), considering the heterogeneity of the population and the response variability (Field, 2005; Castillo Romera et al., 2010). Subsequently, after detecting a significant statistical difference, the Post Hoc Test (Kruskal-Wallis) was applied to compare the median and range of the groups regarding the opinions and perspective characteristic of the groups' institutional contexts. The confidence level considered was 95%.

3. Results

The results are subdivided in topics: research contexts and realities, scientific dissemination and science journalism; description of scenarios; and possibilities for creating science communication products.

3.1. Contexts and realities of research, science communication, and science journalism

The results of the interview analysis were sorted into thematic axes by group. Among the RDs, the four axes were scientific dissemination

Table 3. Thematic analysis of Research Managers: contexts and realities.

Thematic axis	Category	Subcategory	IF	Indicators
Research development	General evaluation	Institutional scenario	A	- Reduction of funding for research - Advancement in scholarship programs to encourage research and publication of articles and calls for scientific and technological initiation - Expanding student participation - Institutional learning to insert research into everyday school life - Lack of maturity - Little focus on research
			B	- Search for other sources of funding: external partnerships - Institutional growth with lack of employees - Clear definition of axes and lines of research to act
	Notes for improvement		A	- Creation of broad projects: insertion of several areas - Creation of interdisciplinary research centers and networks - Building solid research relationships - Overcoming the complex scenario for teacher training - Definition of the paths that research needs to follow - Focus on research - Definition of institutional priorities: axes and areas of action - Consolidation of institutional research policy
			B	- Expansion of financial resources - Consolidation of partnerships - Overcoming bureaucratic obstacles - Expansion of professionals to act in research
Comprehensive research and training	Integration with institutional principles	Complete integration	A	- Research groups leverage research
			B	- Research developed in different areas of activity
		In parts	A	- Social impact must be considered - Social change projects need to be carried out - Necessary articulation between areas
			B	- Attention to the principle of verticalization: integrated technical courses, undergraduate and graduate - Compliance with institutional precepts, market demands - Meeting the demands of society
	Student training	Ability	A	- Creativity - Resignification of work - Personal and professional transformation - Development of research practice
			B	- Development of writing, presentations, and resourcefulness - Identification and troubleshooting - Learning to work in teams and deal with hierarchies - Professional and personal organization
		Perspectives	A	- Student preparation to face the real world of work - Work with projects that integrate teaching, research, and extension - Transformation in learning - Social transformation - Research as part of teaching - Change in the way to value knowledge
			B	- Visible difference between undergraduate students - Awakening of vocations - Performance in the world in general, focusing on the world of work
Improvements in science communication	Prospecting and disclosure forms		A	- Specific channels for scientific and technological dissemination - Interview with researchers - Reports on published books - Scientific reports with fieldwork - Demand policy for research, teaching, and extension disclosures - Use of various communication resources - Insertion of the student as the protagonist subject
			B	- Reports beyond the coverage of scientific events - Creation of specific products and channels: radio, interviews, podcasts, and newsletters - Field event coverage - Face-to-face contact with the public - Contact with local radio stations
Impacts of scientific communication	External context		A	- Democratization of knowledge - Social impacts - Effective communication with society - Approach science and society - Context of research in everyday life - Demonstration of the seriousness and complexity of science and research
			B	- Understanding the role of the institution by society - Search for the institution - Institutional enhancement

(*continued on next page*)

Table 3 (*continued*)

Thematic axis	Category	Subcategory	IF	Indicators
				- Recognition of the location as a generator of knowledge - Insertion in the life of the community - Promotion of interest in science
Communication contributions	Teaching, research and extension		A	- Means to encourage the student to participate in the research - Scientific information to complement knowledge - Encouraging training, permanence, and success
			B	- Promotion of the student's understanding of the importance of research in education

activities, importance of science journalism, research development, and research contributions (Table 2). To discuss the reality of institutional research, its development, and the contributions of science to institutions, as well as assessing the dissemination of institutional research, RDs presented the scenarios in this area. Among the categories, we highlight those presented in Table 2, which run from the beginning of the development of institutional research — about 11 years ago — to the prospects for improvement in scientific dissemination.

Regarding scientific dissemination, RD1 recognizes the scope of work of the Institution's social communication sectors, which is also one of the reasons for not developing an important area specifically. It also highlights the need for institutional priority to develop scientific journalism. This is cited as an important tool for disseminating research, showing the impact of science on people's lives, and giving recognition to the researcher and visibility to the institution, among others. This priority is identified in the registration unit of the Realities and perspectives category:

> "There are many areas of knowledge; you may have to segment, but I think that the lack of having a person thinking exactly that, we also cannot move forward. Because the management of research and post, which has an administrative part, occupies us greatly, and [we have yet to] develop this part of the dissemination [...] I think we must popularize science. It is no use for us to be researching and talking to ourselves, understand?" (RD1)

In the same category, RD2 highlights institutional strengthening through the dissemination of science. It also affirms that social recognition occurs in two ways: quality of research and good publicity:

> "I think that when you take what has been done to the community, to society, I think we strengthen the institution. I think we are in a moment to show that the institution and the job have been done well, because it is not enough just to do a job well. You need to show that the job has been done well, and the identity of an institution goes through this social recognition, and social recognition will be given for good work and good publicity." (RD2)

The other categories established by the RD group (General Evaluation, Educational Principle of Research, and Repercussions) show that, in the last ten years, research has achieved a quantitative leap that is now passing to a phase of qualification of scientific production. This can be seen in the speech of the registration unit of the General Evaluation category: "Before, the research was very fragmented and very punctual in some coordination's in the institution. Therefore, I think that the implementation of scientific initiation was a key point to start the organization of research at the institution" (RD1). For RD2, the leap in quality in institutional research has already been achieved. Thus, it is necessary to project research in the press, strengthening ties and integrating dissemination with the mass media.

Among the contributions of scientific research, the categories present the educational principle as one of the guiding principles of this process in both institutions (Table 2). RD2 emphasizes this integration of research with teaching in his speech. Moreover, RD1 emphasizes the student's growth when participating in a research project through the scientific initiation or technological development program, which can be seen in the registration unit of the Repercussions category:

> "We must work in perspective, even if there is still much to improve, because it always will [require improvements]. It is part of human evolution; we have research as an educational principle, which is research being encouraged in classrooms, laboratories, [and] in the extension. Everything will contribute for this offer to be significant." (RD2).

> "[...] you will notice his growth because he lived through research. He had to study in another way. It is one thing for you to study by discipline, so you can do a job, do an assessment. Another thing is that you are studying to have a foundation, develop knowledge, [and] to be able to solve a problem and answer a question. You will have to write a scientific paper; you will have the opportunity to present it in a scientific seminar. Therefore, research changes the student in his formative process and then changes the way he faces all other disciplines — all his training. Thus, the growth is significant." (RD1)

In the group of RMs, we detected five axes: development of research, research and integral training, improvements in the communication of science, impacts of scientific dissemination, and contributions of communication (Table 3). Following the contextualization of the research and its dissemination, we present evaluations and opinions of the RM group. The managers act in the Rectory and on the research campuses and occupy direction or management functions in the areas of Research, Postgraduate, Innovation, and Extension.

As the results demonstrate (Table 3), among the improvements in the communication of science, managers list different forms of prospecting and means to develop scientific journalism. This goes through the execution of works that are already consolidated by the communication sectors (interviews, reports, and articles), but with a shift in focus for research. According to the RMs, they also add other forms of dialogue and external insertion. In this perspective, the student as a subject is important in the managers' view, which can be seen in the registration units of this category:

> "[...] this guy, what is attractive? It's him seeing himself, right? I think focus on the researcher to remove this vanity. Focus on the project and those touching it at the end, the Pibic student volunteer. I think social media shows us that people are interested in real life. Therefore, the idealistic researcher, that thing [...] I think the first attraction is to do more; I think the second is to talk about the tip, like the field the people, which are the boys." (RM3).

> "[...] I think the journalist and the Social Communication have to allow for the complexity wealth of the research. Never have journalists been needed as much as now and for journalists to be journalists, right? All sectors and segments of society. Never has there been a need for real journalism or journalistic practice. It is the same in science. The moment of trivialization, fake news, and news with 140 characters, I think that the ethics of the journalist has never been more necessary. Within our institution — we have people with a very

good background and very ethical — we are increasingly committed to this strategy of disseminating the seriousness and strength of research, its richness, and then the more I see that we walk for this, the more we can improve advertising." (RM5)

According to the RM group, it is necessary to define priority areas for action at the IFs, as well as consolidate a research policy and build solid relationships. Moreover, an environment conducive to the search for external promotion and partnerships. The areas of operation are well defined for this. The following statements present this scenario regarding the registration units of the General Evaluation:

"[...] we need to build stronger relationships to foster this research. Now, as a manager, I'm thinking about all areas: how we can build documentation, partnerships, research reports that are a little more solid and more lasting. What I am realizing is that the development of research in my institution, sometimes, the time that the public notices are thought out, the time that is allocated for the promotion, I think that it is not enough for us to carry out a little more lasting research that thinks about more efficient results, more linked to reality, that will transform reality. I am realizing the development of research in my institution the time allocated for the promotion. I think that it is not enough for us to carry out more lasting research that considers more efficient results — more linked to reality that will transform it. I think there is a research policy that needs to be built. It is being built." (RM5)

"[...] we as an institution, together with the community we serve, to understand where to aim — not only the area, but what research we are going to do. Is it applied to the market? Is it applied to the productive sectors? Is it applied to the basic part?" (RM3)

Regarding the repercussion of the research for students, according to the statements of managers in the category Research and Integral Training, there is integration between the different axes of action and through the research groups. This can be seen below:

"It meets the principle of verticalization, the demand of society and companies, and the problems identified in the region, it ultimately meets what we call the 'concentration area' and the 'research line' of the programs. [This] then becomes the institutional north for research within the institution, because you typically have no research by this body of researchers that escapes this need — something that is very outside the regional reality or the reality of what can be developed here considering infrastructure." (RM2)

In the group of CMs, we analyzed five axes: communication performance in the dissemination of research, efficient scientific dissemination, science journalism routines, importance of science journalism, and research contributions to the academic-administrative community (Table 4). We realized that scientific journalism is not a specialty present in the routine of the two institutes' communication sectors, only occurring promptly and on demand (Table 4). Thus, there is no planning or an established dissemination agenda. Although CM2 evaluates that there have been advances in recent years in institutional communication, according to the manager, much remains to be developed by the teams of the rectory and campuses, concerning the publication of scientific research.

Still, it is necessary to overcome structural issues, such as reduced work teams and improvement in internal communication flows, to move forward in dialogue with society. These flows occur between journalists/communicators with researchers or with the research sectors. This is reported in the speech below, which represents the record unit of the *flow's* category:

"[...] it needs to be improved at all levels, as well as by the teachers who develop it, understanding the language of disclosure; when we ask for information, it must be better worked. The technical terms should be clarified, because the way communication executes scientific dissemination is not a technical scientific dissemination like a scientific journal; it is a dissemination layman — never heard about the topic [and are] not from the area. You have to read the text and understand the basics of what you're dealing with [...]." (CM2)

In the same category, when the two managers mention that there are few guidelines demanded by the researchers, the managers' opinions converge regarding the causes for the evaluations carried out. They also note the deficiency in communication flows. For CM1, this scenario can be improved by implementing channels in multimedia format to arouse the public's interest and strengthen the dialogue with the research sectors. This is because it is important to monitor the entire process of scientific investigation, which is of public interest. For CM2, the creation of a newsletter, using social networks, and the dissemination on the institutional website are some strategies for scientific journalism to be inserted minimally into daily communication.

Regarding the institutional priority for developing science dissemination projects and actions, the CM2 assessment is that the institute has prioritized institutional communication to this point. Namely, to make advances in science communication, it is necessary to change the focus of action; the management of the two institutions need to prioritize the dissemination of research, as described in the registration unit of the Science dissemination activities category:

"[...] in research, the institution is secondary; it is what enabled the conditions and opportunities for it to be developed, but what is relevant is research. In institutional communication, what is relevant is the institution, which develops through the various situations that we narrate within the scope of institutional communication. Thus, yes, we need to have a different treatment even for people to understand what science communication is, which fits into a communication policy, because not all scientific communication is attributable to Social Communication." (CM2)

In this perspective, CM2 adds that, "the great thing about research is to allow information to circulate freely, for people to take ownership of that information, that innovation, that system, as long as they cite the source, reverencing those who developed or researched it." For CM1, the little experience that the institution has had with a publication aimed at disseminating research was interrupted, because of a lack of institutional priority, among other factors. Regarding the research contributions to the academic-administrative community, the two managers perform a positive evaluation. CM1 highlights that, "science brings a new worldview, allows specialization and mastery of an area, and the researcher becomes a reference." Still, it expands the perspectives, as the research is dynamic and has several possibilities. Thus, CM2 emphasizes that research is "essential for critical and open training, which has been provided by the institution since technical education, with verticalization occurring."

To integrate the scenarios already presented by the groups, the section below describes the results of the quantitative analysis of the data.

3.2. Description of scenarios

The purpose of this section is to present elements necessary to describe the context of scientific journalism as a means of publicizing research in the IFs of Goiás. To complement the characterization of the scenarios regarding scientific journalism development at Institution A and Institution B, we also consider the habits of scientific news readings in newspapers, magazines, and other communication channels (Table 5) — both in the work environment (researchers) and academic environment (students).

Considering the preference for themes and efficient communication channels for scientific dissemination, the subjects also have different opinions (Table 6). As for the most efficient channels for disseminating research to the external public, there are similar and diverse opinions between the groups (Table 6).

Table 4. Thematic analysis of Communication managers.

Thematic axis	Category	IF	Indicators
Communication performance in the science communication	Evaluation	A	- Advancement and improvement in recent years - Can be improved - Differentiation between scientific dissemination and institutional communication - Dissemination of science focuses on scientific research, the institution is the means of making this feasible - Institutional communication focuses on the institution, different from scientific journalism, where the focus is on research
		B	- There is no systematization - There is no specific planning - Actions taken by external demand to the sector - One-off actions
	Justification	A	- Work of communicators on campuses - Little manpower for scientific journalism work - Lack of systematization of the research database - Lack of guidelines demanded by the researchers - Deficiency in communication flows for the dissemination of research - Need for training communicators and researchers
		B	- Lack of proactivity on the part of the researcher in the search for the communication sector and vice versa
Efficient science communication	Flows	A	- Sending information about research with appropriate language to the communication sectors - Presence of technical terms in matters, at the request of the researchers - Researchers need to understand language appropriate to the lay public - Deficient communication flows for scientific dissemination
		B	- Difficulty of the researcher in providing information - Need to stimulate the researcher so that there is interest in disseminating his research through the communication sectors
	Change of scenery	A	- Imminent need for improvement - Improvement in internal flows (research and communication dialogue) means progress in flows with the external community - Combination of text with attractive layout for the reader - Multimedia format to arouse interest - Combination with short videos, professional or not - Monitoring all phases of a research - Small materials, memory construction for complete material with results
		B	- Efficient medium: institutional website (professionals and external community) - Social network (students) - Search for more channels for the three audiences - Monthly newsletter with link to surveys
Science journalism routines	Activities	A	- Eventually on some campuses in recent years - Scientific journalism has already entered the routine in some units - Not present on all campuses
		B	- Scientific journalism is not carried out daily - Short experience with newsletter
	Need for advances in communication	A	- Sending information and guidelines by the Communication Directorate to the communication sectors of the campuses - Advance with classroom experiences, extension, and research - Moving beyond institutional and factual communication
		B	- Overcoming the relationship difficulties with the researcher - Professionalization on campus, with communication professionals
Importance of science journalism	Specialty	A	- Limitations due to the specificities of specialized journalism - Scientific journalism is a special issue - Longer, more detailed, and refined articles - Content worked on and understood by the journalist - Complementation with images, testimonials - Interpretive content - Expansion beyond the translation of the research
		B	- Specific topic in communication policy
Expansion of research dissemination	Contributions	A	- Attracting new partnerships - Formation of research networks - Maturation of institutional research - Society benefits, improvements, and problem solving - Inclusion and accessibility - Personal and professional relevance to the researcher - Research and researcher recognition
		B	- Always positive - Reinforcement of the researcher's interest in the search for improvements - Encouraging students to participate in an event - Enrichment of the institutional image

Table 5. Consumption of science news in magazines, newspapers, websites and others and relevance of topics for life in the institution.

Reading habits	JC	RM	StuR	ReS
	n(%)	n(%)	n(%)	n(%)
Sporadically	2 (8.7)	1 (9.1)	10 (19.2)	10 (6.4)
Monthly	0	1 (9.1)	3 (5.8)	7 (4.5)
Weekly	12 (52.2)	3 (27.3)	26 (50)	57 (36.5)
Daily	9 (39.1)	6 (54.5)	13 (25)	82 (52.6)
Total	23 (100)	11 (100)	52 (100)	156 (100)
Themes present in institutional life	**JC**	**RM**	**StuR**	**ReS**
	n(%)	**n(%)**	**n(%)**	**n(%)**
Selection processes	14 (60.9)	4 (36.4)	47 (90.4)	112 (71.8)
Competitions	12 (52.2)	5 (45.5)	45 (86.6)	106 (68)
Science, technology and innovation	12 (52.2)	6 (54.5)	49 (94.3)	146 (93.6)
Extension	11 (47.8)	6 (54.5)	48 (92.3)	133 (85.3)
Environment and sustainability	11 (47.8)	5 (45.5)	43 (82.7)	133 (85.3)
Research - results, scientists, projects	11 (47.8)	6 (54.5)	47 (90.4)	140 (89.7)
Teaching	10 (43.5)	4 (36.4)	48 (92.3)	136 (87.2)
Culture and sport	10 (43.5)	2 (18.2)	39 (75)	119 (76.3)
Search - programs	10 (43.5)	5 (45.5)	47 (90.4)	136 (87.2)

Table 6. Preferred themes and efficient channels for science communication in institutions in Goiás.

Themes	JC	RM	StuR	ReS
	n(%)	n(%)	n(%)	n(%)
Sustainability	18 (78.3)	7 (63.6)	47 (90.4)	140 (89.7)
Environment	17 (73.9)	9 (81.8)	47 (90.4)	140 (89.7)
Science	16 (69.6)	9 (81.8)	51 (98.1)	147 (94.3)
Culture	16 (69.6)	8 (72.7)	41 (78.8)	130 (83.3)
Technology	15 (65.2)	9 (81.8)	51 (98.1)	148 (94.9)
Art in general	15 (65.2)	8 (72.7)	35 (67.4)	117 (75)
Innovation	14 (60.9)	9 (81.8)	50 (96.1)	144 (92.3)
Scientific divulgation	14 (60.9)	9 (81.8)	46 (88.4)	136 (87.2)
Accessibility	12 (52.2)	6 (54.5)	48 (92.3)	125 (80.1)
Health and wellness	12 (52.2)	6 (54.5)	46 (88.4)	134 (85.9)
Movie theater	12 (52.2)	6 (54.5)	36 (69.2)	91 (58.4)
Food	12 (52.2)	4 (36.4)	42 (80.7)	110 (70.5)
Transgenics	10 (43.5)	5 (45.5)	35 (67.3)	93 (59.6)
Communication channels	**JC**	**RM**	**StuR**	**ReS**
	n(%)	**n(%)**	**n(%)**	**n(%)**
Social networks	16 (69.6)	6 (54.5)	49 (94.2)	117 (75)
Videos on YouTube	12 (52.2)	6 (54.5)	40 (77)	117 (75)
Podcasts	10 (43.5)	4 (36.4)	29 (55.8)	97 (62.1)
Institutional portal	9 (39.1)	3 (27.3)	38 (73.1)	109 (69.8)
Research database	8 (34.8)	5 (45.5)	43 (82.7)	114 (73.1)
Multimedia platform	7 (30.4)	4 (36.4)	45 (86.5)	115 (73.7)
Source Bank	7 (30.4)	3 (27.3)	36 (69.2)	95 (60.9)
Radio program	7 (30.4)	2 (18.2)	28 (53.8)	80 (51.2)
TV program	7 (30.4)	3 (27.3)	36 (69.2)	91 (58.3)
Digital Newsletter	4 (17.4)	2 (18)	29 (55.7)	79 (50.6)
Institutional e-mail	4 (17.4)	3 (27.3)	32 (61.6)	32 (61.6)
Digital magazine	4 (17.4)	2 (18.2)	42 (80.8)	107 (68.6)
Digital Newspaper	3 (13)	1 (9.1)	39 (75)	103 (66)

Regarding the importance of the dissemination of research by institutions for the development of institutes, the results showed similar opinions among the groups, agreeing with the statement. Additionally, frequency in the habit of reading science news was predominant in most of the countries' groups (Table 7).

The groups' opinions differed when asked about the most relevant topics for life in the institution, as well as for dissemination in institutional communication channels (Table 7), showing a statistically significant difference by theme. The JC and RM groups think statistically different from student researchers and researchers regarding all the themes and channels described. On the contrary, when asked about the efficiency of institutional channels for disseminating research to the external public, the results showed a statistically significant difference between the groups (Table 8).

4. Discussion

Considering the institutional contexts of scientific journalism presented in the results of this study, we characterize scenarios in which science communication is fragile in the researched institutions. The opinions of the studied groups converge in this aspect and highlight ways to improve internal and external flows of the dissemination work, such as the creation of specific products and channels and the planning of actions. Thus, we realized that, in the researched Institutes, there is no widespread communication culture, which is one of the important contexts conducive to the development of policies, projects, and actions for scientific dissemination. We also did not find an environment that prioritizes the dissemination of science, potentially indicating a need for institutional management to value and recognize the importance of this work. Moreover, it demonstrates that this area is not institutionalized. Therefore, there may be more chances for establishing a dissemination agenda and other actions, creating what Schäfer and Fähnrich (2020) called an "organizational turn." In this environment, in which institutional communication actions thrive, the advance in specializations and deepening areas is insufficient, perceptible when analyzing the statements of the researched groups. Despite this, there are demonstrated perspectives that the groups have willingness and commitment to implement training in the teams and develop a planned work in the communication of science.

When comparing the assessments of each segment (JC, RM, RD, StuR, and ReS), the results show that the differences in opinions do not fall into significant changes in position and thinking between groups, but reflect the contexts in which they operate. For this reason, managers and journalists/communicators tend to think in a similar way, since they are located in administrative and decision-making bodies and, therefore, we assume that they have a vision and understanding of the whole. Likewise, researchers tend to analyze their specific situations where they are inserted. This culminates in similar opinions of these subjects, who consider in their responses historical, social, and cultural values specific to the contextualization process.

In general, everyone recognizes that it is essential to implement communication that prioritizes science, expanding, and reshaping the focus of communication activities, both institutional and scientific. The interviews and responses to the questionnaire confirm these notes by highlighting the subjects' preferred themes, which prioritize science, technology, and innovation. Still, they demonstrate that when the groups have a habit of reading science news, they are immersed and interested. Among the opinions of the CM, RM, and RD groups, we clearly perceive the presence of two models of public communication in science. The first is the deficit model (Castelfranchi, 2002), contextual, that is, linear communication, which — despite being criticized by authors — is still very present in Brazil and detected in international research (Koivumäki and Wilkinson, 2020). The second is the public participation model (or

Table 7. Contexts and realities: importance of disclosure relevant topics internally in the institution and creation of products.

Relationship between disclosure and institutional development	Groups	n(%)	Median ± Range	p-value
The dissemination of scientific research from my institution is important for the development of the Institute.	JC	23 (9.5)	5 ± 1	0.313
	RM	11 (4.5)	5 ± 2	
	StuR	52 (21.5)	5 ± 2	
	ReS	156 (64.5)	5 ± 3	
I usually read science news in newspapers, magazines, websites and others.	JC	23 (9.5)	3 ± 3	0.003
	RM	11 (4.5)	4 ± 3	
	StuR	52 (21.5)	3±3[a]	
	ReS	156 (64.5)	4±3[a]	
Benefits in creating products	**Groups**	**n(%)**	**Median ± Range**	**p-value**
The creation of new communication products aimed at scientific dissemination can bring benefits to my academic or professional routine.	JC	23 (9.5)	5 ± 2	0.553
	RM	11 (4.5)	5 ± 2	
	StuR	52 (21.5)	5 ± 4	
	ReS	156 (64.5)	5 ± 2	
Relevant themes for institutional life	**Groups**	**n(%)**	**Median ± Range**	**p-value**
Science, technology and innovation	JC	23 (9.5)	4±3[a]	<0.001
	RM	11 (4.5)	4±3[b]	
	StuR	52 (21.5)	5±3[a,b]	
	ReS	156 (64.5)	5±3[a,b]	
Teaching	JC	23 (9.5)	3±2[a]	<0.001
	RM	11 (4.5)	3±3[b]	
	StuR	52 (21.5)	5±3[a,b]	
	ReS	156 (64.5)	5±3[a,b]	
Extension	JC	23 (9.5)	3±2[a]	<0.001
	RM	11 (4.5)	4±3[b]	
	StuR	52 (21.5)	5±4[a,b]	
	ReS	156 (64.5)	5±4[a,b]	
Research - incentive programs	JC	23 (9.5)	3±3[a]	<0.001
	RM	11 (4.5)	3±3[b]	
	StuR	52 (21.5)	5±3[a,b]	
	ReS	156 (64.5)	5±3[a,b]	
Research - results, scientists, etc.	JC	23 (9.5)	3±3[a]	<0.001
	RM	11 (4.5)	4±3[b]	
	StuR	52 (21.5)	5±3[a,b]	
	ReS	156 (64.5)	5±3[a,b]	
Selection processes	JC	23 (9.5)	4±3[a]	<0.001
	RM	11 (4.5)	3±3[b]	
	StuR	52 (21.5)	5±3[a,b,c]	
	ReS	156 (64.5)	4±4[a,b,c]	
Competitions	JC	23 (9.5)	4±3[a]	<0.001
	RM	11 (4.5)	3±3[b]	
	StuR	52 (21.5)	5±3[a,b,c]	
	ReS	156 (64.5)	4±4[a,b,c]	

Nota. Post Hoc; Kruskal-Wallis. The same letters are inserted where there is a statistically significant difference between the groups ($p < 0.05$). *Subtitle:* JC (journalist/communicator); RM (Research manager); StuR (student researcher); ReS (research supervisors). Questionnaire applied with Likert scale, being 1 = Strongly disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = Strongly agree.

public engagement), in which there is a commitment to the democratization of knowledge and the valorization of the dialogue between the journalist and the scientist.

A small concern of universities in publicizing science was also noted by Queiroz and Becker (2016) and Entradas et al. (2020). Among 50 institutions surveyed in Brazil, only 15 have structured sectors of scientific dissemination and scientific journalism. The research also demonstrates that "there is a direct relationship between academic quality and scientific dissemination" (Queiroz and Becker, 2016, p. 178). This resonates with what managers mentioned regarding the research consolidation process, which reaches the stage of qualifying scientific production from this point. Therefore, it opens the way for joint work with the communication sectors or even for the figure of the scientific journalist working directly in the research provinces. The absence of more direct contact between the institutions' communication offices with the press was also detected by the mentioned authors, which is also a need reported by the Research managers.

It also considers the relationship with the researcher and the performance of the educational function of scientific journalism, culminating in collaboration and interdisciplinary initiatives mainly in communication in a digital environment (Metcalfe, 2019; MacGregor and Cooper, 2020). Given this and the data from this study in Goiás, we realized that the conditions are favorable for the creation of mechanisms to affect this dissemination of research in the two institutions, as long as there is professionalization in scientific journalism and science dissemination. It also requires resources to be utilized in this sense (Entradas et al., 2020), such as the use of social networks and multimedia platforms.

In this context, and as one of the fundamental stages of the research, disclosure is essential for the closure and recognition of the investigation.

Table 8. Relevance of themes and channels for science communication.

Themes	Groups	n(%)	Median ± Range	p-value
Science	JC	23 (9.5)	4 ± 2^{a}	<0.001
	RM	11 (4.5)	4 ± 3^{b}	
	StuR	52 (21.5)	$5\pm2^{a,b}$	
	ReS	156 (64.5)	$5\pm3^{a,b}$	
Technology	JC	23 (9.5)	4 ± 2^{a}	<0.001
	RM	11 (4.5)	4 ± 3^{b}	
	StuR	52 (21.5)	$5\pm2^{a,b}$	
	ReS	156 (64.5)	$5\pm3^{a,b}$	
Innovation	JC	23 (9.5)	$4\pm3_{a}$	<0.001
	RM	11 (4.5)	4 ± 3^{a}	
	StuR	52 (21.5)	$5\pm2^{a,b}$	
	ReS	156 (64.5)	$5\pm3^{a,b}$	
Sustainability	JC	23 (9.5)	4 ± 2^{a}	<0.001
	RM	11 (4.5)	4 ± 3^{b}	
	StuR	52 (21.5)	$5\pm2^{a,b}$	
	ReS	156 (64.5)	$5\pm4^{a,b}$	
Environment	JC	23 (9.5)	4 ± 2^{a}	<0.001
	RM	11 (4.5)	4 ± 3^{b}	
	StuR	52 (21.5)	$5\pm2^{a,b}$	
	ReS	156 (64.5)	$5\pm4^{a,b}$	
Culture	JC	23 (9.5)	4 ± 2^{a}	<0.001
	RM	11 (4.5)	4 ± 3^{b}	
	StuR	52 (21.5)	$5\pm4^{a,b}$	
	ReS	156 (64.5)	$4\pm4^{a,b}$	
Science communication	JC	23 (9.5)	4 ± 2^{a}	<0.001
	RM	11 (4.5)	4 ± 3^{b}	
	StuR	52 (21.5)	$5\pm2^{a,b}$	
	ReS	156 (64.5)	$5\pm4^{a,b}$	
Channels	**Groups**	**n(%)**	**Median ± Range**	**p-valor**
Social networks	JC	23 (9.5)	4 ± 3^{a}	<0.001
	RM	11 (4.5)	4 ± 3^{b}	
	StuR	52 (21.5)	$5\pm3^{a,b,c}$	
	ReS	156 (64.5)	$4\pm4^{a,b,c}$	
Videos on Youtube and other channels	JC	23 (9.5)	4 ± 3^{a}	<0.001
	RM	11 (4.5)	4 ± 3^{b}	
	StuR	52 (21.5)	$4\pm4^{a,b}$	
	ReS	156 (64.5)	$4\pm4^{a,b}$	
Multimedia platform	JC	23 (9.5)	3 ± 2^{a}	<0.001
	RM	11 (4.5)	3 ± 3^{b}	
	ReS	52 (21.5)	$5\pm2^{a,b}$	
	ReS	156 (64.5)	$4\pm4^{a,b}$	
Database with research information	JC	23 (9.5)	2 ± 3^{a}	<0.001
	RM	11 (4.5)	3 ± 3^{b}	
	StuR	52 (21.5)	$5\pm3^{a,b}$	
	ReS	156 (64.5)	$4\pm4^{a,b}$	

Nota. Post Hoc; Kruskal-Wallis. The same letters are inserted where there is a statistically significant difference between the groups ($p < 0.05$). *Subtitle:* JC (journalist/communicator); RM (Research manager); StuR (student researcher); ReS (research suervisors). Questionnaire applied with Likert scale, being 1 = Strongly disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = Strongly agree.

Therefore, in addition to the channels indicated, we highlight the need to build processes and a communicative system in which science communication is institutionalized (Entradas et al., 2020), inserting scientific journalism actions. This commitment is evidenced in this study, according to the interviewees' reports and the importance they attach to this work, mainly with the willingness to create collaborative initiatives (Metcalfe, 2019; MacGregor and Cooper, 2020). This is necessary considering that the social communication work of a Federal Institute cannot depart from the guiding concepts of the educational conception of these places. In addition to dissemination, another factor studies mention is that of public engagement and involvement in science, seen as a process — and a term — that goes beyond the communication of science and is reflected in participatory, integrated, and cooperative actions (Bubela et al., 2009; Metcalfe, 2019; Entradas et al., 2020).

For all these reasons, we understand this communication from the IFs as systemic and procedural — be it with its internal public (students, researchers, suppliers, outsourced, and others) or its external public — ensuring that students' family members and civil professionals, the general population, and society benefits from institutional productions. Today, this communication operates in a hybrid movement between analogue and digital forms of dialoguing with society, predominantly through relationships in virtual environments.

Among the limitations of this research, we highlight that we cannot generalize its results, as they are specific and particular cases of the institutions researched. In addition, the research was applied to specific groups related to the research in some way, including students who are part of scientific initiation programs in the IFs and research managers, which restricts opinions regarding the other groups of the Institutions that are noted directly involved with science. However, as its strong point, this study's analyses can be applied in other organizational contexts of IFs and public institutions, especially those in which science is placed in the background. Nonetheless, few studies focus on the organizational environment, especially those that analyze this change in the prioritization of science communication practices, called "organizational turn" by Schäfer and Fähnrich (2020). Fewer are the analyses of scientific journalism in the reality of the Federal Institutes.

The important highlight of this research is that it also expands the results of two organizational contexts, not restricting to a single reality. This research may also guide national and local institutional policies for scientific dissemination, which are still rare in Brazil, starting by accessing information and culminating in the promotion of science education. Still, it is still imperative to legitimize teaching and research institutions by extending science into the community and publicizing scientific production of IFs in the press. In addition, the article suggests future works that analyze the ways in which organizations communicate with society through science produced internally. For this, broader studies — including within more IFs — are needed to propose strategies and improvements.

4.1. Final considerations

Based on the analyzed contexts, the main findings of this study show that scientific journalism in the two FIs in Goiás/Brazil has not developed effectively yet, as specific actions are not part of the plan the work of science journalism and routines of the communication sectors of these institutions. Moreover, for scientific journalism to develop, it is necessary to establish guidelines for the dissemination of science, recognize and prioritize the publication of research, plan the work of scientific journalism, and create specific routines and channels. In addition, communication flows and creating journalistic products and processes must be improved upon. With these changes, it may be possible to carry out actions and improve communication between Federal Institutes and society, through science. Finally, the contexts are favorable for scientific journalism to develop, as institutional management and the communication and research sectors prioritize the dissemination of science and view scientific dissemination as a special issue.

Declarations

Author contribution statement

Tássia Galvão, Matias Noll: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Priscilla Rayanne e Silva Noll: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data included in article/supplementary material/referenced in article.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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