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A Discriminant Analysis of Academic Fields about the ICT Regulation Problem

Autoria

José Antonio Gouvêa Galhardo - jaggalhardo@gmail.com

Cesar Alexandre de Souza - calesou@usp.br

Prog de Pós-Grad em Admin/Faculdade de Economia, Admin e Contab – PPGA/FEA / USP - Universidade de São Paulo

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Resumo

The research is a descriptive study of the differences in experience and perception of researchers from four grand Academic fields (Administration, IS, Law, and Sociology) about the problem of regulating emerging information systems and communications technologies (ICT). It is a pioneering study for a problem that is gaining attention and faces the difficulty of demanding a multidisciplinary approach in which the role of the IS area should be the protagonist. We conducted a Multiple Discriminant Analysis of the answers to a survey with Brazilian researchers from these areas. The questions assessed the experience and contribution to recent ICT regulatory discussions and the perception of difficulties, values, needs, and concerns raised in the literature review and previous qualitative research. We found that most independent variables had no power to discriminate between the academic fields, showing common ground that may facilitate consensus. Researchers generally recognize the difficulties in regulating ICT, but the overall participation and practical contribution are low. The discredit in public consultations and public hearings may be a cause that requires further investigation and regulators to find alternative solutions once the absence of the IS area can have critical consequences for the technical effectiveness of the regulations.

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Abstract

The research is a descriptive study of the differences in experience and perception of researchers from four grand Academic fields (Administration, IS, Law, and Sociology) about the problem of regulating emerging information systems and communications technologies (ICT). It is a pioneering study for a problem that is gaining attention and faces the difficulty of demanding a multidisciplinary approach in which the role of the IS area should be the protagonist. We conducted a Multiple Discriminant Analysis of the answers to a survey with Brazilian researchers from these areas. The questions assessed the experience and contribution to recent ICT regulatory discussions and the perception of difficulties, values, needs, and concerns raised in the literature review and previous qualitative research. We found that most independent variables had no power to discriminate between the academic fields, showing common ground that may facilitate consensus. Researchers generally recognize the difficulties in regulating ICT, but the overall participation and practical contribution are low. The discredit in public consultations and public hearings may be a cause that requires further investigation and regulators to find alternative solutions once the absence of the IS area can have critical consequences for the technical effectiveness of the regulations.

Keywords: ICT regulation, Multidisciplinary, Academic fields, Discriminant Analysis.

1 Introduction

The regulation of emerging Information and Communication Technologies (ICT) has begun to arouse academic interest in the Information Systems (IS) area. Recent calls for papers from the Association for Information Systems (AIS) basket journals (Gozman et al., 2019; Aanestad et al., 2021) invite more research, highlighting the necessary multidisciplinary approach to study the problem, destined to assist policymakers in practice.

The multidisciplinary nature of a phenomenon stems from the possibility of studying the research problem from multiple theories and perspectives (Vaidya & Campbell, 2016), which results in a scientific production that takes a broad spectrum of technical, operational, practical, and philosophical positions (Zuiderwijk et al., 2021). The need to combine different research strands to achieve a cohesive interdisciplinary understanding of a phenomenon motivates seeking to know these strands (Jiang & Cameron, 2020; Elliot, 2011).

Multidisciplinary is a kind of difficulty inherent to the political environment in which discussions about regulation occur with the participation of diverse actors. The multidisciplinary challenge reproduced in the political sphere of legal and regulatory discussions gains a novel dimension when the subject involves emerging ICT and the digital economy.

Four aspects give a different character to the current dilemmas and issues facing ICT regulation: the speed of evolution, the pervasiveness of digital technologies, the disruption of geographic borders in a world connected by the internet via a network of digital platforms, and the scale of the impacts on society (Gozman et al., 2019; High-Level Expert Group on Artificial Intelligence, 2019; World Bank, 2021).

Among the actors, academics and practitioners help legislators in different ways, such as through parliamentary debates and public consultations on regulatory proposals. However, what should we expect? Would an academic from the Administration area be more liberal and more averse to obstacles that inhibit innovation and entrepreneurship or concerns about Environmental, Social, and Corporate Governance (ESG) principles already prevalent in the area? On the other hand, would an academic from

the Sociology field be more favorable to state intervention to protect excluded groups and democracy or be more averse to limitations on freedom of expression? Would an academic from the Law field be more favorable to creating new regulations or be more comfortable defending the application of current legislation and the analysis of concrete cases based on analogy, hermeneutics, and jurisprudence? What to expect from an academic in the IS area, a greater aversion to controls and limitations that inhibit the creative development of methods for collecting, storing, processing, transmitting, and analyzing data, or does more in-depth technical knowledge enhance risk aversion to new technologies?

The IS area is specialized both in the technical issue related to emerging ICTs and in the ability to capture and understand the ontology of the problem from the user's point of view (Fonseca & Martin, 2007), which qualifies the area in a position of strategic capacity to the discussions involving the legal repercussions of the broad transformations that the pervasiveness of the digitalization of life brought (Beath et al., 2013, Riemer & Peter, 2021). Without the participation of the IS area, ICT regulation will hardly be effective and achieve the intended objectives (Fast et al., 2022).

The research problem refers to the multidisciplinary scenario of regulation of emerging ICT, especially the participation of different fields of Academia in discussing and constructing legislative and regulatory proposals. Our literature review found no investigations to overcome ontological and epistemological differences between disciplines concerning the ICT regulation problem.

The question we are addressing is: what are the differences between Academic fields regarding experience and perceptions concerning the ICT regulation problem?

At this stage, we aim to describe the differences between four grand academic areas (Administration, IS, Law, and Sociology) in terms of experience and perceptions about the problem of regulating ICT in Brazil. The specific objectives are to describe the differences in participation and contribution to the discussions, the differences in perception of the difficulties in regulating ICT, and the differences in perception of values and beliefs concerning ICT regulation.

Based on the challenges in regulating ICT raised in our literature review and on the worldview through values, needs, and concerns captured in interviews with eleven Brazilian parliamentarians, legislative assistants, and specialist bureaucrats who participated in public hearings in 2019, we conducted a survey with professors and researchers from the four grand academic areas. Each grand area incorporated related areas (e.g., IS - Informatics and Computer Science, Engineering, Mathematics, and Statistics). The analysis technique was the Multiple Discriminant Analysis (MDA), in which the grand academic area was the categorical dependent variable under analysis, taking the answers to each question based on our previous literature review and qualitative research as independent variables.

We found common ground between the areas that should facilitate the discussions toward regulating emerging ICT. However, the overall participation was low, which contradicts the assessment of the importance of participation. Possibly, it is caused by the discredit of researchers in public consultations and public hearings due to past experiences with suggestions presented being overlooked, in which the IS area stood out.

The rest of the article is organized as follows: in the next section, we present the multidisciplinary theme, its relationship with the problem of ICT regulation, the difficulties in regulating raised in our previous literature review, and the role of the Academy in the discussions. We then describe the research method, findings, and discussion of the results to conclude with the theoretical and practical implications of the study and suggestions for future research.

2 Background

2.1 The multidisciplinary and the ICT regulation

The ICT regulation theme is still immature in the IS field but gaining attention. Some of the calls for papers from the AIS basket journals show the path starting from the ethical concern with AI and Analytics for society (Dennehy et al., 2016), passing through the call for responsible research (Davison et al., 2017), the impact to the socio-economic development of digital platforms in developing countries

(Davison et al., 2018), the implications of winner-takes-all platform economics, and the social, environmental and economic implications of the blockchain (Rossi et al., 2019), the concern with fake news phenomenon on the Internet (Dennis et al., 2019), and with the failure of digital transformation initiatives in Latin American context (Joia et al., 2020). This path led to the calls for papers from AIS basket journals highlighting the gap in research and suggesting questions like: "How to bridge the gap between ethics and policy (e.g., for AI)? Where is the overlap and divergence?" (Gozman et al., 2019), or "how should policymakers develop frameworks, regulations, and laws on ethics and accountability regarding the deployment of digital technologies in society?" (Aanestad et al., 2021). These studies shall embrace various fields, such as Anthropology, Economics, Law, Public Policy, and Sociology, from a cross-level, multi-referent, and inter-disciplinary perspective.

Integrating knowledge from several domains is not a new challenge for the IS. It is an inherent field trait (Webster & Watson, 2002). However, the contribution of the IS area is still predominantly intradisciplinary (Tarafdar & Davison, 2018).

Calls for papers (e.g., Beath et al., 2013; Zuiderwijk et al., 2021) from AIS basket journals have sought to stimulate the integration and expansion of the discipline's boundaries, seeking to contribute to and influence different academic areas. Some of the answers propose new theories, such as the Interdisciplinary Structuration Theory (Puron-Cid, 2013), frameworks (e.g., Ciriello, 2021), or new research methods, such as Competitive Benchmarking (Ketter et al., 2016).

Some researchers seek knowledge in other areas through interdisciplinary literature reviews motivated by the need for a holistic view of the problems (e.g., Elliot, 2011), by the recognition of the lack of consensus on key findings and implications (Coombs et al., 2020), which undermines more cohesive treatment (Smith et al., 2011).

These contributions are essential to deal with socio-technical problems that are increasingly complex and have vast repercussions in different ways in the business environment, society, and governments, which cannot be reduced to a mere empirical measurement (Raadschelders, 2011).

Artificial intelligence, facial recognition, cryptocurrencies, autonomous vehicles, and digital platforms are some recurring themes involving emerging ICT in which the concern to discuss and establish limits and rules for development and use is present in the studies of multilateral organizations (e.g., ILO, 2021), standard-setting organizations (e.g., IEEE, 2019), government agencies (e.g., High-Level Expert Group on Artificial Intelligence, 2019), consulting companies (e.g., Eggers & Turley, 2018), and non-government organizations (NGO) (e.g., Ada Lovelace Institute & AI Now Institute and Open Government, 2021). Following this trend, it is common to find a paradoxical situation where the CEOs of Big Tech companies claim more regulation for their business (e.g., Bartz & Culliford, 2021). Definitively, a new direction of interdisciplinary research that brings the IS area closer to that of political studies is opened (Pelizza, 2021).

2.2 The difficulties in regulating ICT and the IS role

In our literature review on the difficulties of regulating ICT, we selected 41 articles from journals or conferences published between 2009 and 2019.

The philosophy field greatly influenced most studies due to ethical discussions like ethical issues in crowdsourcing practices (Schlagwein et al., 2019) and privacy dilemmas in healthcare (Mittelstadt & Floridi, 2016), or ethics by design (Schuelke-Leech et al., 2019).

Notwithstanding the gap in studies focusing on regulators, we got insights from the authors about regulators' difficulties in regulating ICT, which we separated into six groups described in Table 1.

Group	Difficulties	Example
Technical issues	Related to computational limitations and decision-making modeling complexity	Access to the data and the algorithms (Hacker, 2018), ethics by design (Weng et al., 2015).

Group	Difficulties	Example
Legal issues	Involving technical aspects of the law field	Competition and conflict between different forms of regulation (Hacker, 2018), Deregulation aversion (Vogelsang, 2017)
Drivers	Externalities that influence the regulation process	AI apocalypse view (Wasilow & Thorpe, 2019), Failures, accidents, or death caused by autonomous vehicles (Schuelke-Leech et al., 2019)
Environmental issues	Related to the political environment in which the regulation process occurs and geopolitical aspects.	Business lobbying (Benvenisti, 2018), Multidisciplinary (Mahieu et al., 2018)
Societal objectives	Philosophical and sociological questions.	The complexity of human interaction (Pagallo, 2015), public and policymakers' moral imagination (Schuelke-Leech et al., 2019)
Individual behavior or trace	Regulators' characteristics	Bounded rationality (Sokolovska & Kocarev, 2018), lacks expertise (Calo, 2015)

Table 1. Regulators' difficulties in regulating ICT found in the literature review.

Multidisciplinary was in the group of difficulties inherent to the political environment in which discussions about regulation occur with multiple actors with different academic backgrounds, professional life experiences, economic power, power of communication and persuasion, and worldview. Among the actors, academics and practitioners help legislators by participating as guests in parliamentary committee debates, contributing criticism and suggestions in public consultations on regulatory proposals, or are hired by the government, business sectors or civil society, or even by multilateral organizations to analyze and give an opinion on a given problem.

The reviewed literature does not address which areas of Academia participate, and most influence the outcome of the discussions, nor if there is a difference between the perception of academics about the problems related to ICT regulation. Therefore, whether or not the necessary holistic multidisciplinary approach to balance the positive and negative outcomes of emerging ICT, which Jeroen van den Hoven calls "Comprehensive Engineering" (Maedche, 2017), is achieved.

The following section presents the research method by describing the research instrument, the sample collection, and the analysis technique.

3 Method

The research is a descriptive study of the differences in attitudes and opinions of researchers from four grand Academic fields (Administration, IS, Law, and Sociology) about ICT regulation. We described their experiences discussing and contributing to law and regulation proposals and their opinions about some of the difficulties in regulating ICT raised in our literature review. Besides, we tried to capture their perception of values, needs, and concerns, representing the worldview of eleven parliamentarians, their direct assistants, and technocrats from the executive branch and prosecution service whom we interviewed in the previous stage of this research. They all participated in Public Hearings about ICT regulation in 2019, which occurred in Science and Technology specialized committees from the legislative houses at Brazil's three levels of government (Federal, State, and Municipal).

We selected four grand Academic areas, grouping related ones, described in Table 2 because they were the most common background of the invited experts in the Public Hearings.

Grand academic area	Related areas included in the Grand area
Administration (A)	Administration, Accounting, Economics, and their specialized disciplines (e.g., Marketing, Finance)
IS (C)	Informatics and Computer Science, Engineering, Mathematics, and Statistics
Sociology (S)	Sociology, Anthropology, Political Science, and Philosophy
Law (L)	Law

Table 2. Academic areas included in each Grand Academic area of the study.

3.1 Research instrument (questionnaire)

The technique used in the study was a survey with professors and researchers from the four grand areas. We divided the research instrument into four sections with objectives and examples of questions described in Table 3.

Section / Number of questions	Objective	Dimensions	Examples of questions
Demographic profile Four questions	Survey the generational profile, the culture of the legal system by the country of birth, the areas of the academic background of the respondents, and the possible professional link to the public administration that could result in a bias in the results.	-	What is your age group? What is your born country? Identify the area(s) of knowledge of your academic background. Include undergraduate, master, and doctoral areas.
Experience in the emerging ICT regulation Three questions	Survey researchers' experiences in the ICT regulation process in recent years in Brazil.	Participation and Contribution	How have you participated in ICT regulation discussions in the last five years? If you contributed with criticisms or suggestions in the Public Consultations, please indicate which ones.
Difficulties in regulating emerging ICTs One question with twelve items was evaluated.	Raise the researcher's perception about the difficulties in regulating ICT identified in the literature review and classified into six groups.	Difficulties	In your opinion, how do the elements below impact emerging ICT regulation in terms of difficulty to overcome? Access to company data and algorithms
Values, Needs, and Concerns Three questions with ten, nine, and ten items each.	Assess the respondent's importance to some statements or doubts in interview excerpts classified as values, needs, and concerns.	Worldview	For each selected interview excerpt, mark the degree of importance for the value associated with the statement or doubt presented.

Table 3. Research instrument description

Appendix 1 details the research model by describing the variables related to each question of the research instrument, the measurement scales, and the actions for treating them.

The study's objective is to determine whether differences between the grand academic areas exist, which are the elements of the categorical dependent variable under analysis, taking the answers to each question based on our previous qualitative research as independent variables. Besides, we want to determine which of the independent variables contributes most to the differences in the average score profiles of the academic groups.

3.2 Sample collection

The invitation to participate in the research was e-mailed between 04/04 and 30/04/2022 and answered until 10/05/2022, complemented by the authors' social network academic groups. We collected e-mails on the pages of Brazilian educational institutions for courses in areas of research interest. In addition to the University of São Paulo, institutions were selected based on the Assessment of the National Postgraduate System (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), 2022), taking the best-qualified courses in each of area. In the end, we sent 2710 e-mails, receiving 170 responses.

3.3 Quantitative analysis technique

The analysis technique was the Multiple Discriminant Analysis (MDA) which is suitable when the dependent variable is non-metric multichotomous, the independent variables are metrics, and the primary objective is to understand group differences (Hair Jr et al., 2018). Nominal independent variables were converted into a dummy, and ordinal variables to a numeric scale.

To understand group differences, we analyzed by combining a subset of independent variables to represent the discrimination dimensions (Participation/Contribution, Difficulties, and Worldview) indicated in Appendix 1.

We ran the Box's M test in R (Fox et al., 2021) for each dimension to assess the independent variables' assumption of equal dispersion and covariance matrices. The tests in all dimensions (Table 4) rejected (significant p-value) the null hypothesis that the observed covariance matrices for the dependent variables are equal across groups. Therefore, we opted for the Quadratic Discriminant Analysis (QDA) once it is recommended when the assumption of a common covariance matrix for all classes is not observed (Hair Jr et al., 2018). We ran the analysis in R with the MASS package (Venables & Ripley, 2002). The results were analyzed by visual inspection of the group means for each independent variable.

Data	Chi-Sq (approx.)	df	p-value
dtparticp[, 2:3]	54.85	12	1.926e-07
dtcontrib[, 2:3]	Inf	12	< 2.2e-16
dtdific[, 2:13]	464.77	312	4.223e-08
dtval[, 2:11]	288.97	220	0.001234
dtnec[, 2:10]	239.01	180	0.002135
dtpreoc[, 2:11]	334.25	220	1.038e-06

Table 4. Box's M-test for Homogeneity of Covariance Matrices

The following section presents the results in each discrimination analysis dimension.

4 Findings

4.1 Demographics

From the 170 responses received, we excluded ten respondents with academic backgrounds exclusively in other areas (e.g., psychology, biology, medicine, dentistry) that were out of the planned scope of the study. Besides, we excluded 21 respondents who failed to answer more than 50% of the questions. Thus, we reached 139 respondents, of which 110 completed at least 97% of the questions. The question with the highest non-response rate (11%) was about the difficulty of "Sharing true values among the various stakeholders". All others had an abstention rate of less than 10%.

Thirty-four respondents reported academic background in more than one area, including at least one of those in the study's scope. Table 5 describes the distribution of responses by academic area and age. Despite not meeting the condition of being mutually exclusive (Hair Jr et al., 2018), we decided to keep

the analysis of these responses as a multidisciplinary ("M") independent group to see whether it discriminates from the pure areas.

Academic Area	Responses	%	20-29	30-39	40-49	50-59	>=60
Administration (A) [a]	25	18%		5	5	6	9
IS (C)[b]	34	24%	1	1	11	14	7
Law (L)[c]	25	18%	2	6	3	11	3
Sociology (S)[d]	21	15%	1	4	6	6	4
Multidisciplinary (M)[e]	34	24%	1	3	9	11	10
Total	139	100%	5	19	34	48	33

Table 5. Distribution of respondents by grand academic area and age group

Note: (a) A - Administration, Accounting, and Economics. (b) C - Information Systems, Informatics and Computer Science, Engineering, Mathematics, and Statistics. (c) D - Law. (d) S - Sociology, Anthropology, Political Science, and Philosophy. (e) M - Multidisciplinary, including at least one grand area of interest.

All areas, including the multidisciplinary group, exceeded the recommended minimum of 20 respondents for the discriminant analysis (Hair Jr et al., 2018). Individually, 12 of the 41 questions have an area with less than 20 respondents, with a minimum of one question with 16 respondents in the Sociology area. The other 11 questions reached at least 18 respondents in each area.

As for the legal culture, 97% of the respondents were Brazilians, and the few isolated cases of foreigners were born in civil law countries (Spain, France, Italy, Portugal, and Russia).

Only seven respondents were employees of bodies or entities of the executive, legislative, prosecution service, or judiciary. These few cases did not introduce bias in the responses compared to other respondents from the same academic area to which they belonged. 30% had no ties to the government, while 65% were professors or researchers at public universities.

4.2 Experience in the emerging ICT regulation

Almost half of the respondents had some experience with ICT regulation, as summarized in Table 6. The grand area of Sociology was the only one in which the number of participants exceeded the number of non-participants.

	Participation					Contribution					
Area	No	%	Yes	%	Total	No	%	Yes	%	Total	%
A	14	56%	11	44%	25	9	82%	2	**18%**	11	100%
C	18	53%	16	47%	34	11	69%	5	**31%**	16	100%
L	14	56%	11	44%	25	8	73%	3	27%	11	100%
S	9	**43%**	12	**57%**	21	9	75%	3	25%	12	100%
M	20	59%	14	41%	34	9	64%	5	**36%**	14	100%
Total	75	**54%**	64	**46%**	139	46	**72%**	18	28%	64	100%

Table 6. Participation and Contribution in any of the options by grand area

The majority (72%) of those who participated indicated a single form of contribution, limited to reading the reference document or regulatory proposal in Public Consultation (Figure 1). More than three forms of participation were only observed for a few respondents (6%) from the Law and Sociology areas.

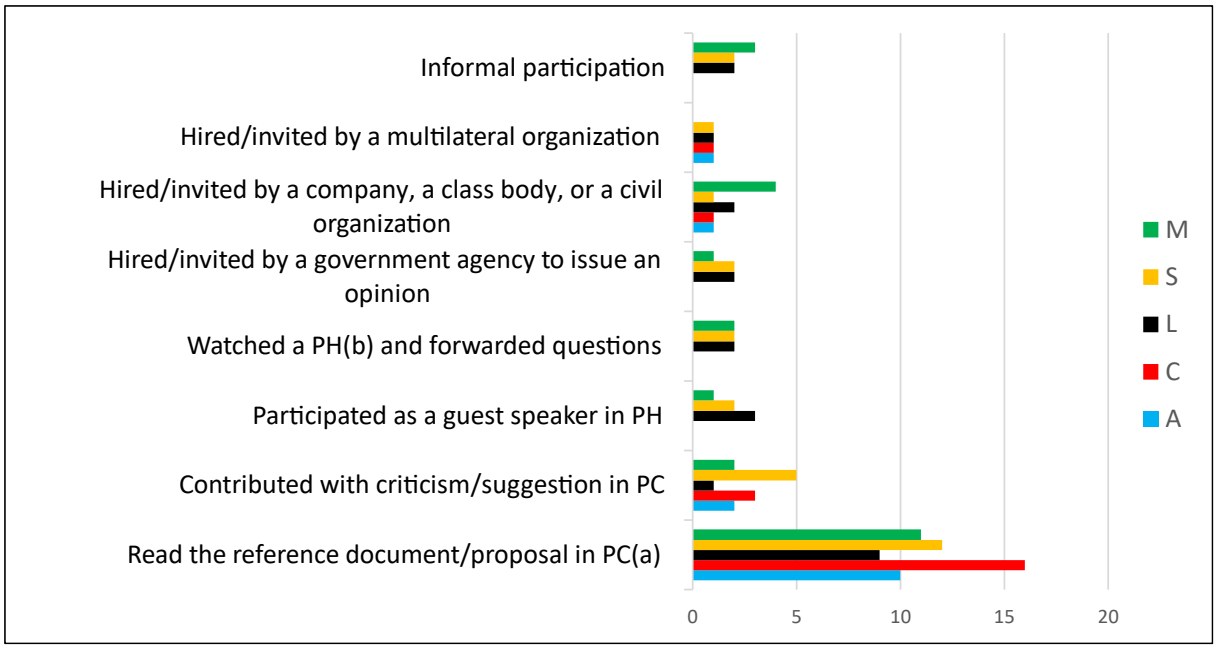

Figure 1. *Forms of participation in the ICT regulation process experienced by respondents from each area*

Figure 2 presents the means results for each area obtained from the QDA for the independent variables of participation and contribution.

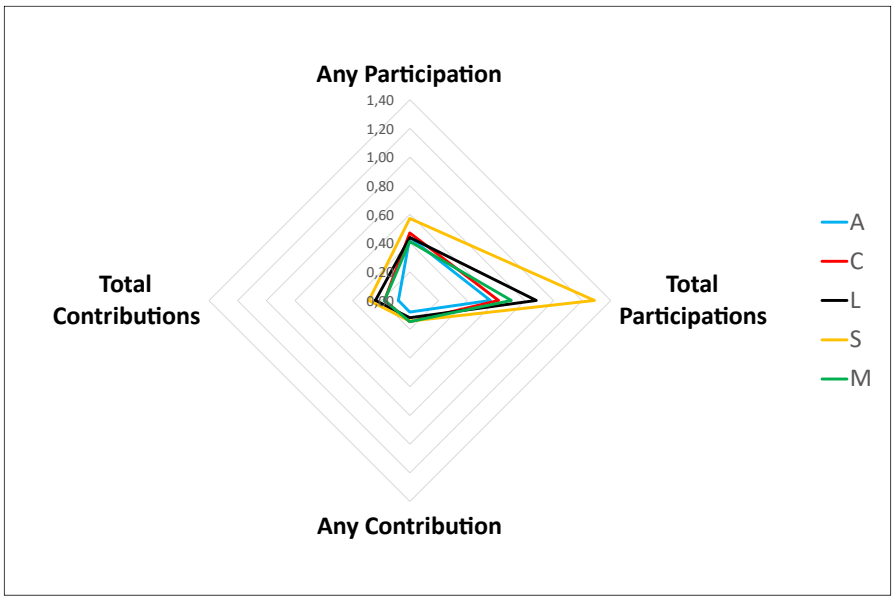

Figure 2. *Radar chart of QDA group means of Participation and Contribution independent variables for each academic area*

Both participation and contribution are presented in two ways. First, participation and contribution are counted once, regardless of how many ways the respondents indicated (Any). The second (Total), for each respondent, sums up the different forms of participation (e.g., I read the reference document/proposal in Public Consultation + I contributed with criticism/suggestion in Public Consultation = 2) and contribution indicated (e.g., Brazilian strategy for fifth-generation networks (5G) + Brazilian Strategy for Digital Transformation = 2).

QDA confirmed that the Sociology area has slightly higher participation in some options than the other areas that do not show significant differences. This prominence of the Sociology area is amplified when the participation weighted by the number of participation alternatives is considered, followed by the Law field.

The Administration area contributed the least to the regulation proposals, differing slightly from the other areas.

The Public Consultations that received the most contributions were the Brazilian AI Strategy and the Digital Government Strategy. On the contrary, the Brazilian strategy for 5G networks and the Reference Model for the Publication of Open Data did not receive any contribution (Figure 3).

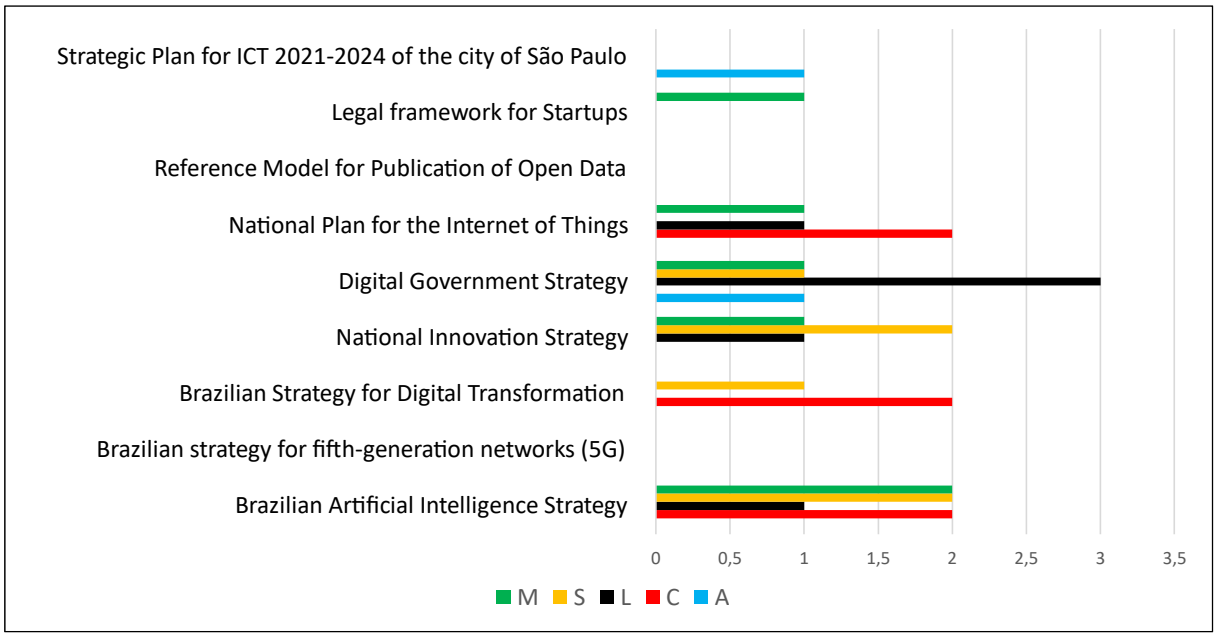

Figure 3. Public Consultations related to the regulation of ICT that received criticism and suggestions from respondents in each area

Among those who contributed, the distribution was relatively homogeneous between those who considered the criticisms and suggestions helpful; useless; and who did not check, as described in Table 7. The areas of IS and Sociology had a greater weight on those not satisfied with their contributions being disregarded.

Area	Yes, a good part	%	No, very few	%	I do not know. I did not check	%	Total	%
A	1	50%		0%	1	50%	2	100%
C	1	20%	3	**60%**	1	20%	5	100%
L	1	33%		0%	2	67%	3	100%
S		0%	2	**67%**	1	33%	3	100%
M	2	40%	1	20%	2	40%	5	100%
Total	5	28%	6	33%	7	39%	18	100%

Table 7. The usefulness of contributions from each area

4.3 Differences in the perception of the difficulties in regulating ICT

The respondents rated most of the difficulties with a fair to a high degree of difficulty. Access to corporate data and algorithms and the Business Lobby were the only difficulties rated as extremely difficult. The AI Apocalyptic Cinematographic Vision was the only difficulty with an overall trend rating from fair to low difficulty.

QDA revealed no significant discrimination between areas in the respondents' assessment of most difficulties, as illustrated in Figure 4.

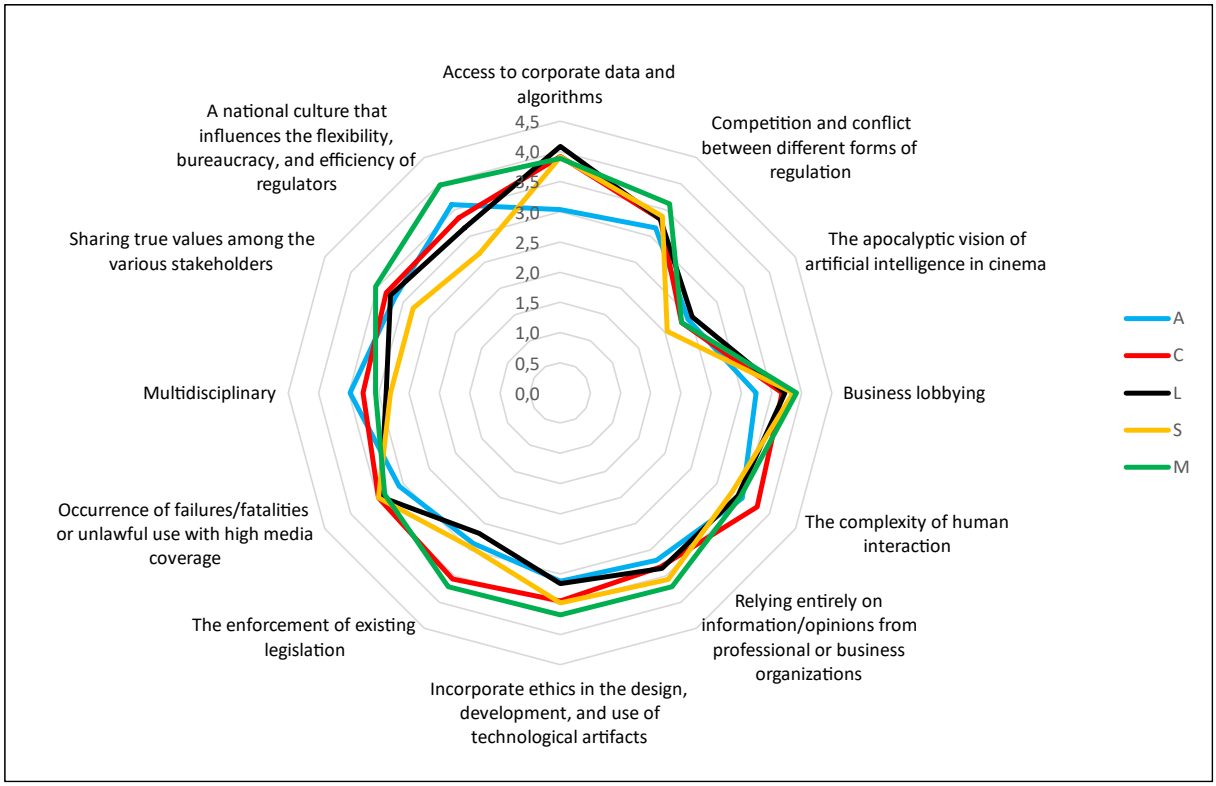

Figure 4. The radar chart of the QDA group means of Difficulties regulating ICT as independent variables for each academic area

The Administration area showed the most apparent discrimination regarding the difficulty of "accessing corporate data". The "enforcement of existing legislation" was another difficulty in which assessment by the IS area and the multidisciplinary background respondents was higher than in other academic fields. The last difference was the Sociology area regarding the difficulties of "sharing true values among the various stakeholders" and "a national culture that influences the flexibility, bureaucracy, and efficiency of regulators", especially in this case in comparison with the respondents with a multidisciplinary background.

4.4 The differences in worldview

QDA showed that most independent variables (values, needs, and concerns) do not discriminate between academic areas.

Most of the values evaluated by the respondents did not show a clear trend. The only exception was the value expressing the belief that "it is possible to regulate ICT" in contrast with the disbelief. The perception that "it is possible to regulate" was considered very important, while the perception that "it is not possible to regulate" was evaluated as of little importance. Another lighter but noticeable trend

that makes sense with this result is the one that classifies the value of "wasted time" with the discussions as unimportant.

Among the values (Figure 5), the belief that the "government is an obstacle" appeared with greater discriminant power, mainly in the Sociology area and less in the Law area. Both consider this value less critical. The two areas also feature prominently in the "incrementalism" assessment, indicating a slightly lower assessment of importance to the value. The Sociology area appears again isolated, giving less importance to "neutrality" and the "liberal" value in which researchers with a multidisciplinary background, not those from the Administration area, appear at the opposite end of the evaluation. The last value that appears slightly highlighted, perhaps, as expected, was that of the IS area regarding the assessment that it is possible to regulate ICT with a lower level of importance.

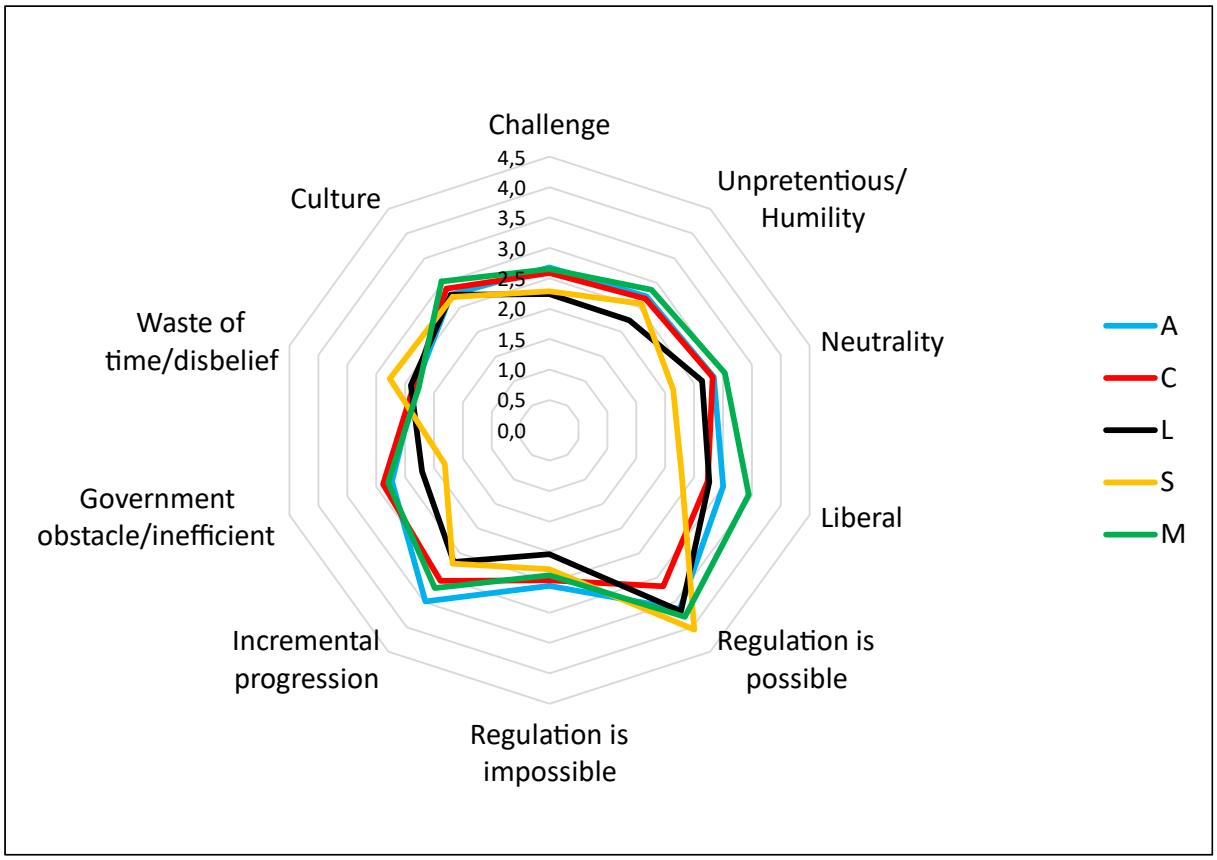

Figure 5. *Radar chart of the QDA group means for Values as independent variables for each academic area*

The needs presented marked trends placing "transparency" and the need for "long-term planning" as very important. The only need with a slight tendency to rank as minor importance was "nationalism".

The Sociology area also discriminates more often than the other areas when assessing needs, as illustrated in Figure 6. "Social protection", "diversity", respect for "human dignity", and having the "government as a protagonist" were needs evaluated by the area with the highest degree of importance distinguishing from the other areas.

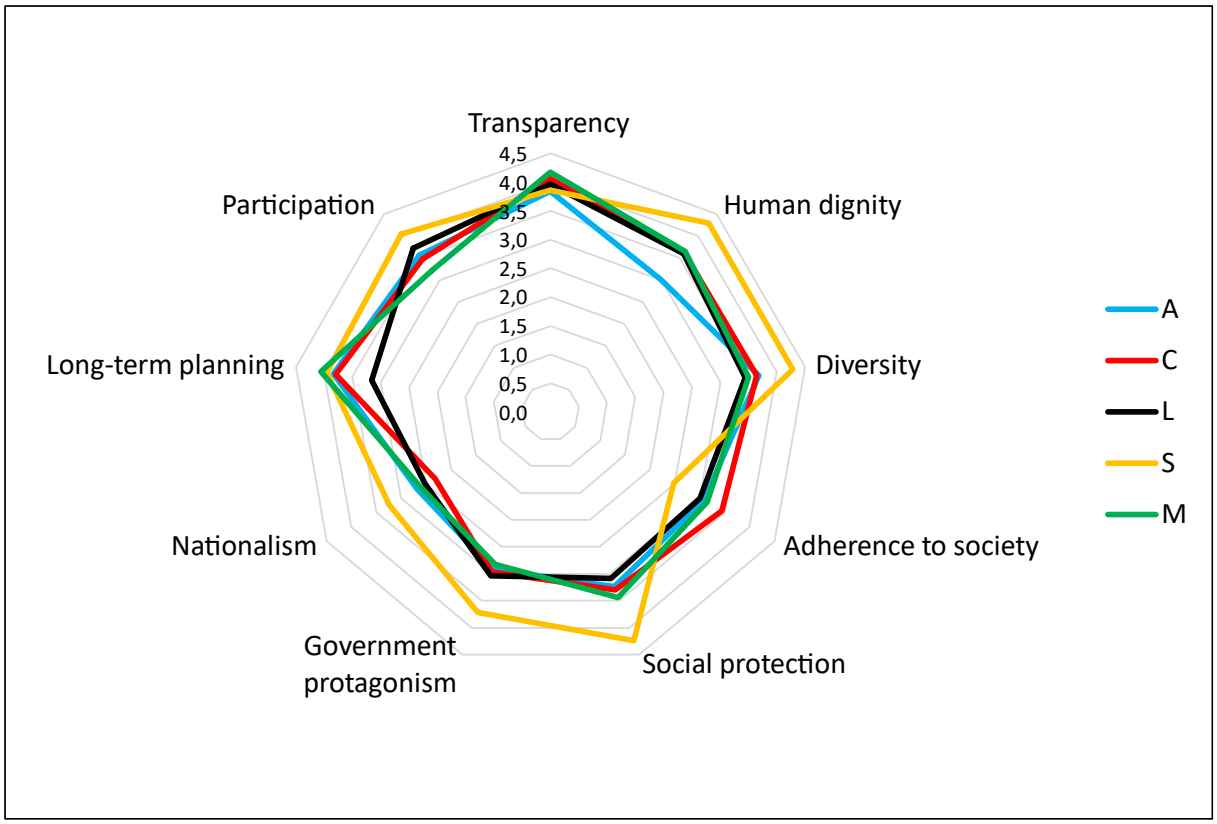

Figure 6. Radar chart of the QDA group means for Needs as independent variables for each academic area

On the other hand, when evaluating the need for "adherence to society", the Sociology area stood out, evaluating it with a lower level of importance. The assessment of the Administration area for the need for "human dignity" stood out at the opposite extreme to that of the Sociology area, giving it a lower degree of importance. The Law area also appears with a slightly lower assessment of the need for "long-term planning".

Concerns had a similar result, with a ranking trend of more importance for those about the "justice divide", "digital divide", and the concern with "results and impacts". Furthermore, concerns with a tendency of minor importance ranking were the "punitive bias" and the "outdated legal institutes".

Researchers with multidisciplinary backgrounds discriminate, giving greater importance to both concerns (Figure 7).

The Sociology area detached again, giving greater importance to the concern with the "universality of benefits". Once more, it appeared along with the Law area with a slightly lower assessment of importance for the "business environment". The Administration area, in turn, gave less importance to the concern with access to" justice".

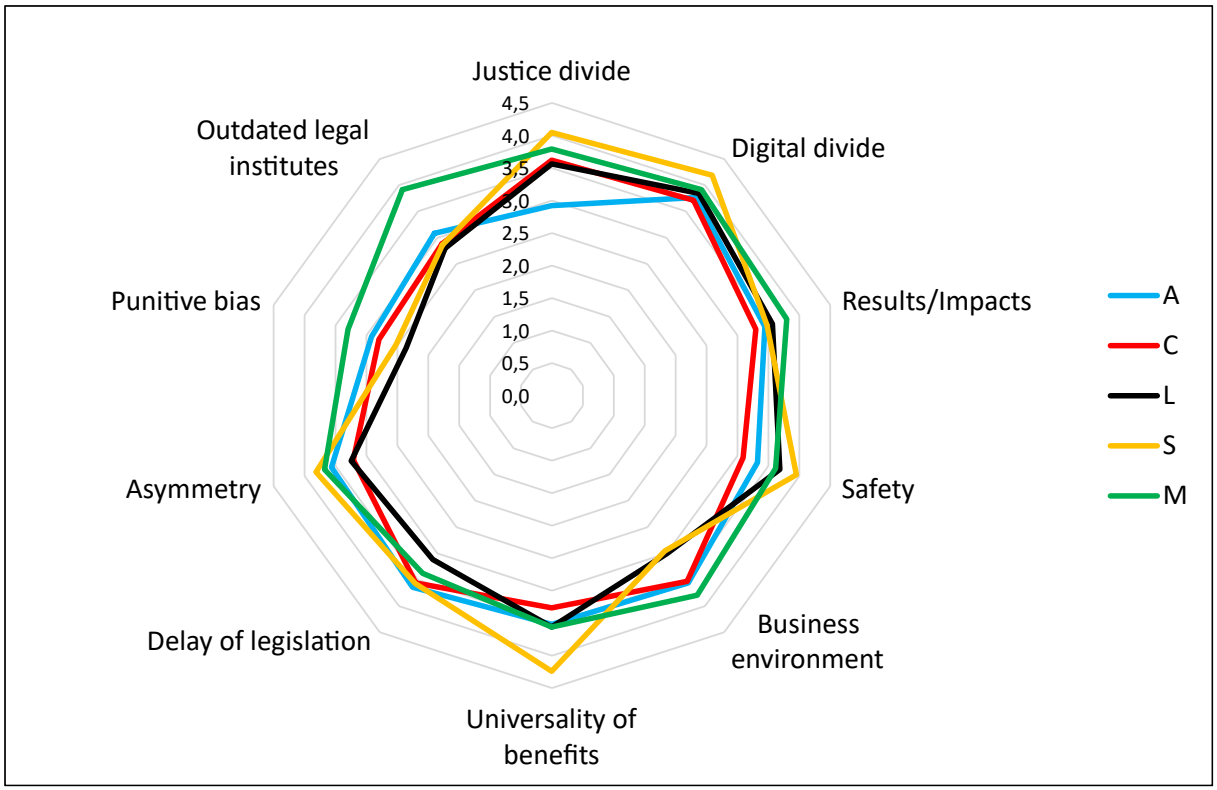

Figure 7. *Radar chart of the QDA group means for Concerns as independent variables for each academic area*

5 Discussion

The sample of respondents minimally covered the study's grand areas of interest for the application of discriminant analysis. However, we obtained 6% of responses which dropped to 5% of invitations forwarded by e-mail after excluding invalid respondents. The low index always raises the question about the meaning of the non-response. In part, it can be explained by the aversion of many researchers to answer any Survey. However, non-participation in the regulation discussion process as a motivator cannot be discarded.

The result of the study exclusively portrays respondents with a positivist legal culture (civil law). The generational profile of the sample has a significant predominance of people who are not digital natives (84%). It is an acceptable result for a universe of professors and researchers nowadays, opening up the possibility of a change in results over the next 10 to 20 years.

A first form of multidisciplinary incidentally captured by the survey was the presence of respondents with undergraduate, master, and doctoral degrees in at least two grand academic fields. These respondents were maintained in the analysis composing a multidisciplinary group that did not stand out in participation and contribution compared to the pure academic areas. Interestingly, it stood out evaluating the liberal value with greater importance when expected for the administration area, more focused on the business environment. Another difficult-to-explain result concerns the greater importance given by the multidisciplinary group for the concern with the punitive bias of regulation and for outdated legal institutions. Could this be related to a trait that is more flexible, innovative, and prone to challenges?

Academic participation, in general, was small and very focused on reading the regulatory proposals presented in public consultations, while practical contributions were very few. This result contradicts the general importance given to the need for participation and the recognition of the possibility of regulating ICT. The discredit with Public Consultation instruments, fueled by restricted dissemination,

tight deadlines, and a negative experience regarding suggestions and criticisms overlooked in previous consultations, may be one of the reasons for the low effective participation in the discussions. It is worrying when one realizes that the IS area, together with Sociology, was the one that most considered its contributions useless. This neglect feeling may justify a slightly lower assessment of the IS area for the possibility of regulating ICT and explaining the greater importance given to the difficulty related to applying existing regulations.

The Sociology area was the only one that showed slightly greater participation, perhaps by tradition and due to the study profile being closer to formulating and evaluating public policies. Naturally, together with the Law area, it contributed more effectively with criticism, suggestions, participation in public hearings, and advice to politicians, companies, and multilateral organizations, including informally.

In general, the respondents recognized the relevance of the difficulties in regulating ICT identified in the literature, except for the apocalyptic cinematographic view of AI. Besides, most independent variables had no power to discriminate between the academic areas. It means there is a common ground of values, perception of needs, and concerns that may facilitate discussions toward regulating emerging ICT.

The overall assessment of the need for transparency, respect for human dignity, diversity, and long-term planning, as well as the concerns about the justice divide, digital divide, and universality of benefits, is consistent with the discussion and production of policy standards and good practices for developing and ethical use of emergent ICT (e.g., IEEE, 2019; High-Level Expert Group on Artificial Intelligence, 2019). The exceptions with ratings with a slightly lower degree of importance were the need for nationalism and the concern about the punitive bias against innovations. In the first case, the assessment may reflect the disruptive effect of the internet and the globalized digital economy on the geographic concept of borders and sovereignty.

The emphasis of the Sociology area on the greater importance of the needs of human dignity, diversity, social protection, having the government as a protagonist, and the concern with the universality of benefits, and the lesser concern with the business environment is an expected result by the tradition of the area. Otherwise, the lesser importance given to incrementalism and to the need to adhere to society is surprising, as the Sociology area values debates and social participation, which fits with the incremental legislative tradition. The result may reflect a sense of urgency of regulation in the face of the perception of risks to values of respect for human dignity and diversity.

A final case was the lesser importance given by the Administration area to the need to respect human dignity and the concern with access to justice. It could also be considered coherent with a common sense about the area expected to provide further importance for the liberal value. However, respondents with a multidisciplinary background detached, considering the liberal value more important than academics in the Administration area.

6 Conclusion

The research answers the call for studies (Gozman, Butler and Lyytinen, 2019; Aanestad et al., 2021) to bridge the gap between ethics and the problem of regulating ICT, contributing to the deepening of the analysis of the difference between four grand areas of Academia in Brazil (Administration, IS, Law, and Sociology), each of which grouping related academic areas.

It is a pioneering study for a problem that is gaining attention and faces the difficulty of demanding a multidisciplinary approach in which the role of the IS area should be the protagonist (Beath et al., 2013, Riemer and Peter, 2021).

Through a discriminant analysis of a survey with 139 professors and researchers, we analyzed the experience, contribution, and perception of the difficulties pointed out in the literature review that regulators have to face and the perception of values, needs, and concerns that represent the worldview of a sample of Brazilian politicians and specialized bureaucrats from the executive and public prosecution service, who participated in the discussions that we interviewed in the previous phase of this research.

The purpose of the study was not to generalize the results from the answers to a few survey questions applied to a limited sample of professors and researchers in the Brazilian scope. However, the study goes beyond the common sense about the characteristic profile of each of the analyzed academic areas, offering an objective description of the differences in perception of the problem of regulating emerging ICT.

Despite recognizing the importance, the overall participation of all academic areas of the study was low. Notably, the absence of the IS area can have severe consequences for the technical effectiveness of the regulations that may be imposed, creating legal uncertainty for businesses and IS professionals in developing solutions and the scientific development of the field. Therefore, the study's main takeaway concerns the possible discredit of public consultations and public hearings as instruments of effective participation of the Academia. It reveals the need for studies on how Academia participates in discussions and the effects of discrediting these instruments on researchers. For example, public consultations that did not receive contributions can be compared to those that presented a better participation performance to assess which aspects compromised participation (e.g., the form of disclosure, the deadline for submitting proposals, the means used to receive contributions, the form of treatment, analysis, and consolidation of contributions).

This takeaway has practical implications for legislators that have to look for alternative instruments to improve the participation of different fields of Academia that do not serve as a mere platform to pretend participation that, in the end, is not used, falling into disrepute.

We hope the research will also contribute to the academic topic concerning multidisciplinary, interdisciplinary, and transdisciplinary collaboration for scientific development.

We can suggest other pathways for future research, taking methodological approaches able to overcome the limitation of self-selection bias of surveys, to deepen knowledge about the most challenging results. First is the lesser importance given by the grand Sociology area to incrementalism and the need to adhere to society. Second, the lesser importance the grand Administration area gives to the need to respect human dignity and the concern with access to justice, considering the impact on a digital business environment with winner-takes-it-all disruptive characteristics. Third is whether the greater concern with the punitive bias of regulation of researchers with multidisciplinary backgrounds could be related to a trait that is more flexible, innovative, and prone to challenges.

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Appendix 1. Research model for discriminant analysis of grand academic fields.

Demographics				
Variable	**Type**	**Question**	**Values**	**Action**
Idade	Ordinal	2. What is your age group?	2 = 21 to 29 years; 3 = 30 to 39 years; 4 = 40 to 49 years; 5 = 50 to 59 years; 6 = 60 years or more	NA
paisnasc	Nominal	3. What is your born country?	Brazil; Outros	NA
paislaw	Nominal		0 = civil; 1 = common-law; 2 = muslim	Convert *paisnasc* to country legal system scale
area	Nominal	4. Identify the area(s) of knowledge of your academic background. * Include undergraduate, master, and doctoral areas.	A = Administration/Management, Accounting, Economy; C = Informatics and Computer Science, Engineering, Mathematics and Statistics; D = Law; S = Sociology, Anthropology, Philosophy, Political science; O = Others, Biology, Medicine, Psychology; M = Multidisciplinary (more than one area)	Convert by aggregating the areas into five grand groups and adding the multidisciplinary area (more than one area) in a sixth group.
servidor	Nominal	5. Do you work as a public servant or in a commissioned position?	0 = No; 0 = Yes, at a Higher Education Institution or Research Center; 1 = Yes, in another body or entity of the Executive, Legislative, Public Prosecutions Service, or Judiciary	Convert to a dichotomous scale to identify servants or commissioned respondents in positions other than that of professor or researcher.

Dimension Participation					
Variable	**Type**	**Question**	**Options**	**Values**	**Action**
particip_lidoc	Nominal	6. How have you participated in ICT regulation discussions in the last five years?	I read the reference document/proposal in Public Consultation.	0 = No; 1 = Yes	Create dummy variables taking as a reference that did not participate. The *Other* option was analyzed and did not add new participation options. Correct the data filled in as Other and missing values as Did not participate.
particip_critic	Nominal		I contributed with criticism/suggestion in Public Consultation.		
particip_palest	Nominal		I participated as a guest speaker at a Public Hearing.		
particip_assist	Nominal		I watched a Public Hearing and forwarded questions through the channel/platform for citizen participation.		
particip_publico	Nominal		I was hired or invited by a government agency to issue an opinion and make recommendations.		
particip_privado	Nominal		I was hired or invited by a company, a class body, or a civil organization to express opinions and make recommendations.		
particip_organismo	Nominal		A multilateral organization hired or invited me to issue an opinion and make recommendations.		
particip_informal	Nominal		I was informally contacted by a parliamentarian, an executive branch authority, a prosecutor, or a judge to issue an opinion and make recommendations.		
particip_nao	Nominal		I did not participate because I did not follow or was not interested in participating.		
particip1	Nominal	Any of the positive participation options were indicated?	if Σ *(particip_...)* = 0	True = 0; False = 1	NA
particip2	Interval	Summing the positive participation options selected	if *particip_nao* = 0	Σ (*particip_...*)	Alternative that allows weighting participation in different ways by the same respondent.

Dimension Contribution					
Variable	**Type**	**Question**	**Options**	**Values**	**Action**
contribuiu_IA	Nominal	7. If you contributed with criticisms or suggestions in the Public Consultations, please indicate which ones.	Brazilian Artificial Intelligence Strategy	0 = No; 1 = Yes	Check and correct the data filled in as Other. Consist with the information filled in the *particip*. Create dummy variables taking as a reference that did not contribute.
contribuiu_5G	Nominal		Brazilian strategy for fifth-generation networks (5G)		
contribuiu_DigiTrans	Nominal		Brazilian Strategy for Digital Transformation		
contribuiu_Inova	Nominal		National Innovation Strategy		
contribuiu_DigGov	Nominal		Digital Government Strategy		
contribuiu_IoT	Nominal		National Plan for the Internet of Things		
contribuiu_OpenData	Nominal		Reference Model for Publication of Open Data		
contribuiu_Starups	Nominal		Legal Framework for Startups		
contribuiu_PETISP	Nominal		Strategic Plan for Information and Communication Technology 2021-2024 of the City of São Paulo		
contribuiu1	Nominal	Any of the contribution options were indicated?	if Σ (*contribuiu_...*) = 0	True = 0 False = 1	NA
contribuiu2	Interval	Summing the contribution options indicated.		Σ (*contribuiu_...*)	Weighting of respondents' contributions by the different alternatives.
aproveitada	Nominal	8. Were your criticisms or suggestions utilized?	0 = Did not participate; 1 = Yes, a good part; 2 = No, very few; 3 = I do not know. I did not check	NA	Convert to a numeric scale

Dimension Difficulties				
Variable	**Type**	**Question**	**Values**	**Action**
-	-	9. In your opinion, how do the elements below impact emerging ICT regulation in terms of difficulty to overcome?	1 = No difficulty; ~ 2 = Few;	Convert to the numeric scale.
dif_acesso	Ordinal	Access to corporate data and algorithms		

Dimension Difficulties				
Variable	**Type**	**Question**	**Values**	**Action**
dif_formareg	Ordinal	Competition and conflict between different forms of regulation	3 = Reasonable; 4 = Lots of; 5 = Extreme difficulty; 0 = I do not know, or I prefer not to comment	
dif_iaapocal	Ordinal	The apocalyptic view of artificial intelligence in Cinema		
dif_lobby	Ordinal	Business lobbying		
dif_relhuman	Ordinal	The complexity of human interaction		
dif_confia	Ordinal	Relying entirely on information/opinions from professional or business organizations		
dif_etica	Ordinal	Incorporate ethics in the design, development, and use of technological artifacts		
dif_tradleg	Ordinal	The enforcement of existing legislation		
dif_falha	Ordinal	Occurrence of failures/fatalities or unlawful use with high media coverage		
dif_multidisc	Ordinal	Multidisciplinary		
dif_valorverd	Ordinal	Sharing true values among the various stakeholders		
dif_cultura	Ordinal	A national culture that influences the flexibility, bureaucracy, and efficiency of regulators		

Dimension Worldview (Values)				
Variable	**Type**	**Question**	**Values**	**Action**
-	-	10. For each selected interview excerpt, mark its degree of importance for the value associated with the statement or question presented.	1 = Irrelevant; 2 = Little importance; 3 = Important; 4 = Very important; 5 = Essential; 0 = I do not know, or I prefer not to comment	Convert to the numeric scale.
val_desafio	Ordinal	**Challenge**: "It is very, very much challenging and exciting, but it is also a privilege for us to live this moment. Fifteen years from now, when everything is better organized, people will look back... Wow, the people who were there at the beginning of the conformation of this new communications scenario...."		
val_humildade	Ordinal	**Unpretentious/Humility**: "...I think that my role is to take the information as clearly as possible, more objectively possible, but I also understand that difficultly I will succeed in changing the opinion of somebody."		
val_neutralidade	Ordinal	**Neutrality**: "I want to make this line very clear so that people... so that professionals have a better quality of life, can work more independently, and apps can also earn more. I think my job is always a win-win."		
val_liberal	Ordinal	**Liberal**: "We can and should discuss the limits of regulation, but not to the point of making the business unfeasible."		

Dimension Worldview (Values)				
Variable	**Type**	**Question**	**Values**	**Action**
val_regsim	Ordinal	**Regulation is possible:** "...the internet is a regulated environment, yes. Moreover, in this environment, the asymmetries, the disparities in strength we already saw in the real environment will reproduce."		
val_regnao	Ordinal	**Regulation is impossible:** "...the internet is an unregulated space, or not subject to regulation, or that should not be regulated."		
val_increment	Ordinal	**Incremental progression:** "Society in order to walk, it... normally... is progressive... and this progressive walk passes through the maturation of matters."		
val_govinef	Ordinal	**Government obstacle/inefficient:** "The point is that it will delay the process and make progress difficult, but this still shows a very narrow view that the implementation of technology is the implementation for the sake of implementation."		
val_tempo	Ordinal	**Waste of time/disbelief:** "Maybe this discussion on a more open model, a public network, or other crypto assets gets lost in the time it takes for a bill to be discussed and appreciated in the House and Senate and be approved. You may end up missing these questions."		
val_cultura	Ordinal	**Culture**: "the big challenge is not even legislative anymore. I think it is cultural."		

Dimension Worldview (Needs)				
Variable	**Type**	**Question**	**Values**	**Action**
-	-	11. For each selected interview excerpt, mark its degree of importance for the need associated with the statement or question presented.	1 = Irrelevant; 2 = Little importance; 3 = Important; 4 = Very important; 5 = Essential; 0 = I do not know, or I prefer not to comment	Convert to the numeric scale.
nec_transp	Ordinal	**Transparency:** "So, it is crucial that society can follow. Today there are tools. Any Brazilian can access TV Câmara, Rádio Câmara, and the Chamber, Senate, and Congress websites and follow the debates."		
nec_dighuman	Ordinal	**Human dignity:** "We really need a law to implement a human department to see if there is injustice with the labor relationship, with people..."		
nec_divers	Ordinal	**Diversity:** "The issue of diversity is not about gender only, but it is diversity in the broadest sense. People are different. Territories are different. So, the fullness of diversity needs to be respected. Because regulation is a standard, and sometimes the pattern is dumb. So, you have to perceive how this affects the different actors in the ecosystem."		
nec_aderesoc	Ordinal	**Adherence to society:** "as these companies that appeared in the market, they greatly reduced the price of the product, and they made the market more agile, that is, the service that is provided is a service provided much faster, much more agile, much more efficient and with a much lower price,		

Dimension Worldview (Needs)				
Variable	**Type**	**Question**	**Values**	**Action**
		society tends to consider that these companies are doing a good business, they are meeting society's desires, these companies are right. They offer work and very high-quality service to society."		
nec_protsoc	Ordinal	**Social protection:** "I believe; I even read some guys on the subject... I believe that a universal basic income should already be considered. I understand the problems of this income because what is basic in one place is not basic in another, but people will need to be prepared to either change jobs or adapt to a new phase. Anyway, it takes at least three years of preparation to change… two years. So, what do you do?... It is complicated."		
nec_govprot	Ordinal	**Government protagonism:** "I often noticed that whoever was in the area, inside the government, had a perhaps more accurate perception of the existing problems than an external consultancy. Of course, it also adds value, but I do not see the possibility of replacing the analysis of those in public administration with a consulting study."		
nec_nacional	Ordinal	**Nationalism:** "You have to commit to the citizen, a commitment to society, a commitment to territory, a commitment to the nation."		
nec_planlp	Ordinal	**Long-term planning:** "Because what I miss as a politician, as a deputy, as someone who feels the need to be accountable, what is our plan for two thousand and forty, two thousand and fifty? Where do we want to go?"		
nec_particip	Ordinal	**Participation:** "I think that the digital divide accentuates the situation that already exists about the fact that not everyone affected by a phenomenon will naturally participate in the construction of solutions. Some will naturally be spectators, and others will be actors, which was already true in the pre-digital world. So, some people want to get involved in political discussion, debates, and participation, and others will complain, they will think it is good and bad, but they will not want to get involved."		

Dimension Worldview (Concern)				
Variable	**Type**	**Question**	**Values**	**Action**
-	-	12. For each selected interview excerpt, mark its degree of importance with the concern associated with the statement or question presented.	1 = Irrelevant; 2 = Little importance; 3 = Important; 4 = Very important; 5 = Essential;	Convert to the numeric scale.
preoc_acessjus	Ordinal	**Justice divide:** "The normal driver does not have easy access to the legal system and, in a way, the apps they samba on. They do wrong things, nobody... the driver does not know how to complain."		
preoc_incdig	Ordinal	**Digital divide:** "My grandmother lives in the countryside. Besides the generational matter, there is no telephone there. I think about the children who are growing up there. They are outside the digital world, where connectivity is a prerequisite."		

Dimension Worldview (Concern)				
Variable	**Type**	**Question**	**Values**	**Action**
preoc_impact	Ordinal	**Results/Impacts:** "The legislation must have much rationality, and a commitment to impacts, to results. It cannot be emotion. Furthermore, much legislation we see being processed and approved is pure emotion. Hence this will usually cause future problems."	0 = I do not know, or I prefer not to comment	
preoc_segur	Ordinal	**Safety:** "My concern is protection. It is so much so that my question to Natália is about safety. My question to you is about security. All the questions I am going to ask are about protection."		
preoc_busin	Ordinal	**Business environment:** "Then, there is our tax system too, which is an insane asylum. Nowadays, with the ease of setting up headquarters abroad, you see several startups setting up headquarters abroad, providing services here. We are scaring away the best we can have."		
preoc_univers	Ordinal	**Universality of benefits:** "To serve the citizen within a state whose contact difficulty is much broader than in the region where we live. So, this discussion comes up a lot at this moment of the pandemic and the debate on 5G."		
preoc_defasleg	Ordinal	**Delay of legislation:** "Today, due to digital transformation, we see a phenomenon in which everything becomes the object of technology. All sectors of the economy, society, and the public sector are now impacted by these technological phenomena that generate a brutal change in the speed at which things happen and quickly create this lag in legislation approved by the National Congress."		
preoc_assimet	Ordinal	**Asymmetry:**" It is a dispute, shall we say, illegitimate because some are subject to the entire regulatory framework, others are not."		
preoc_punicao	Ordinal	**Punitive bias:** "Today, the rules are so strict on top of the error that, as I said, the person has no incentive to think outside their line there ((gesture with the hands in parallel limiting the vision)) with fear of making mistakes. Moreover, they are afraid of being punished... improbity... Today, I think the fear of making mistakes has become more expensive than corruption."		
preoc_instleg	Ordinal	**Outdated legal institutes:** You have our constitution, our fundamental document, and a series of mechanisms to protect certain legal assets which no longer make sense. How will I restrict foreign capital on the internet if I can access the content from anywhere? Does that make sense? Does it make sense to talk about content quota? Does it make sense to speak about granting so you can provide a service?		