The Two Sides of the Innovation Coin

Full Paper

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Abstract

With the use of the Stakeholder Theory and the Diffusion of Innovation Theory, a Model for Analysis of the Consequences of IT Innovation Adoption was developed, addressing both positive and negative sides of innovation consequences. The Model has been validated in interviews with PhDs specializing in the field, then applied to the case of Open Data adoption by the Federal District Government of Brazil. In the empirical study, 95 consequences for various stakeholders were categorized. The study's synthesis can be viewed in a single image that reveals the similar and conflicting understandings of the different innovation stakeholders, and can be used as an innovation management tool: the Map of Consequences of Innovations Adoption.

Keywords

Consequences of innovation adoption, consequences of innovations, pro-innovation bias, open data, open government data.

Introduction

The search for innovation has required considerable effort from entrepreneurs, government officials and academics in order to add more value to products or services delivered to recipients. Some take it to be the fuel of the economy, the solution to social problems and the remedy for lack of competitiveness (Bessant and Tidd 2007). However, despite the remarkable role played by innovations as a key factor in the evolution of mankind (Tigre 2014), this approach does not encompass all the characteristics of this phenomenon, given that both positive and negative consequences stem from innovation (Jassen 2004).

This work discuss that whether an innovation is perceived as good or bad depends on the point of view of who is suffering its consequences and propose a model to analyze the consequences of IT innovations adoption in the perception of different stakeholders, based on the assumptions of the Stakeholder Theory (Freeman and Reed 1983; Freeman 1984; Mitchell, Agle and Wood 1997) and the Diffusion of Innovations Theory (Rogers 2003). To illustrate and refine the theory, a qualitative case study of adoption of Open Data by the Federal District Government of Brazil is presented.

Innovations and Their Consequences

Innovation seems to be trendy now. We can see a whole generation making efforts to innovate, in a true innovation cult (Fontenelle 2012), to the extent that, according to an anonymous claim in the technology scene: "Startups are considered the new Rock and Roll". That is, while young people used to spend a huge amount of time in a music studio, practicing with their instruments, dreaming of playing in a band as big as the Beatles, today many young people get together in technology-based start-ups, hoping to become the next Mark Zuckerberg (billionaire creator of Facebook.com).

In this context, we can see several companies founded in recent years bringing significant changes to the markets where they operate, such as: Uber in the transportation market, Netflix in movie rental, Airbnb in the hotel sector, and Whatsapp in telecom. Each of these companies can be seen as an example of what Schumpeter (1934) called creative destruction, given the implication for the markets in which they operate. In Schumpeter's view, technological change drives development, revolutionizing the economic structure from within, in a process of new combinations (innovations), which come in waves or clusters concentrated in time, and explaining the cycles that the economy goes through. This economic aspect has already been widely discussed in the literature (Schumpeter 1934; Rosenberg 1982; Freeman and Soete 1997; Nelson and Winter 1977 and 1982; Dosi 1984).

However, this creative destruction also brings about changes to other stakeholders beyond the company that disseminates innovation and its direct competition. Still thinking of the examples above, what is the consequence of Uber for the Government? If several taxi drivers leave the market and only one large company provides this type of service, will the price to the final consumer increase? Can Netflix also influence demand for traditional cinema? With this concentration of content into a single portal, are artists restricted only to the channel's major productions? Will the use of Airbnb lead to an increase of apartment burglaries? Moreover, if the room rented through the website does not match the available photos, who to turn to? WhatsApp, in turn, uses the infrastructure of telecom operators, but does not contribute to its improvement. If telecom companies stop operating, and Whastsapp also stops working, what will happen to consumers?

These aspects indicate that current market dynamics involve a wide range of stakeholders and contexts, for which a model to analyze the consequences of adopting IT innovations that takes into account economic, social, political, psychological and technological aspects of innovations, as well as their positive and negative characteristics, would be of great value.

In this regard, Rogers's Diffusion of Innovation Theory - DIT (2003) provides the foundation for the development of a comprehensive model to analyze the consequences of adopting innovations. For the author, innovation can be understood as an idea, practice or object that is perceived as new to an individual or to another adopting unit (company, association, government, etc.). For Rogers, it does not matter if the idea is really new from the viewpoint of when it was first used or discovered. What matters is the perception of innovation and the reaction to this novelty. That is, if the idea seems new to the adopter, its use is an innovation.

Rogers (2003) also presents in the DIT a definition for the consequences of adopting innovations, described as changes that take place for an individual or a social system as a result of the approval or rejection of an innovation. According to the author, despite the importance of the consequences of innovations, they have received very little attention from researchers as well as from the agents of change, who should recognize their responsibility for the consequences of the innovations they introduce, to the extent of being able to identify their advantages and disadvantages.

Sveiby et al. (2009) conducted a study on undesirable and unintended consequences of innovations, confirming the findings of Rogers (1983) regarding gaps in the study of innovation consequences, especially negative ones. While Rogers in 1983 found that only 0.2% of papers on innovation addressed innovations consequences, the research of Sveiby et al. found in 2009, nearly 30 years later, that only 0.1% of papers on innovation addressed its unintended and undesirable aspects (some examples of research in this field can be found in Bawden and Robinson 2009; Markus and Mentzer 2014; Tarafdar et al. 2015).

Both Rogers (1983) and Sveiby et al. (2009) studies lead to the reflection that a result may be desirable (positive) or undesirable (negative) depending mainly on the viewpoint of whoever it refers to and, therefore, the Stakeholder Theory (Freeman and Reed 1983; Freeman 1984; Mitchell, Agle and Wood 1997) appears to provide to the study of the consequences of IT innovation adoption a broad understanding of the phenomenon.

Freeman (1984) characterizes stakeholders as any group or individual who can affect or is affected by the achievement of the organization's objectives, giving rise to awareness of the influence of various players over organizations. This aspect, until then, was not taken into account in the analyses conducted by companies, which focused on the shareholder or owner as the main justification for organizational action. According to Freeman and Reed (1983) there are other groups for which the organization is responsible,

such as employees, customers, suppliers, funders and society, and these groups also have influence over organizational action.

Although the stakeholder theory was developed within a global vision of the organization, its use can be focused on specific situations in which the stakeholders take a position regarding a particular issue and are interested and can express a preference, such as in the case of corporate innovation projects (Vos and Achterkamp 2006; Troshani and Doolin 2007).

Two models for the study of innovation consequences employing the stakeholder theory were found. The model of Bloomrosen et al. (2011) provides an indication that the analysis of the consequences should be directed to a specific innovation. The authors conducted studies of the undesirable consequences of adopting information technology in health services, taking advantage of the classification made by Rogers (2003), as well as the studies of Ash, Sittig, Dykstra et al. (2007). On the other hand, Sveiby et al. (2012) develops the analysis of undesirable and unanticipated aspects of innovations. However, a criticism of the model of Sveiby et al. (2012) concerns the eminent focus on the dysfunctions of innovations.

The aspect highlighted in this study is that to analyze the consequences of innovations, one cannot choose just the side of the desirable consequences or the other side of the undesirable consequences, just as we cannot talk about the cost-benefit of something without knowing the cost or without knowing the benefit. It is a relationship, and in order to understand a relationship, both sides need to be understood, as the two sides of the same coin.

Thus, based on the literature surveyed, a Model for Analysis of the Consequences of IT Innovation Adoption was developed, within the framework of an empirical study divided in two phases, as shown below.

Model for Analysis of the Consequences of IT Innovation Adoption

The research was divided into two distinct phases: Phase 1 - Development of the Model for Analysis of the Consequences of IT Innovation Adoption and Phase 2 - Application of the Model for Analysis of the Consequences of IT Innovation Adoption. In Phase 1, we sought to collect the opinion of PhDs specialized in innovation to validate the Model for Analysis of the Consequences of IT Innovation Adoption developed according to the theoretical framework surveyed. In Phase 2, the validated theoretical model was used to study, through interviews with stakeholders, the case of the Open Data innovation adopted by the Federal District Government of Brazil.

Phase 1 – Development of the Model for Analysis of the Consequences of IT Innovation Adoption

In order to validate the conceptual model developed, we targeted as subjects individuals with academic and professional experience that would allow in-depth review of the proposed theoretical model, so that the participants of phase 1 of the study should necessarily have two characteristics: a doctorate degree and research in the field of Innovation. Altogether, nine interviews were conducted, totaling approximately 6 hours of recorded audio. It should be noted that the total number of respondents (nine) was determined by theoretical saturation of the 5 pre-formulated categories, following the recommendation for two additional interviews to be carried out after the meeting of the saturation point.

Initially, the interview audio was transcribed with the aid of Express Scribe Transcription Software Pro. Then, the data of the transcribed interviews was analyzed using the RQDA software (R programming language package). The data was analyzed through content analysis, as recommended by Bardin (2011). Thus, in the pre-analysis phase, the documents to be submitted for analysis were established, objectives were formulated and indicators defined to provide the grounds for the final interpretation. Then, with the aid of the RQDA software, the material was explored, through execution of coding and categorization procedures. Upon conclusion of the analysis procedures, 351 registration units (themes) were found and grouped into 41 codes for the 5 pre-formulated categories. Finally, in the stage of treatment and interpretation of the results, the data was treated so as to make it significant and valid.
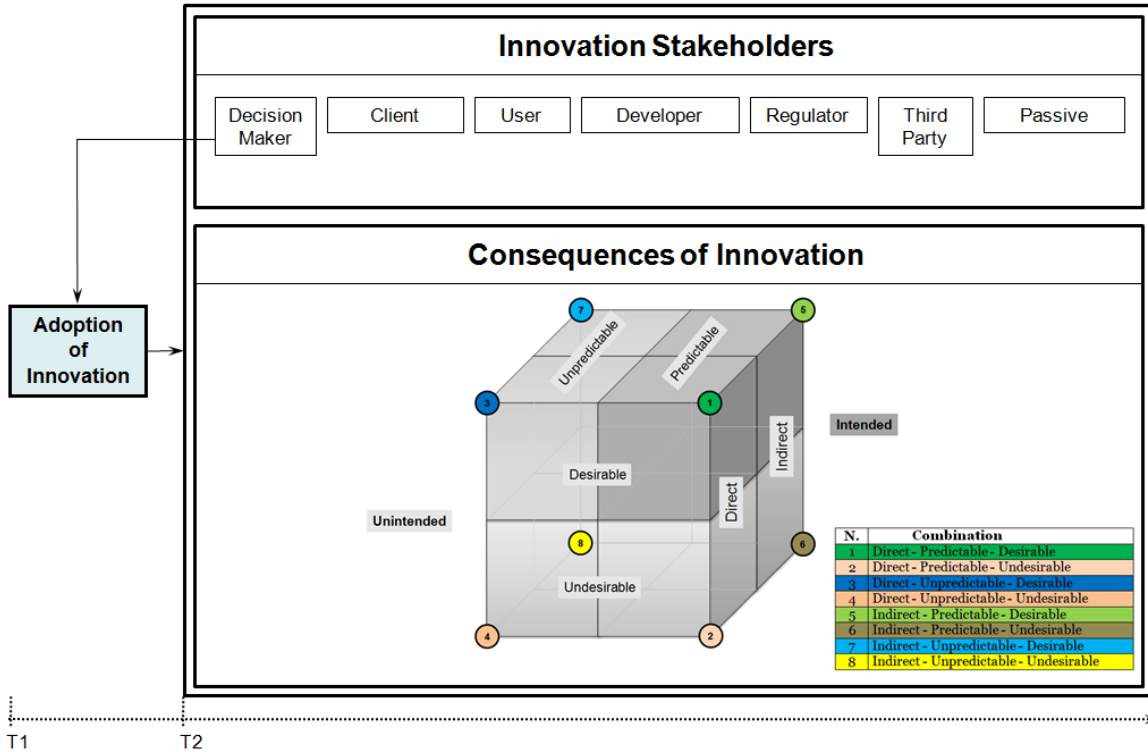
Figure 1. Model for analysis of the consequences of IT innovation adoption, prepared by the author based on Rogers (2003), Vos and Achterkamp (2006), Bloomrosen et al. (2011) and Sveiby et al. (2012).

Phenomenon	Dimension	Term	Concept
Innovations Innovation is defined as an idea, practice or object that is perceived as new by an individual or other unit of adoption (company, association, government etc.), whether or not the idea is objectively new from the standpoint of when it was first used or discovered. The perceived newness of the idea for the individual determines his or her reaction to it. That is, if the idea seems new to the individual, it is an innovation (Rogers, 2003).	**Consequences of innovations** The changes that occur to an individual or a social system as a result of adoption (decision to use and implement a new idea) or rejection of an innovation (Rogers, 2003).	**Desirable Consequences**	Those that represent the functional effects of an innovation for an individual or a social system.
		Undesirable Consequences	They are related to the dysfunctional effects of an innovation for an individual or a social system.
		Direct Consequences	The changes to an individual or social system that occur in immediate response to the adoption of an innovation.
		Indirect Consequences	They are related to changes to an individual or social system arising from the direct consequences of an innovation.
		Predictable Consequences	The changes resulting from innovations that can be anticipated at the time of adoption.
		Unpredictable Consequences	The changes resulting from innovations that can not be anticipated at the time of adoption.
		Intended Consequences	Consequences that are necessarily Predictable and Desirable.
		Unintended Consequences	Consequences that are not Predictable and Desirable simultaneously, and that may be either Predictable or Desirable.
	Innovation Stakeholders Is it any group or individual who can affect: (1) the achievement of the innovation's objectives; or (2) that is affected by the achievement of these objectives. (Vos and Achterkamp (2006).	**Decision maker**	Decides whether an innovation will be adopted, based on analysis of the requirements.
		Client	Establishes the requirements of innovation.
		User	Uses innovation.
		Developer	Contributes to the development of innovation.
		Regulator	Influences innovation through rules and regulations.
		Third party	Can influence the results of innovation both positively and negatively, but does not fit the other classifications.
		Passive	Is affected by the results of innovation, without being able to influence these results.

Figure 2 - Phenomenon, Dimension, Terms and Concepts of the Model for Analysis of the Consequences of IT Innovation Adoption

As a result of it was possible to propose a Model for Analysis of the Consequences of IT Innovation Adoption, as described in Figure 1, with its concepts presented in Figure 2. To better illustrate the possible combinations of consequences and their dynamics, a cube was drawn in Figure 1, wherein each dichotomy is located on its face and its counter-face, so that each corner of the cube provides one of the 8 kinds of different combinations of Desirable and Undesirable, Direct and Indirect, Predictable and Unpredictable consequences. It was named ACIA Cube (Cube for Analysis of the Consequences of Innovation Adoption).

The ACIA Cube allows us to demonstrate another important aspect regarding the dynamics of consequences over time, which can lead to a given consequence changing between different possibilities at different times. Thus, with support from the work of Vos and Achterkamp (2006), which sets out four stages for an innovation project, it is understood that over time certain consequences move between different possibilities for each of the stakeholders, demonstrating that the understanding of certain consequences may change for stakeholders over time (Figure 3), a situation that can be apprehended with the systematic use of the Model for Analysis of the Consequences of IT Innovation Adoption.
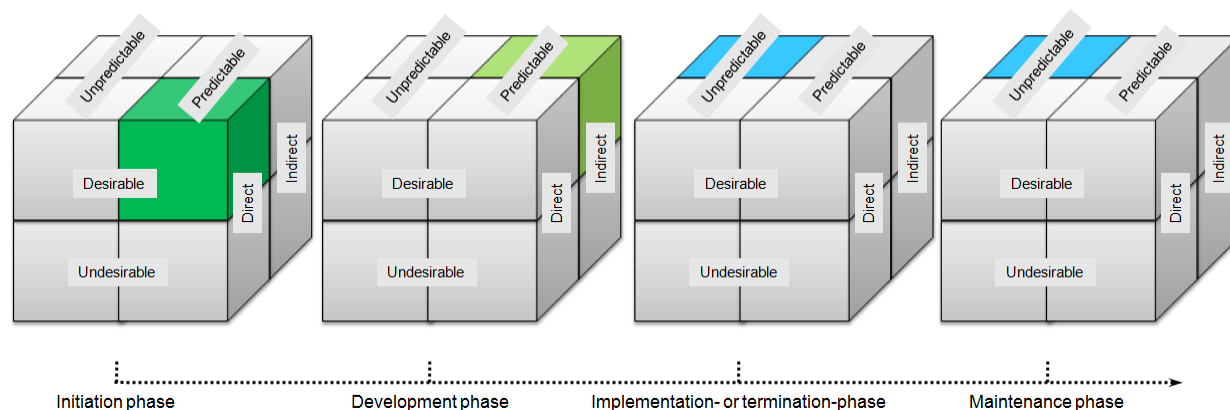
Figure 3. Visual representation of possible variation of the ACIA Cube over time for each stakeholder

Phase 2 – Application of the Model to the Open Data Innovation Adopted by the Federal District Government of Brazil

Aimed at analyzing the relationships between innovation stakeholders and the consequences of innovation adoption, the Model for Analysis of the Consequences of IT Innovation Adoption, validated after interviews with experts, was used to assess the adoption of Open Data by the Federal District Government of Brazil - GDF. To this end, the innovation to be investigated was established: Open Data.

Open Data concerns the active publication of primary data that is complete and updated, in reusable format and license free, with a view to increasing transparency and social participation in pursuit of mutual benefits (both for the organizations that open their data and those that use the open data). As defined by the Open Knowledge Foundation, "open data is data that can be freely used, re-used and redistributed by anyone, subject only, at most, to the requirement to attribute and share-alike." (Open Data Foundation 2012).

To examine whether the model developed to analyze the consequences of innovations matched the specific case of Open Data in the Federal District Government of Brazil, interviews were conducted with at least one representative of each of the roles described in the model involved with this innovation, namely: Decision maker, Client, User, Developer, Third party and Passive. The Decision maker was the first to be interviewed, and through him, in a snowball technique, other stakeholders were identified. It should be noted that the information regarding the consequences attributed to the Regulator stakeholder was obtained from a documental report by an entity that disseminates standards for Open Data use. Altogether, seven interviews were conducted, totaling about 5 hours of recorded audio. Similarly to the procedures adopted in the first phase of the study, the audio of the interviews was initially transcribed

with the help of Express Scribe Trascription Software Pro, then analyzed with the use of RQDA software. Data were analyzed using content analysis (Bardin 2011).

After the analysis procedures were carried out, ninety-five consequences of the adoption of Open Data by the Federal District Government of Brazil were found, mentioned spontaneously by respondents. Each one of the consequences was analyzed according to the typology of consequences of innovation adoption developed in the analysis model, i.e. classified as direct or indirect, predictable or unpredictable, desirable or undesirable consequence. Another aspect to be highlighted concerns the total of consequences for each possibility of the typology, for every corner of the ACIA Cube. Thus, frequency was counted and percentages demonstrated for the case of Open Data in GDF, according to Table 1.

N.	Type of Consequence	(n)	(%)
1	Direct - Predictable - Desirable	11	11,6%
2	Direct - Predictable - Undesirable	14	14,7%
3	Direct - Unpredictable - Desirable	0	0,0%
4	Direct - Unpredictable - Undesirable	10	10,5%
5	Indirect - Predictable - Desirable	39	41,1%
6	Indirect - Predictable - Undesirable	7	7,4%
7	Indirect - Unpredictable - Desirable	4	4,2%
8	Indirect - Unpredictable - Undesirable	10	10,5%
	TOTAL	95	100%

Table 1 - Frequency for each type of consequence of ACIA Cube found in the case of Open Data in the Federal District Government of Brazil

It should be noted, in Table 1, that Indirect consequences were mentioned almost two times more frequently than Direct ones, 63,2% versus 36,8%, an aspect which can be attributed to the possibility of indirect consequences having several generations of effects over time, as pointed out in the model of Sveiby et al. (2012).

The greatest discrepancy between categories was found in the Predictable types, 74,7%, and Unpredictable types, with 25,3%. This, together with observations on the Desirable types, 56,8%, and Undesirable types, 43,2%, leads to the conclusion that if most consequences are known in advance and still a large number of them is undesirable, many of the consequences of innovation adoption are treated as trade-offs, as raised by Ash, Sittig, Dykstra et al. (2007) and Bloomrosen et al. (2011).

Still on the Desirable types, 56,8%, and Undesirable types, 43,2%, the percentage proximity of observations in both cases drew attention. Given the literature raised about the pro-innovation bias (Abrahamson 1991; Rogers 2003; Sveiby et al. 2009), it was expected that the Desirable observations would top the undesirable, an aspect that was not found in the case under study.

Another important aspect concerns the almost equal division between Intended consequences, 52,6%, and Unintended ones, 47,4%, for although 6 of the 8 possible combinations concern the Unintended consequences, the 2 possible combinations of the Intended consequences are still more frequent.

It should be noted that the findings are not consistent with generalization 11-2 of Rogers (2003, p. 388), in which the author states that Undesirable, Indirect and Unpredictable consequences generally appear together, as do the Desirable, Direct and Predictable consequences. In the case of the study in question, the percentage sum of the two possibilities is equal to 22,1% of the raised consequences (11,6% + 10,5%), counting the other possibilities which are beyond the generalization with 77,9% of the observations.

The possibility with the lowest number of occurrences referred to Direct, Unpredictable and Desirable consequences, which were not mentioned in the context of this study. On the other hand, the most frequent consequences were Indirect, Predictable and Desirable, with 39 mentions, representing 41,1% of

the findings. This appears to refer to the type of innovation studied, since, as emerged in the interviews, Open Data encourage participation and social control.

Upon grouping the consequences, given that different stakeholders mentioned the same consequence in some cases, it was possible to arrive at 57 consequences that, together with the validated typology, made it possible to analyze the relations between the Stakeholders and the consequences of adopting the Open Data innovation in the Federal District. The consequences are shown in Figure 4, which summarizes in a single image how the types of consequences indicated are perceived by the different stakeholders interviewed, named Map of Consequences of Open Data Adoption by the GDF.

With the aid of the map, one can immediately see some issues. To start, it is noted that a color scheme was used to better demonstrate how different perceptions of the stakeholders are perceived in relation to the whole of the consequences. Thus, the consequences were ordered with the highest number of citations at the top, and the lines were subtracted from the image to ensure visual fluency.

From the beginning, it is possible to see the difference between the quadrants dark and light green and the other quadrants. The quadrants in green color (type 1 and 5 squares of the ACIA Cube) are the Intended consequences, while the others correspond to the Unintended consequences. The dark blue color is not present on the map, meaning the absence of Direct, Unpredictable and Desirable consequences (type 3 square of the ACIA Cube), as already mentioned. The type 7 of the ACIA Cube (color light blue) consequence has only 4 observations; they are happy surprises according to Ash, Sittig, Dykstra et al. (2007), characterizing Indirect, Unpredictable and Desirable consequences.

The perception of the different stakeholders regarding some consequences is also similar. On 7 occasions, at least three different stakeholders claimed to perceive the same consequence, which can be seen in lines 1, 3, 4, 5, 6, 8 and 10. We can also see when full alignment is missing among all the stakeholders regarding the same consequence, a fact that occurs 6 times in the 57 occurrences raised, totaling about 10% of occurrences with different consequences for different stakeholders, which can be observed in lines 1 , 2, 5, 7, 9 and 17, which relate, respectively, to the following consequences: Competition for visibility of transparency resulting from open data; Intra-organizational conflicts; Possibility of providing intelligible information to any citizen, even citizens not specialized in data handling (intelligibility); Demonstration of budget limitations for investment in Open Data; Little demand for open data already available (low social engagement); and Contract with NGOs for diagnosis aimed at implementation of an Open Data policy.

In the case of line 1, the consequence with the greatest number of mentions (five), which addresses Competition for visibility of transparency resulting from open data, a dispute was found between areas of government that was considered unpleasant by all respondents. The difference is that for one of them the consequence was Direct and for the others Indirect. In line 2, the consequence of intra-organizational conflicts was detected. Such conflicts arise from technical changes, political definitions and mental paradigms associated with the use of Open Data.

Another use of the map is to observe the Stakeholder column directly. For example, the Passive column presents only Intended consequences (five observations), which makes sense since this stakeholder is by definition the farthest from innovation. In turn, the column that grouped Clients and Users presents many Unintended consequences (fifteen observations), which can be considered innovation improvement points. Finally, despite the previously described tendency of innovation supporters to see only the positive aspects of what they are trying to disseminate (Abrahamson, 1991; Rogers, 2003; Sveiby et al., 2009), the Decision maker in this particular case is an exception to the rule and is aware of a number of difficulties arising from the innovation that he or she is driving, as shown in the column grouping the Decision maker's answers.

Thus, the collection of the views of different stakeholders on the same innovation generated a versatile and broad framework for the treatment of innovation that, without the participation of these different stakeholders, would be hard to obtain. These points are therefore reflected in theoretical contributions, given that they develop part of the DIT, with its connection with the Stakeholder Theory, indicating a direction for studies that address the consequences of innovation adoption. While this new mechanism of demonstrating the positive and negative aspects of innovation provides a practical contribution to innovation management, the Map of Consequences and, at least regarding the situation of open data in GDF that was investigated, identifying the unpredicted consequences, can be used for learning and improving both innovation and its implementation process.
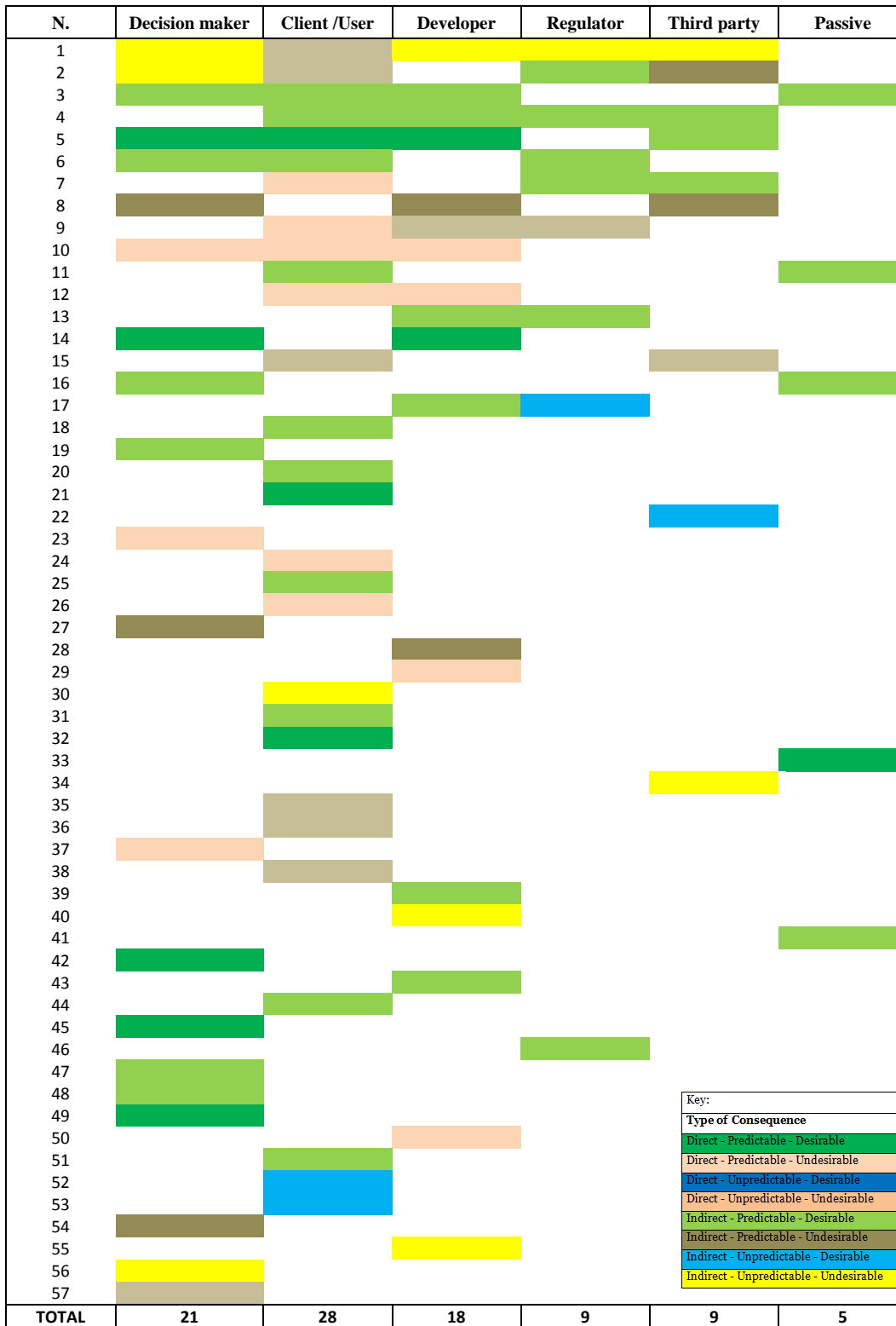
N.	Decision maker	Client /User	Developer	Regulator	Third party	Passive
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55						
56						
57						
TOTAL	21	28	18	9	9	5

Key:

Type of Consequence

- Direct - Predictable - Desirable
- Direct - Predictable - Undesirable
- Direct - Unpredictable - Desirable
- Direct - Unpredictable - Undesirable
- Indirect - Predictable - Desirable
- Indirect - Predictable - Undesirable
- Indirect - Unpredictable - Desirable
- Indirect - Unpredictable - Undesirable

Figure 4. Map of Consequences of Open Data Adoption by the Federal District Government of Brazil

Conclusions

Based on the assumptions of the Diffusion of Innovations Theory (Rogers 2003) and the Stakeholder Theory (Freeman 1984), this study aimed to identify and categorize the consequences of innovation adoption in the perception of different stakeholders, contributing to studies in the field of innovations, especially in the development of an approach that takes into account not only the positive aspects of innovation, but also the difficulties that arise from it, in a broader perspective that goes beyond the pro-innovation bias.

It was possible to achieve the general objective of this study, namely, to identify and categorize the consequences of innovation adoption in the perception of different stakeholders, contributing to studies focused on innovation in a peculiar way, since, while it is unnecessary to emphasize positive aspects stemming from innovations, given the extensive literature on this subject (Fagerberg et al. 2006; Hall and Rosenberg 2010), on the other hand it is also important to recognize that there are negative aspects arising from innovations. This condition must be reflected, and the method developed here demonstrates empirically for the case of Open Data adoption by the Federal District Government of Brazil that 43,2% of its consequences were deemed undesirable.

The study, therefore, contributed to the DIT, coupled with the Stakeholder Theory, and opens a new front for studies aimed at monitoring innovations that are largely concerned only with economic aspects or the economic versus social relationship. With the model, it is possible to analyze the numerous possibilities that the consequences of innovation adoption may have, such as psychological, social, political, technological and economic ones.

Still from the academic perspective, the study proves that different stakeholders of an innovation can perceive differently the effects of the same consequence, which has the potential to explain the organizational phenomenon known as resistance to change (Coghlan 1993), as an action arising out of the conflict between these points of view. The survey also made it possible to raise a number of occurrences that can be treated as opportunities or threats by the researched organization, which can contribute to efficiency in achieving organizational objectives and also to the literature on risk management (Beck 1992; Raz and Hillson 2005).

From a practical point of view, the method used in the study can be used to monitor the innovation process (Tidd, Bessant and Pavitt 2005), both in the private and public sector, since the Model for Analysis of the Consequences of IT Innovation Adoption developed here enables broad monitoring of the consequences related to innovation. For example, funding agencies concerned with the results of the initiatives that they support may find in this material a new perspective for monitoring their projects.

It is also necessary to recognize the complexity of the matter, expressed in numerous possibilities that the consequences of innovation adoption may bring about on multiple levels: individual, organizational and societal; and with effects that may vary over time (Figure 3).

As to an agenda for future studies, another possibility to be explored would be to apply the concept of salience (Mitchell, Agle and Wood 1997) in studies on the list of stakeholders surveyed in the study, which can be used for further study of the influence of innovation stakeholders on the Decision maker. Yet another possibility would be to use the model to analyze the connections between the different stakeholders with regard to the actions of the User, contributing to studies that address consumer resistance (Kleijnen et al. 2009).

The Model's comprehensive nature can also be used, together with theories that address the paradox of productivity (Brynjolfsson and Saunders 2010), to analyze whether investments in Innovation and Communication Technologies (ICTs) produce other types of return to organizations that are not specifically related to resolving bottlenecks or expediting existing processes, such as innovations involving the participation of new agents, organizational arrangements, digital tools, management practices and business models, which can be combined to produce new goods, processes and services in both the private and the public sector (Pinheiro and Tigre 2015).

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