Examining Sources of Resistance to the Implementation of a Patent Management System in a Developing Country: Evidence from a Case Study of the Brazilian Patent Office

Gabriel Canto Cavalheiro, Luiz Joia

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Gabriel Marcuzzo do Canto Cavalheiro, Luiz Antonio Joia

Getulio Vargas Foundation, Praia de Botafogo, 190 - 4º e 5º andares; CEP 22253-900; Rio de Janeiro; Brazil
gabmcc@fgvmail.br, luiz.joia@fgv.br

Abstract. User resistance to information systems implementation has been identified as a significant reason for the failure of new systems and hence needs to be understood and managed. While previous research has explored the reasons for user resistance, there are gaps in our understanding of how users evaluate change related to a new information system within patent office organizations. This paper explores the sources of resistance associated with the implementation of a Patent Management System (PMS) at the Brazilian Patent Office, which is named ´Instituto Nacional da Propriedade Industrial` (INPI). This study investigates typical types of user resistance together with strategies for overcoming these resistances. In the case under analysis, the study shows that resistance to the PMS caused a delayed adoption of the system and the main motives for resistance were: the employment relationship and the perceived interference of the system with the power and autonomy of the patent examiners.

Keywords: Information systems, resistance, patent office, implementation

1 Introduction

As the value of companies is increasingly determined by their ability to innovate, the protection of intellectual property (IP) assets has become absolutely paramount in the current knowledge-based economy. Consequently, since a patent office enables the protection of inventions through patents, it is becoming an essential public institution in supporting enterprise value creation. In fact, two essential objectives underlie a patent office. On the one hand, it promotes more investment in research and development by providing a monopoly to the inventor in exploring the invention [22]. On the other hand, it encourages the disclosure of inventions so that others can use and build upon research results [7]. According to van Pottelsberghe and Mejer [25], the operation of a National patent office affects directly the credibility of the patent examination process and, as a consequence, the demand for patents by firms. Hence, this type

adfa, p. 1, 2011.

of public organization is constantly seeking to improve efficiency and effectiveness of its operations [2; 25].

Accordingly, over the past decades, Information and Communication Technology (ICT) has been largely adopted by patent offices throughout the world as an instrument to enhance execution of business processes. In practice, the ICT solutions adopted by these offices are often referred to as e-government solutions. Based on that, this research has adopted the e-government definition proposed by Stanforth [24], which defines e-government as the socio-technical arena within which information and communication technologies are applied to organize public management in order to increase efficiency, transparency, accessibility and responsiveness to citizens.

Although governments are traditionally considered more conservative entities, slower to adopt new initiatives than players in the business realm, various authors recognize that there are many opportunities for developing e-government applications [16; 4; 18]. In the particular context of e-government, there is a widespread consensus that knowledge about public information systems has turned into a critical resource for public organizations [24]. As such, given the scale and complexity of their operations, patent offices are characterized by their extensive use of ICT.

However, user resistance to information systems implementation has been identified as a significant reason for the failure of new systems and hence needs to be understood [12]. A primary assumption is that information systems frequently embody a distribution of intraorganizational power among the key actors affected by its design [17]. So far, the extant literature in IS has widely covered the area of user resistance, primarily when it comes to health information systems [17; 14; 13; 10], but is largely silent on the context of information systems implemented within national patent offices. To our knowledge, this article is the first contribution addressing the sources of resistance to IS implementations within patent office organizations. This paper is aimed at identifying sources of user resistance that may occur when implementing an information system supporting the operations of a patent office.

The outline of this paper is as follows. First, we provide a literature review on topics central to this research as the theories addressing resistance to information systems. Following this, the research methodology is discussed. Then, the empirical setting is provided by assessing the resistance to the implementation of an information system at the Brazilian patent office. Subsequently, reflections are made regarding the lessons learnt from the case. Finally, our conclusions are put forward.

2 Literature Review

2.1 Patent Office

As pointed out by Pavitt [20], innovation is inherently uncertain, given the impossibility of predicting accurately the cost and performance of a new artifact, and the reaction of users to it. Hence, the logic behind the patent system assumes that firms invest in risky R&D activities in order to generate innovative new technologies. These firms can protect their new technologies by applying for a patent [2; 9]. In case the patentholder intends to commercialize the invention in other countries, a patent application needs to be filed in the national patent office of each desired country [25].

In practice, patent office organizations are public bodies responsible for processing patent applications for a country [8]. In short, the simplified workflow of patent offices can be described in the following way. First, the patent office receives patent applications continuously. After a period of confidential deposit, the patent applications are classified and sent to patent examiners with adequate technical background. Then, the patent examiner assesses the invention and search for prior art to decide whether the invention is patentable [25].

2.2 Resistance to Information Systems

Our research provides a review and interpretation of resistance in the particular context of IS implementation. As a matter of fact, the expression “Resistance to Information Systems”, as used in this article, includes all instances both of non-usage and of inadequate use of information systems by the potential users [17]. This resistance is also identified when individuals adopt behavior that may lead to the discontinuation or removal of the system [14; 12].

IS literature has examined the phenomenon of resistance primarily concerning health information systems [6; 10; 13]. For instance, Horan et al [10] demonstrated that medical professionals will not allow a system to become successful within a hospital if it is inadequate for their work practices. Similarly, Paré [19] conducted multiple case study to understand resistance to the implementation of clinical information systems within a US hospital. Nevertheless, the pioneering work of Markus [17] continues to be the sole benchmark in the treatment of collective behavior within the scope of the organization. Lapointe and Rivard [14], in turn, elaborated a theory that integrates the individual and collective levels of action.

Previous literature suggests several theories for understanding the cause of user resistance to IS implementations. According to Markus [17], there are three alternative vectors, derived from the general view of resistance. These three vectors comprise: System-Oriented Theory, People-Oriented Theory and Interaction Theory.

System-Oriented Theory.

Fundamentally, the system-oriented theory states that individuals or groups pose resistance to IS implementations due to factors related to the design of the system. As such, the system-oriented theory argues that resistance is derived from external factors related to the system’s design [13]. Markus [17] cites the following as examples of system factors that incur resistance: lack of user-friendliness, technically deficient systems, and poor ergonomic design. According to the system-determined theory, when such factors are present, the system’s intended users will resist its utilization.

People-Oriented Theory.

People-oriented theory suggests that people resist the new system because of factors internal to a person or group [11]. As such, this theory presupposes that people or groups resist information systems for factors of a personal nature [17]. Examples of this vector include, for instance: lack of training, fear of computers and the lack of perceived utility by the user in relation to the system.

Interaction Theory.

The interaction theory is certainly the most sophisticated of the three theories. That theory involves people factors as well as system factors. This explanation identifies neither the system nor the organizational setting as the cause of resistance, but their interaction. Essentially, resistance-generating conditions are mismatches between the patterns of interaction prescribed by a system and the patterns that already exist in the setting into which the system is introduced [17]. Thus, the resistance is explained as a product of the interaction of system design features with the intraorganizational distribution of power dimensions [13].

Markus [17] acknowledges the existence of various ramifications for this interaction vector. Consequently, she highlights two perspectives, namely the socio-technical variant and the political variant. The socio-technical variant focuses on the distribution of responsibilities for organizational tasks. This variant emphasizes that new information systems can give rise to a new division of labor and of functions and responsibilities that is different from that which existed prior to that time in the organization. In this way, IS implementations can be perceived as enablers of organizational change [12]. In the political variant, resistance can be explained as a product of the interaction between design attributes of the system and the intra-organizational distribution of power and status. In this variant, the systems are developed and implemented with the main objective of influencing the power between different organizational sub-units [12; 17].

2.3 Overview of Causes of Resistance to IS

Given the different aspects of the three theories on resistance to IS outlined above, it was possible to develop an overview of the theories. Therefore, in this study a decision was made to use the pioneering ideas of Markus (1983), since it incorporates the various dimensions relating to resistance to information systems. Consequently, Table 1 summarizes the three approaches to resistance to information systems.

Table 1. Causes of Resistance to Information Systems; Source: (Markus [17]; Joia [12]; Joia & Magalhães [13])

Causes of Resistance to IS		
System-Oriented Theory	**People-Oriented Theory**	**Interaction Theory**
Characteristics of the system	Factors inherent to people	Interaction System – Context of Use
Lack of flexibility	Lack of training	SOCIO-TECHNICAL VARIANT
Graphic interface/usability	Resistance to technology	Interaction of the system

perceived as poor		with the division of labor
Unnecessary complexity	Fear of computers	POLITICAL VARIANT
Poor ergonomic design	Inadequate technical project	Interaction of the system with the distribution of intra-organizational power

3 Research Method

This paper studies the resistance to implement an open-source information system at the Brazilian patent office. Here we use a case approach to explore resistance to the implementation of information systems from a qualitative perspective. We adopt a case study approach that examines a phenomenon in its natural setting, using multiple methods of data collection [5; 15]. According to Yin [26], case study is an adequate methodology to answer "how" and "why" questions. Moreover, Stake [23] argues that case study is not a choice of the research, but rather a choice of the research object.

There has been a growing interest in the use of qualitative techniques in the administrative sciences. A fundamental difference between case studies and quantitative methods is that the case study researcher may have less a priori knowledge of what the variables of interest will be and how they will be measured [1]. For quantitative data, there are clear conventions the researcher can use, such as the widely accepted rules of algebra through which the validity of mathematical deductions is known [15]. Given the lack of previous research on resistance to PMS implementation, the qualitative approach is the most adequate to provide a rich understanding of this new field.

In this study, data was collected through the triangulation of several methods, which included participant observation, in-depth interviews and document analysis. We carried out in-depth interviews with the key developer, several users of the PMS, as well as patent examiners from other patent offices, who also have experience using a PMS. Besides identifying the world view of the primary stakeholders, the interviews were intended to identify actors that supported and opposed the system. The interviews were held between September 2011 and January 2013. The interviewees were: SISCAP´s developer, Vice-President from INPI, Patent Examiners from INPI, as well as Patent Examiners from other patent offices: European Patent Office; Pakistan Patent office and Norwegian Patent office.

In essence, the data analysis process consisted of both triangulating data sources, as well as developing a code scheme. The code scheme contributed to group similar events into a similar heading. In order to enhance reliability, key informants were also requested to review the case study report. According to Yin [26], the corrections made through this process contribute to enhance the accuracy of the case study.

4 Case Study: Implementation of SISCAP

This case examines the development and implementation of an information system that supports the operations of the Brazilian national patent office. This system called

‘Sistema de Cadastramento de Produção’ (SISCAP) is an open-source information system designed and developed entirely by a Brazilian patent examiner who examines patent applications in the field of electronics. The initial idea for the system arose in 1998, short after the SISCAP´s developer joined INPI. Seeking to improve the efficiency of the patent examination process, SISCAP was designed based on his experience accumulated as a patent examiner. Given his previous experience with the development of information systems, it was possible for him to visualize the benefits of automating some of INPI´s manual procedures and, hence, he found an opportunity to become an open-source pioneer at INPI.

Nevertheless, the start of SISCAP´s development only started in 2002, after the completion of a specialization program in web design at COPPE/Universidade Federal do Rio de Janeiro (UFRJ), which is widely know as a reputable technical institution in Brazil. Here it is also worthwhile to mention that the costs associated with his enrollment in this program were covered by INPI. According to the SISCAP´s developer, attending this specialization program enabled him to rapidly acquire programming skills on languages used for the development of web applications.

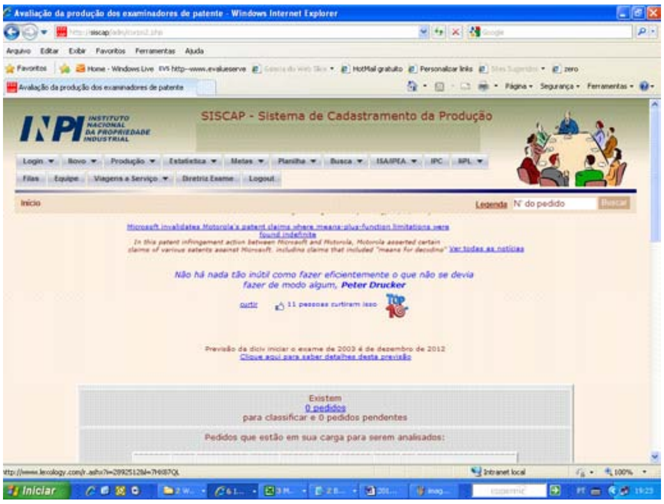

Fig. 1. SISCAP Interface

The initial SISCAP prototype was a simple tool developed in ASP within the Windowns operating system to support the work of senior patent examiners in providing training to junior patent examiners. This initial prototype was not an institutional project, but rather an individual initiative, which was developed by the SISCAP´s developer in his free time. The system was designed to enable senior examiners to upload electronic files containing patent examination reports elaborated by junior patent examiners. This first version was implemented at the desktop of the SISCAP´s developer, but the other patent examiner could access this early version remotely from their own computers. Over the years, new functions were constantly added to the system. Figure 1 displays the current SISCAP´s interface available to patent examiners. This initial page generated after logging into the system, provides access to several functions such as generating documents with data corresponding patent applications, see all uploaded reports, access patent applications available for examination, etc.

4.1 Facing Initial Resistance

As head of an INPI´s division, the SISCAP´s developer initially used the system to review the quality of the reports produced by junior patent examiners. In 2006, senior patent examiners fulfilling the role of tutors to junior patent examiners used SISCAP during the training period of junior patent examiners. However, once this training program was complete, the tutors immediately stopped using SISCAP. This means that the senior patent examiners started to do everything on paper again, even after experiencing the convenience associated with a tool that provided complete forms with data on the patent applications, generated management statistics and enabled the storage of all patent reports. In short, all tutors decided to start doing everything again only on paper simply because using SISCAP was not compulsory in 2006. As can be seen from a declaration of a patent examiner transcribed below:

> "I had a concern regarding the control over the system and there was significant uncertainty regarding the use of data collected by SISCAP".

In order to extend the use of SISCAP within INPI, the SISCAP´s developer demonstrated this first version of the system to a couple (two or three) of other patent examiners of other divisions who also started working for INPI in 1998. This informal demonstration occurred in the first semester of 2006. Yet the reactions of this group of patent examiners was primarily negative, thereby frustrating the initial expectations of the SISCAP´s developer who hoped that the convenience generated by the automation of the process of filling in information in the patent report would convince the patent examiners to adopt the system. It turned out that SISCAP was heavily criticized by these patent examiners. According to the SISCAP´s developer, the following criticism was made by this group of patent examiners towards him:

> "You are a patent examiner, so why are you trying to develop an information system to INPI? This is not your responsibility!"

> "I don´t want to make it possible for other people to see my patent reports"

> "Implementing this system is unethical.You are unethical"

A few weeks after demonstrating SISCAP to patent examiners of other divisions, the SISCAP´s developer was called to attend an individual meeting with INPI´s Director of Patents. The topic of the meeting was an anonymous complaint that the SISCAP´s developer was creating an unauthorized parallel system for registering patent reports. Despite the verbal warning, this meeting did not result in any formal punishment, as the motivation behind the system was clarified.

Despite this frustrated attempt to promote a voluntary adoption of the system, the SISCAP´s developer continued the development of the system by himself. However, he decided to stop promoting its adoption within the organization and to only use it within his division. The first major design change, involved the migration of the application from the proprietary ASP platform from Microsoft to the open source PHP/MySQL platform. This design decision was motivated by the need to improve performance of the system and the awareness that a large-scale service like Wikipedia was entirely developed upon the open-source PHP/MySQL platform.

4.2 SISCAP's Adoption

As a consequence of this resistance, for more than two years, the adoption of SISCAP remained limited to the division of the SISCAP´s developer. The rate of adoption started to speed up significantly after the application obtained political support from a higher-level management of INPI. Basically, strong political support was provided by a patent examiner occupying a management position at the presidency of INPI. As such, the heads of other divisions relating to chemical and biological technologies also decided to adopt SISCAP, which resulted in more than half of the Brazilian patent examiners using the system in the beginning of 2009.

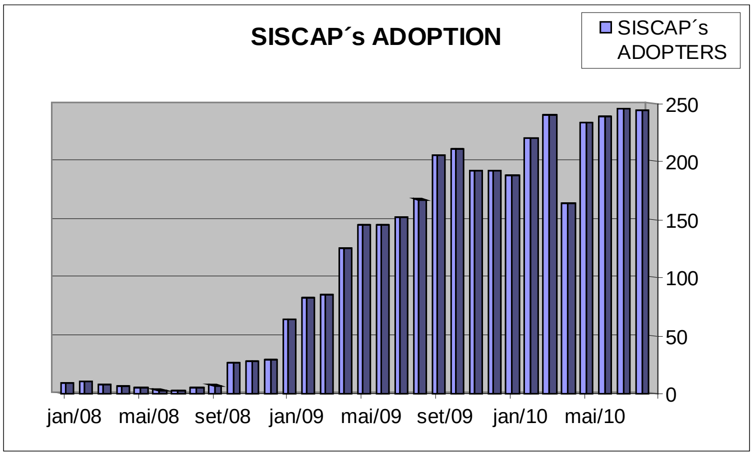

Fig. 2. SISCAP´s adoption over time. (Source: SISCAP Stat)

Despite the initial resistance posed by some patent examiners, the adoption of SISCAP became obligatory in September 2009 with the publication of an internal memorandum that turned SISCAP into the official system for uploading patent reports of all patent examiners at INPI. This memorandum forced the last divisions to adopt SISCAP immediately. Given the experience obtained with the promotion of SISCAP, it was possible to determine that without political support from INPI´s management, it would be impossible to convince all patent examiners to adopt the system. Here a top-down approach turned out to be the most effective implementation strategy. Figure 2 displays a graph representing SISCAP´s adoption in terms of the number of patent examiners using the system.

4.3 Expanding the Technological Infrastructure

Since SISCAP became an official system, the INPI administration decided to gradually expand the technological infrastructure for the system. However, this configuration of SISCAP implemented in a single desktop has imposed performance limitations that made it impossible to scale up the system. In this way, towards the end of 2009, the system was migrated from the machine of the SISCAP´s developer, which runs Windows, to IBM blades running Linux. Beyond the computational resources, another patent examiner and a programmer started working on SISCAP in order to integrate it with the other systems at INPI. This integration effort, which is called the `e-patentes` project, was awarded a national-government prize in 2012.

5 Case Discussion

By examining the implementation of SISCAP at INPI, it was possible to identify a set of patterns characterizing resistance to the implementation of a PMS. In order to clearly describe the source of resistance, each element of the three theories on resistance to IS are examined and an overview of the sources of resistance is provided in table 2.

Table 2: Identified sources of resistance associated with the implementation of SISCAP

Causes of Resistance to IS	
System-Oriented Theory	**Observations**
Characteristics of the system	LOW RELEVANCE: The interviews did not reveal problems with the specific characteristics of SISCAP.
Lack of flexibility	LOW RELEVANCE: The need for more flexibility was not identified.
Graphic interface/usability perceived as poor	LOW RELEVANCE: There were no complaints from patent examiners regarding the design of the system. It was not an important factor.
Unnecessary complexity	LOW RELEVANCE: The system was not perceived as unnecessarily complex.
Poor ergonomic design	LOW RELEVANCE: Design was not a barrier.
People-Oriented Theory	**Observations**
Factors inherent to people	HIGH RELEVANCE: Patent examiners are highly specialized technical professionals and their decisions on patentability of inventions have significant

	financial implications for firms.
Lack of training	LOW RELEVANCE: SISCAP is considered relatively simple to use.
Resistance to technology	LOW RELEVANCE: Given their educational background, patent examiners are likely to have much experience with complex technologies.
Fear of computers	LOW RELEVANCE: As opposed to medical staff, most patent examiners seem to feel comfortable with computers.
Inadequate technical project	LOW RELEVANCE: The technical project was not carefully assessed by patent examiners who offered resistance to SISCAP´s implementation. Apparently, any PMS project would generate resistance.
Interaction Theory	**Observations**
Interaction System – Context of Use	HIGH RELEVANCE: The patent office has a very particular institutional context, as it gathers a high level of expertise in several technical areas.
SOCIO-TECHNICAL VARIANT	HIGH RELEVANCE: Patent reports may have huge financial implications for firms. As such, many patent examiners may perceive access to their reports as a new form of control.
Interaction of the system with the division of labor	
POLITICAL VARIANT	HIGH RELEVANCE: Alignment of the system with the political environment of the organization was critical in order to obtain support from high-level management. User resistance was circumvented by making the use of the system compulsory.
Interaction of the system with the distribution of intra-organizational power	

This overview identifies neither the system-oriented theory nor the people-oriented theory as the main source of resistance in the SISCAP case. Here the interaction theory seems to have the strongest explanatory power. As argued by Markus (1983), users are inclined to use a system if they think the system increases their power, but users are inclined to resist using a new system if their power is threatened. Obviously, in the SISCAP case, user resistance was closely related to the perception that the implementation of the system would be a threat to the power of patent examiners.

6 Conclusion

We have identified different sources of resistance to the implementation of SISCAP explaining why widespread adoption of the system could only be accomplished by turning the system compulsory. In fact, when the introduction of an information system, such as SICAP, specifies a distribution of power, which represents a perceived loss to certain patent examiners, this group is likely to resist the system. Three major points emerge from the above discussion.

First, the social context surrounding a PMS and the possible organizational conflicts existing in the organization have a strong impact on implementation of the system and can even determine whether it will succeed or fail [17; 14]. Therefore, it is important to analyze the context in which the system will be implemented in order to understand clearly how the system will be perceived by patent examiners.

Second, the uncertainties arising from the implementation of SISCAP resulted in passive resistance in the form of a delayed use of the system. Accordingly, full adoption of the system was only accomplished by making the use of the system compulsory to all Brazilian patent examiners.

Third, the fact that SISCAP resulted from an individual initiative of a patent examiner generated resistance motivated by a misinterpretation on the motivation behind the system. Consequently, seeking high-level management support of a PMS seems to be the most appropriate implementation strategy.

Finally, our analysis provides a blueprint to guide future research and facilitate knowledge accumulation concerning the sources of resistance to information systems supporting the operations of patent offices.

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