

IT Governance Effectiveness and Its Influence on Innovation Product and Process

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The pervasive dependence on IT has raised concerns on IT governance (ITG). However, ITG and innovation do not have had the attention among academics. This study aims to examine the relationship among effective ITG, ITG relevant knowledge and their influence on innovation product and process. This study uses structural-equation-modelling SEM to evaluate 215 surveys collected from members of ISACA, PMI and ACIS in Colombia. We found that ITG has positive and significant influence on innovation. ITG relevant knowledge influences positively innovation when ITG experience is high, however, when ITG experience is low, its effect is perceived as negative on innovation.

INTRODUCTION

Information technologies (IT) and innovation are topics that have received enough attention from the literature. Both terms are recognized by public and private sectors around the world as a driver to improve public services in the case of governments (Walker, 2006) and as a driver for improving business performance getting competitive advantage for firms in private sector (Nguyen and Chau, 2017). In fact, Tiwana and Kim (2015) remark a clear relationship among both topics stating that most of the firms use IT in their daily operations, but IT by itself doesn't create advantages, the real weapon to differentiate firms is how agile they are in using IT to create innovation at all levels. For instance, this increasing use of IT in daily operation has raised a growing concern about the increasing and critical dependence on IT by firms and to how to deal with its increasing complexity. These concerns are rapidly spread out between public and private sectors. Besides that, in the last decade, some corporate and significant business collapses like Enron, WorldCom among others, pushed governments to enact new regulations about the accuracy of information in organizations (Chatfield and Coleman, 2011). Those regulations like Sarbanes-

Oxley (SOX) or BASEL in the United States and Switzerland respectively, have pushed organizations around the world to adopt some corporate management practices (Bermejo et al., 2014) that make compulsory that business executives oversight and check the accurate information about IT projects, and making them the only visible head responsible of providing regulators with timely and trusty information (Raghupathi, 2007).

These kinds of management practices created to deal with the increasing complexity of governing and managing IT are well-known as IT governance (ITG). ITG in the academy has two clear drawbacks. First, the literature about the topic is still scarce and few of the works conducted in the topic are related to investigate which ITG mechanisms really improve ITG in organizations (Ali and Green, 2006), and second, there is not clear definition about what ITG is. Mahy et al. (2016) conducted a comprehensive literature review about the definitions of ITG, and they found 26 different definitions and a consensus between academics and practitioners that IT Governance still is an unclear concept. Nevertheless, for this work we use a mix of the most referenced definitions from (Hoch and Payán, 2008; ITGI, 2003; Weill and Ross, 2004) that is: IT Governance is a set of structured processes and relations that help businesses to achieve their strategy's objectives through well IT use that maximizes IT investment returns with a balance of the risks that come out from IT operations. For IT practitioners, the topic is gaining attention among them and it is well recognized. For instance, (Ali and Green, 2005) mentioned that ITG was ranked at the top three concerns' priorities among chief information officers (CIOs) worldwide.

Othman et al. (2011) argue that ITG practices could be seen as incremental and administrative innovation. To support this idea, they remark that the CIO role or position is a clear example of administrative innovation because it is a new role that represents significant and major changes not only at structure, but also at processes levels in organizations. They also highlighted that there is a huge gap between develop and developing countries in terms of studies about ITG. They mentioned that most of the studies about ITG have been done in develop countries. In addition, in terms of ITG there is not a clear research streamline. Most of the studies are descriptive by themselves studying the influence of some ITG frameworks like ITIL and COBIT, but there are few quantitative studies that address the topic of ITG and how effective it is. Moreover, the ITG effectiveness presents few studies that address how ITG practices influence the effectiveness of ITG.

In addition, the literature presents a disconnection between ITG and innovation. Innovation also has a drawback in its definition. Baregheh et al. (2009) conducted a study researching innovation in different fields and they collected 60 different definitions. For this work we use the definition from OECD and used by (Héroux and Fortin, 2018) that in our understanding is so far one of the few academics work that research the link between ITG effectiveness and innovation. That definition "refers to innovation as the perception of new or upgraded product or process or new business methodologies adopted by individual organizations".

In the Colombian context, government initiatives point out to improve IT in the next few years. In fact, the Colombian government has established IT and innovation as priorities for national development, expecting to invest 1% of its gross domestic product (GDP) into IT by 2018 (Colciencias, 2016). In addition, the national government has promoted IT governance enacting some initiatives such as the national IT plan, the act 052 to assure information security in financial companies from public and private sector, and the adoption of some best practices in public sector like: total quality management, project management methodologies, information security management to name just a few of them.

As we mentioned before, there are only few studies that directly address empirically ITG effectiveness. In fact, Preittigun et al. (2012) conducted and study comparing ITG research and they found that among 100 articles classified as suitable for their study less than 10% were empirical studies, the rest were conceptual papers. Besides that, they found that most of the research articles were conducted in develop countries and they highlighted that develop countries have regulations linked to ITG, whilst developing countries do not have these regulations yet. With this horizon, this work tries to fill the gap not only between researches about ITG, but also to conduct the first empirical study that links ITG and innovation in Colombian context.

ITG effectiveness is defined as the degree by which IT delivers the appropriate services needed to support business operations and goals (Buchwald et al., 2013). To achieve an effective ITG, 5 objectives must be accomplished: “Cost-effective use of IT, effective use of IT for growth, effective use of IT for asset utilization, effective use of IT for business flexibility, and Effective use of IT for compliance with legal and regulatory requirements”. The first four objectives were proposed by (Weill and Ross, 2004) and the fifth one was proposed by (Bowen et al., 2007).

In addition, our approach examines the ITG relevant knowledge represented by the perception of the knowledge that executives have about ITG mechanisms. In consequence, three research questions are formulated:

- a) What is the influence of ITG effectiveness on innovation?
- b) What is the influence of ITG knowledge on innovation?

The paper continues as follows. Section two reviews the literature that supports our study. Section three presents the research model and hypotheses. Section four describes the research methodology. Section five presents the results and discussion, and section six presents a summary with contributions, limitations, and future studies.

LITERATURE REVIEW

The adoption of ITG is very particular and unique for each organizations and the adoption of mechanisms that work in one organization does not mean that the same mechanisms will work in other organizations (Luciano et al., 2015). (ITGI, 2003) affirms that ITG is under responsibility of the board of directors and an effective ITG performance is a direct responsibility of the board of directors (Simonsson et al., 2010). In fact, the lack of executives’ support to implement an effective ITG is viewed as a main obstacle as a result of the underestimation of its strategic importance by the board of directors (E. Boritz and Lim, 2007). In the case of innovation Zona et al. (2013) state that the board of directors set the strategic direction of the organization, emphasizing innovation and change, and establishing the parameters for screening specific aspects of innovation projects.

(Birkinshaw et al., 2008) defined management innovation as "the invention and implementation of management practice, process, structure, or technique that is new to the state of the art and is intended to further organizational goal". They also mentioned that the introduction of novelty practices produce organizational changes that in few terms are considered as a management of innovation.

ITG and innovation separately have been considered as strategic issues for organizations. Mohamed and Kaur Ap Gian Singh (2012) consider that IT governance needs the strategic level commitment because it is a strategic issue that deals in how IT contributes to give business value to organizations and Baregheh et al. (2009) mention that innovation is considered also as a strategic issue that organizations must should promote to sustain their competitive position. The same authors remark that organizations have the necessity to innovate responding to changes in customer behaviors to capitalize the opportunities that technology brings to the markets with the aim of sustaining competitive advantage through the role that innovation plays for organizations. Other study conducted by (Calik et al., 2017) state that innovation is a key driver that support competitive advantage of firms by developing new product or services.

One of the main barriers in the topic of ITG is its definition. Summarizing the definitions from (Hoch and Payán, 2008; ITGI, 2003; Weill and Ross, 2004) we have that ITG is a set of structured processes and relations that help businesses to achieve their strategy’s objectives through well IT use that maximizes IT investment returns with a balance of the risks that come out from IT operations. In spite of its few acknowledgements, the ITG topic is gaining attention and its importance has started to be well recognized. In fact, Mahy et al. (2016) affirm that with the pervasive and critical dependence on IT by organizations, ITG is not an option; it is a necessity that must be addressed and adopted for organizations and Simonsson et al. (2010) stated that every organization that deals with IT has implicitly ITG.

Regulations worldwide like CLERP 9 and SOX in the USA are important drivers that have pushed the development, adoption, and generalized acknowledgment worldwide by practitioners as well for researches of ITG (Ali and Green, 2005; Buckby et al., 2008; De Haes and Van Grembergen, 2009;

Lunardi et al., 2014; Robinson, 2005). Regulations like SOX have been enacted after significant business collapses like Enron, WorldCom that pushed governments to enact those regulations about the accuracy of information in organizations (Chatfield and Coleman, 2011) making that ITG becomes compulsory for many organizations (Hardy, 2006).

Failures or lack of ITG have been mentioned recently. Raghupathi (2007) gave two examples as a consequence of lack of ITG. First, He mentioned how a breach in security rules of VISA and American Express produced losses of personal information of their users and second, He highlighted the long downtime in the Tokyo Stock Exchange’s services that avoid making financial transactions for several hours.

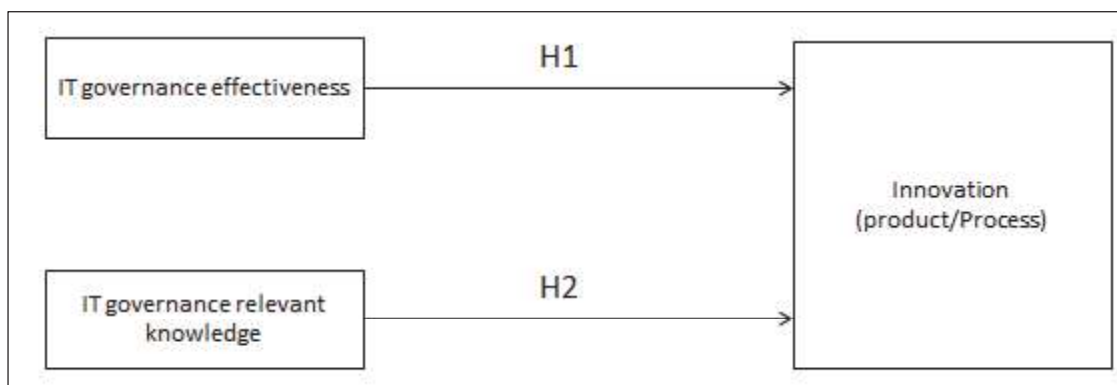
There is a consensus in the literature that IT is used as a driver to develop innovation with the strong support from the board of directors and executive management of the organizations (Hérouxa and Fortin, 2016). However, as we mentioned earlier there is no link in the literature about ITG and innovation. The exception is the study conducted by (Héroux and Fortin, 2018) in which they found that as many well developed ITG mechanisms the effects on product and process innovation are different. They found that the perception of good ITG mechanisms rise the level of product innovation, but it is also associated with less process innovation. Surprisingly from this study they found that board’s IT competence has not significant influence on innovation.

However, some studies about ITG mention innovation indirectly. Othman et al. (2011) mention that the CIO is relatively a new position or role within organizations that represent significant and major changes at structure and processes level and it could be viewed as an example of radical administrative innovation. They argue that ITG practices could be seen as incremental and administrative innovation. (Daft, 1978) emphasizes that administrative innovations deal with the allocation of resources, policies, rewards, whilst issues related to technology are addressed by technical innovations. (Vaccaro et al., 2012) state that CEOs and executives through their leadership play an instrumental role in the introduction of new processes, practices, or structures in organizations. These practices support the management on the daily basis and cause changes in the way management is performed (Hamel, 2006). Moreover, top management executives have the status and power to introduce organizational changes into the organizations and most of these administrative innovations are implemented using a top-down approach because they are approved in many cases by the board members (Daft, 1978).

RESEARCH MODEL AND HYPOTHESES

The proposed research models are shown in Figure 1. The ITG effectiveness and ITG knowledge are hypothesized in order to evaluate their influence on innovation products and processes.

**FIGURE 1
RESEARCH FRAMEWORK**



IT Governance Effectiveness - ITGEFF

Most of firms use IT in their daily operations. But IT by itself does not create advantages, the real weapon to differentiate firms is how agile they are in using IT to create innovation at all levels (Tiwana and Kim, 2015). However, the acquisition, deployment, and appropriate use of IT must be effective in order that organizations can get the benefits from IT (Robinson, 2005). The same author affirms that this effectiveness is provided by ITG. In fact, Buchwald et al. (2013) mention that the degree by which IT delivers the appropriate services needed to support business operations and goals is the definition of ITG effectiveness. To achieve and effective ITG, 5 objectives must be accomplished: “Cost-effective use of IT, effective use of IT for growth, effective use of IT for asset utilization, effective use of IT for business flexibility, and Effective use of IT for compliance with legal and regulatory requirements”. The first four objectives were proposed by (Weill and Ross, 2004) and the fifth one was proposed by (Bowen et al., 2007). Nevertheless, there is an intangible tension between ITG and agility to foster innovation as it is expressed by (Couto et al., 2015). They mention that ITG propose anticipation through well-designed plans in advance; whilst agility for innovation promotes quick adaptation to dynamic and volatile environments. Therefore, we hypothesize the following:

H1: The effectiveness in ITG influences positively innovation at product and process level.

IT Governance Relevant Knowledge - ITGKN

Knowledge in ITG by executive management and board of directors is a critical issue to achieve a good ITG effectiveness. Some activities like the implementation of IT controls for compliance with regulations need a strong support and knowledge from the top management’s roles because these activities seems to be costly and difficult to operate (J. E. Boritz and Lim, 2008). ITGI (2003) defines ITG knowledge as the knowledge about ITG structures, ITG processes, and ITG relational mechanisms that executive management has. Structures determine responsibilities, roles within business units that are in charge of decision-making process related to IT. Processes are related to manage all procedures, policies, and documentation about the management of IT, and relational mechanisms are the soft skills that create a proper environment between members from the business and IT in order to reach common objectives. Therefore, we hypothesize the following:

H2: The ITG relevant knowledge influence positively innovation at product and process level.

IT Governance Experience - ITGEXP

How long ITG implementation takes to achieve effective results is a question that does not have a clear answer. Rau (2004) make emphasis that only through the evolution of multiple years, specific roles to set policies and control results in ITG reach the enough mature to achieve effectiveness in ITG. (Gu et al., 2008; Kearney, 2008; McGilvray, 2006) share a common view that the timeline to get a good ITG effectiveness is a long journey. For this study, we proposed that companies which started ITG implementation within a period longer than 10 years have high experience in ITG and companies with 10 years or less have low experience.

Product and Process Innovation

(Héroux and Fortin, 2018) said that product innovation occurs when a firm develops or introduces completely new products or products with important updates that enhance their functionality. The same authors said that process innovation occurs when a process receive important upgrades making it more efficient and productive.

RESEARCH METHODOLOGY

The survey design for collecting data was developed by adapting the surveys of previous studies. Before delivering the survey to the target responders, we conducted an expert’s review of the constructs

with the aim of confirming the understanding of the questions. The sample data used by this work was collected via surveys. Email invitations were sent to the three most significant associations in Colombia such as the ISACA (Information Systems and Audit Control Association, Bogotá – Chapter), PMI (Project Management Institute – Bogotá – Chapter), and the Colombian Association of Computer Science Engineers (ACIS – Asociación Colombiana de Ingenieros de Sistemas). (Ferguson et al., 2013; Simonsson et al., 2010) argue that members from ISACA are IT experts that are permanently updated about ITG issues and they have the experience and professional qualifications that warranty the accurate of their responses. Personal emails were also sent to computer science engineers and some education institutions that were suggested by the experts. The responders were IT experts with experience dealing with IT governance. We received 215 surveys with valid responses out of 908 or a 23.67% response rate. All ethics guidelines were followed to assure that each responder of the survey participated voluntarily. The information gathered by our survey instrument will be maintained in absolute confidentiality, assuring total anonymity of the responders. The data collected was used only for achieving the objectives of the research. Tables 1, 2, and 3 show the sample characteristics of the data.

**TABLE 1
RESPONDER’S PROFILE FREQUENCY**

Responder’s profile	Frequency	Percentage
CIO	29	13.5
Professor/Teacher	9	4.2
IT Practitioner	56	26.0
IT Supervisor	9	4.2
IT Manager	42	19.5
IT Director	34	15.8
Vice-President	6	2.8
CEO	30	14.0
Total	215	100

**TABLE 2
TYPE OF ORGANIZATION BY FREQUENCY**

Responder’s profile	Frequency	Percentage
Commercial Public	9	4.2
Not Profit Organization	15	7.0
Government	41	19.1
Private	150	69.8
Total	215	100

TABLE 3
TYPE OF INDUSTRY BY FREQUENCY

Responder's profile	Frequency	Percentage
Agriculture, forestry and fishing	2	0.9
Mining and quarrying	3	1.4
Manufacturing	6	2.8
Electricity, gas, steam and air conditioning supply	2	0.9
Water supply: sewerage, waste management and remediation activities	3	1.4
Construction	10	4.7
Wholesale and retail trade; repair of motor vehicles and motorcycles	3	1.4
Transportation and storage	2	0.9
Information and communication	45	20.9
Financial and insurance activities	12	5.6
Professional, scientific and technical activities	25	11.6
Administrative and support services activities	11	5.1
Public administration and defense; compulsory social security	8	3.7
Education	30	14.0
Human health and social work activities	11	5.1
Arts, entertainment and recreation	1	0.5
Other Services (Except Public Administration)	40	18.6
Activities of extraterritorial organizations and bodies	1	0.5
Total	215	100

Study Variables

The variables in this study were adopted from previous studies. Two dependent variables are used for this study: Product innovation and process innovation. The independent variables are: ITG effectiveness, ITG knowledge, and ITG experience was used as a moderator. With the exception of ITG experience, all variables were measured using a five-point Likert scale. Table 4 shows a brief definition of each variable, the acronym used by each variable, and the source in which the variables were extracted to develop this research.

TABLE 4
DEFINITIONS AND SOURCE OF VARIABLES

Variable	Definition	Reference
IT Governance Effectiveness (ITGEFF)	ITG effectiveness is defined as the degree by which IT delivers the appropriate services needed to support business operations and goals (Buchwald et al., 2013).	(Weill and Ross, 2004) and (Bowen et al., 2007)
ITG relevant knowledge (ITGRKN)	ITGI (2003) defines ITG knowledge as the knowledge about ITG structures, ITG processes, and ITG relational mechanisms that executive management has	(Ali et al., 2013)
Product innovation (INPD)	Héroux and Fortin (2018) said that product innovation occurs when a firm develops or introduces completely new products, or products with important updates that enhance their functionality.	(Prajogo and Ahmed, 2006)
Process innovation (INPR)	Héroux and Fortin (2018) said that process innovation occurs when a process receive important upgrades making it more efficient and productive.	(Prajogo and Ahmed, 2006)
ITG experience (ITGEXP)	Dummy variable. We proposed that companies which started ITG implementation within a period longer than 10 years have high experience in ITG and companies with 10 years or less have low experience.	Not apply

RESULT AND DISCUSSION

In order to analyze our data, we perform the descriptive statistics of mean, standard deviation, Cronbach's alpha, and composite reliability (CR) for variables in this study. 215 observations were available for this study. The Cronbach's alpha and CR tests were conducted to check the reliability of the data collected. According to (Lunardi et al., 2014), CR would be preferable to use because it is based on item loadings. The CR and Cronbach's alpha tests show that all variables are under acceptable limits with all scores above 0.7. Both tests indicate the reliability of the data used in this study. Table 5 presents the result of our descriptive statistics.

TABLE 5
DESCRIPTIVE STATISTICS AND RELIABILITY MEASURES

Item Code	Alpha	CR	Mean	Std.Dev
ITG importance (ITGIMP)	0.915	0.918		
ITGIMP_1			3.820	0.970
ITGIMP_2			3.900	0.883
ITGIMP_3			3.780	0.888
ITGIMP_4			3.830	0.882
ITGIMP_5			4.050	0.825
ITG Successful (ITGSUC)	0.917	0.918		
ITGSUC_1			3.450	0.894
ITGSUC_2			3.550	0.851
ITGSUC_3			3.470	0.911
ITGSUC_4			3.520	0.880
ITGSUC_5			3.770	0.837
Product innovation (INPD)	0.947	0.948		
INPD_1			3.430	1.189
INPD_2			3.490	1.080
INPD_3			3.430	1.189
INPD_4			3.290	1.160
Process innovation (INPR)	0.939	0.940		
INPR_1			3.600	0.989
INPR_2			3.520	1.036
INPR_3			3.63	1.014
ITG relevant knowledge (ITGRKN)	0.947	0.948		
ITGRKN_1			3.480	1.027
ITGRKN_2			3.470	1.027
ITGRKN_3			3.460	0.994

For our exploratory factor analysis EFA we use maximum likelihood for the extraction method with promax rotation in order to extract the unique factors that support each construct from our survey instrument. In order to examine the suitability and adequacy of the data collected, two tests are recommended by academics: “Kaiser-Meyer-Olkin KMO measure of sampling adequacy and Bartlett’s test of sphericity” that check if the data is appropriate for EFA (Williams et al., 2010). The KMO test

score was 0.896. The Bartlett's test scores were ($X^2=4319.45$; $df=190$; and $p=.000$) for chi-square, degrees of freedom, and p-value respectively which indicate that our data is appropriated to perform EFA. From our EFA we obtained the pattern matrix in which five factors were extracted. Table 6 shows that all values in the pattern matrix are above 0.5. As it is suggested by (Kaiser, 1974) are under acceptable limits. The five factors extracted were named ITG importance, ITG successful, ITG knowledge, Innovation product and Innovation process. The five factors explained a total of 77.36% of the variance.

**TABLE 6
PATTERN MATRIX**

Factor Extracted	Factor loading	Factor				
		1	2	3	4	5
IT governance importance (ITGIMP)	ITGIMP 1			.756		
	ITGIMP 2			1.007		
	ITGIMP 3			.777		
	ITGIMP 4			.742		
	ITGIMP 5			.616		
IT governance successful (ITGSUC)	ITGSUC 1		.814			
	ITGSUC 2		.850			
	ITGSUC 3		.854			
	ITGSUC 4		.849			
	ITGSUC 5		.633			
Innovation product (INPD)	INPD 1	.941				
	INPD 2	.885				
	INPD 3	.909				
	INPD 4	.835				
Innovation process (INPR)	INPR 1					.826
	INPR 2					.910
	INPR 3					.859
IT governance relevant knowledge (ITGRKN)	ITGRKN 1				.883	
	ITGRKN 2				.960	
	ITGRKN 3				.902	

In our confirmatory factor analysis we check once again the data reliability using the test of composite reliability CR because the variable ITGGEFF comes out from the combination of ITG importance and ITG successful into a second order construct. CR is used to check the reliability based on item loadings as it is suggested by (Lunardi et al., 2014). The scores obtained for CR test are above the minimum level of 0.7, which indicate the reliability of our data. Discriminant validity was checked getting the square root values for all items with values greater than any inter factor correlation in the matrix and by the average variance extracted (AVE) showing that all values are greater than 0.5. Table 7 shows the validity of the measures for our data set.

**TABLE 7
MODEL VALIDITY MEASURES**

	CR	AVE	MSV	MaxR(H)	ITGSUC	INPD	ITGIMP	ITGRKN	INPR
ITGSUC	.918	.694	.569	.933	.833				
INPD	.948	.820	.511	.949	.472	.906			
ITGIMP	.918	.694	.569	.930	.754	.540	.833		
ITGRKN	.948	.858	.258	.952	.508	.381	.466	.926	
INPR	.940	.838	.511	.941	.575	.715	.580	.404	.916

The structural model was used to check the hypotheses stated earlier. Figure 2 shows the SEM; solid lines indicate casual paths and the insignificant path are presented with dot lines. Table 8 shows the summary of the model fit and figure 2 shows the SEM path analysis; solid lines indicate casual paths and the insignificant paths are presented with dot lines.

**TABLE 8
MODEL FIT MEASURES**

Measure	Estimate	Threshold
CMIN	736.658	
DF	320	
CMIN/DF	2.302	Between 1 and 3
CFI	0.904	> 0.95
SRMR	0.067	< 0.08
RMSEA	0.078	< 0.06

**FIGURE 2
RESULTS FROM BOTH GROUPS**

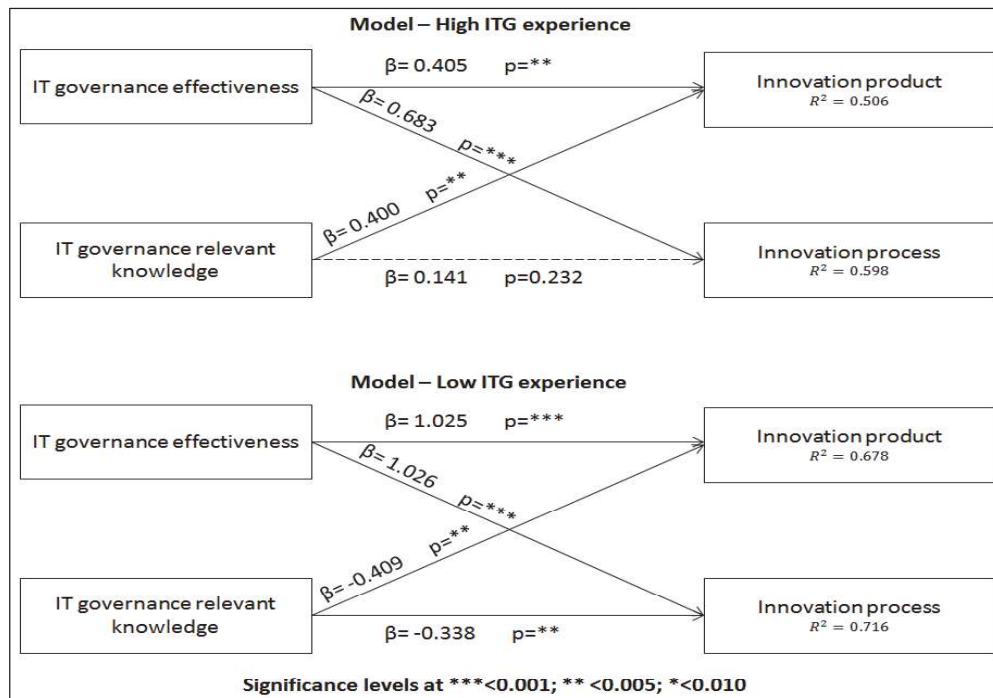


Figure 2 shows the summary of the significance level and standardized regression weights of our models' path. In the first group with ITG experience high, as we were expected ITGEFF has positive and significant influence on INPD and INPR with standardized estimates of (.405, $p=.002$ and .683, $p<.001$), accepting our hypothesis H1 for The first group. These results suggest that as long as ITG deliver properly the 5 objectives proposed by (Bowen et al., 2007; Weill and Ross, 2004), the perception about its influence on product and process innovation is positive. The ITGRKN as we expected has positive and significant influence on INPD (.400, $p=.002$), but surprisingly it does not have significant influence on INPR. As a result our hypothesis H2 is partially accepted. This result could be explained because many changes in policies, procedures, and documentation that these organizations should carry out to implement ITG.

In the second model with ITG experience low, as we were expected ITGEFF has positive and significant influence on INPD and INPR with standardized estimates of (1.025, $p<.001$ and 1.026, $p<.001$) accepting our hypothesis H1. The perception about its influence on product and process innovation is positive too as in the first model. The ITGRNW has significant, but negative influence on INPD and INPR with standardized estimates of (-.409; $p=.002$ and -.338' $p=.008$), rejecting our hypotheses H2 for the second group.

SUMMARY, IMPLICATIONS, CONTRIBUTION, LIMITATIONS AND FUTURE STUDIES

Summary

The goal of this study was to investigate the effect of IT governance effectiveness and ITG relevant knowledge on innovation product and process, as well as the differences between those relationships when the ITG experience is high or low. As we expected, the results show that the influence of ITG effectiveness on innovation is perceived as positive and significant. The influence is slightly higher on process innovation for both groups. Somehow those results are consequent because the introduction, adoption, and deployment of ITG practices involve the introduction of new processes. So far the study conducted by (Héroux and Fortin, 2018) found that ITG exert positive influence on innovation. That study and our study are the unique studies that relate ITG with innovation and in both studies the perceived influence of ITG on innovation is clear.

This study measured IT governance effectiveness using the most accepted approach proposed by (Weill and Ross, 2004) and complemented later by (Bowen et al., 2007) in which the authors measure IT governance effectiveness base on the achievements of the following objectives: "Cost-effective use of IT, effective use of IT for growth, effective use of IT for asset utilization, effective use of IT for business flexibility, and Effective use of IT for compliance with legal and regulatory requirements". The variable ITG relevant knowledge was measured based on the approach of (Ali et al., 2013) measuring the level of knowledge that executives management have about ITG mechanisms. The innovation product and process were measured using the approach of (Prajogo and Ahmed, 2006).

The sample data used by this study was collected via surveys. Email invitations were sent to the three most significant associations in Colombia such as the ISACA (Information Systems and Audit Control Association, Bogotá – Chapter), PMI (Project Management Institute – Bogotá – Chapter), and the Colombian Association of Computer Science Engineers (ACIS – Asociación Colombiana de Ingenieros de Sistemas). Other personal emails were sent to computer science engineers, which were suggested by the experts and some academic institutions. The responders were IT experts with experience dealing with IT governance. We received 215 surveys with valid responses out of 908 or a 23.67% response rate. This study found that IT governance effectiveness impact positively and significant innovation product and process.

Contribution

Our study contributes to ITG research field introducing the first quantitative approach that measure ITG effectiveness and its relation with innovation product and process. Our approach uses the five objectives that must be achieved through the use of IT by organizations. These objectives summarize

what organizations are looking for, in terms of IT. So far, there is only one study that addresses ITG and innovation, however, that study did not evaluate the effectiveness of ITG. Instead, those study measures ITG based on the perception of some individual ITG mechanisms.

In addition, our study includes the introduction of new variables like the ITG relevant knowledge and ITG experience. These variables make our study more robust as a result of taking into account the relative knowledge in ITG by the executive management at the organizations and the experience that organizations have about the implementation of ITG. Besides that, previous studies in ITG include data sample collected from specific economic sectors. In our study, the dataset includes organizations from different economic sectors, different size including SMS's and large enterprises.

Implications

In practical aspects our results show that a perception of an effective ITG impact positively innovation at products and processes levels. The relevant knowledge in ITG mechanisms by top management is perceived as a positive contributor to innovation only when there is enough ITG experience. This result show to practitioners that ITG is not just a matter of know some theoretical concepts, executives in general have to get the enough experience in issues related to ITG in order that IT practitioners perceived their knowledge as a relevant contributor to foster innovation by using IT properly. Our results suggest that organizations that want to enhance their innovation should look for the ITG mechanisms needed to improve the role that IT plays in their organizations. IT can leverage innovation activities only if IT delivers the proper services to support business operations. As many academics suggest, ITG effectiveness is a long journey and organizations should start the adoption of ITG practices in order that they begin to figure out how ITG will enhance in the long term the benefits that IT could bring to organizations.

Limitations

IT governance is a topic that involves all members from an organization. Even though in our sample we had different IT specialist responders' profile, we suggest including other members from organizations, especially personnel from the front-line that on the daily basis face the pros and cons of any decision related to IT. Another limitation we faced is that the data for this study was gathered only through surveys covering only organizations from Colombia avoiding to generalize our results to other countries.

Future Studies

In order to get more accurate measures of ITG effectiveness and its influence on innovation, other approach to measure innovation product and processes should be evaluated. We suggest, evaluating the ITG effectiveness based on how the objectives are matched with organizational goals about innovation, in order to have more robust measures about how ITG effectiveness is among organizations and how it influences innovation. Other proposal is to extend this study to different countries overseas to get an idea about how ITG effectiveness influences innovation in other countries.

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