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Digital Broadband and Open Innovation: First Insights in Information Technologies Sector

Banda ancha digital e Innovación abierta: Primeras Impresiones en el Sector de Tecnologías de la Información

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Abstract

Purpose. The study is aimed to disclose how Digital Broadband (DBD) is affecting the practice of Open Innovation (OIN) in the Information Technologies Sector of Metropolitan

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Zone of Guadalajara, Mexico (ITSZMG) to achieve a model, for the improvement of relationships.

Methodology. It is a descriptive, exploratory, correlational, cross-sectional, qualitative-quantitative research. As a qualitative study, it is based on a deep literature review after which, we used Delphi Panel with Analytic Hierarchy Process (AHP), determining our main factors: DBD (1 factor/ 6 variables/43 indicators) and OIN (3 factors/23 variables/161 indicators) in a questionnaire Likert scale, involving 600 ITSZMG specialists at 200 SMEs. The survey was on the period of September-December 2016. As a quantitative study, we applied Confirmatory Factor Analysis using EQS 6.2 software.

-The value of this study, is to propose a generalized model involving the relationship between DBD-OIN for ITSZMG, and identify the underlying variables and their relationships to make suggestions about how to be more innovative, among the firms in the sector.

-Final results: 5/6 DBD variables have significant positive effect on 18/23 OIN variables.

This implies opportunities to develop the model.

-Conclusions: We obtained an empirical model capable of identifying its own DBD-OIN relationships in order to be, a more innovative firm in the ITSZMG.

Keywords: Digital Broadband; Open Innovation; Information Technologies; Mexico

Resumen

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Objetivo. El estudio está orientado a descubrir cómo la Banda Ancha Digital (DBD) está afectando la práctica de la Innovación Abierta (OIN) en el Sector de las tecnologías de Información de la Zona Metropolitana de Guadalajara, México (ITSZMG), para lograr un modelo que mejore sus relaciones.

Metodología. Es una investigación descriptiva, exploratoria, correlacional, transversal, cualitativa-cuantitativa. Como investigación cualitativa, se basó en una amplia revisión de la literatura tras la cual, se usó el Panel Delphi en conjunto con el Proceso de Análisis Jerárquico (AHP), determinando nuestros principales factores: DBD (1 factor/6variables/43 indicadores) y OIN (3 factores/ 23 variables/ 161 indicadores), en un cuestionario en escala de Likert, involucrando a 600 especialistas en 200 firmas Pyme de la ITSZMG. El levantamiento de datos fue en el periodo de Septiembre-Diciembre 2016.Como investigación cuantitativa, se aplicó Análisis Factorial Confirmatorio, usando el software EQS 6.2.

El valor del estudio, es el proponer un modelo generalizado involucrando las relaciones entre DBD-OIN para la ITSZMG, e identificar las variables subyacentes y sus relaciones para realizar recomendaciones sobre cómo ser más innovador, entre las firmas en el sector.

Los resultados finales: 5/6 variables del DBD, tuvieron un efecto positivo sobre 18/23 variables de la OIN. Esto significa oportunidades de desarrollo del modelo,

Conclusiones: Obtuvimos un modelo empírico capaz de identificar sus propias relaciones DBD-OIN para lograr ser, un firma de mayor innovación abierta en la ITSZMG.

Palabras Clave: Banda Ancha Digital; Innovación Abierta; Tecnologías de Información; México.

Introduction

Jalisco, Mexico, has the most representative cluster of Information Technologies Sector located into the Metropolitan Zone of Guadalajara, Mexico (ITSMZG), headquarters of the Mexico's '*Ciudad Creativa Digital'*. The ITSMZG has around 200 IT Firms that export 2,000 million USD annually on high value-added service and generate 20,000 jobs in the state (Economista, 2016). At the same time, Mexico has a Digital Broadband (DBD) recent policy, available since 2013, with 2015 data ranking reports (ITU-UNESCO, 2016) for instance: Fixed-Broadband Subscriptions per 100 inhabitants, ranked in the place 52/138 among other issues; all these data are considered a great opportunity to develop the OIN factor. The DBD even increases the promotion of innovations in small and medium enterprises (SMEs) and the productivity with significant savings by reducing the transaction costs. We remind that the SMEs in Mexico are the main source of jobs because they're representing the 99.8% of all companies in Mexico, which generates 52% of gross domestic product and 72% of jobs in the country.

Problem, Research question and Rationale of the study

We have two remarkable factors, firstly the ITSZMG that is characterized as a sector with advanced OIN practices and secondly the DBD that is considered by the Mexican government as a support and guarantee for its development (Estrategia Digital, 2013). Thus, we determined as a problem, to propose a construct that involves the relationship between the OIN and the DBD, determining and analyzing all the determinant factors related in order to improve all the process of OIN based on DBD to be adapted and applied in the ITSZMG.

So, our research question is posed as: what is the relationship between DBD on OIN in ITSMZG? The rationale of the study is due the ITSMZG interest to know how the main factors of DBD are influencing the OIN process, to identify the weak relationships and to do several suggestions about reinforcement of such relationships proposed, for improvement of the model.

The Specific Research Questions (SRQ) are:

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SRQ1. What are the variables proposed for the general conceptual model?

SRQ2. What are the relationships of these variables?

SRQ3. *What are the most relevant variables of the model?*

Searching the Variables of the Construct

The subjects under study were all the 600 ITSMZG specialists, including: SME CEOs (120), back office/ front office managers (120), software designers (120), professors (120) and directors of business consultant firms (120) all of them grouped in the cluster.

To achieve the proposal of variables of the construct, we went through a literature review of more than 40 papers about models regarding the OIN and SMEs, selecting the main factors, variables and indicators of each one, and listed in a matrix table per author. See Table 1.

Table 1. Authors and variables related with the OIN Factor

[Number]Author	Variables Identified
[1] OECD (2003)	(1) LSP; (2) T&M; (3) P&S; (4) COM
[3]Asakawa y Sawada. (2010)	
[8] West & Bogers (2014)	
[7] Mejia-Trejo et al. (2013)	
[15]Chatenier et al. (2010)	(4) COM
[1] OECD (2003)	(5) INC
[4] Allarakhia et al. (2010)	
[2] OECD (2008)	

[5] Gassman y Enkel (2004)	(6) KC&A
[1] OECD (2003)	
[6] Goglio-Primard, y Crespin –Mazet (2014)	
[9] Keup y Gassman (2009)	
[10] Parmented (2010)	(7) PKMG
[11]Lichtenthaler (2015)	
[12]Chien-Tzu y Wan Fen (2014)	
[13]Beckman et al. (2004)	(8) OIO
[12]Chien-Tzu y Wan Fen (2014)	
[14]EIRMA (2003)	
[2] OECD (2008c)	
[16] Osterwalder y Pigneur, (2010)	(9) MKS
[38] Saebi & Foss (2013)	
[2] OECD (2008c)	
[17]Chesbrough (2003)	
[16] Osterwalder y Pigneur, (2010)	(10) VP
[19]Von Hippel (2005)	
[17]Chesbrough (2003)	
[20]Van der Borgh et al. (2012)	

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[16] Osterwalder y Pigneur, (2010)	(11) CRM
[2] OECD (2008c)	
[21]Rayna y Styriukova (2014);	
[16] Osterwalder y Pigneur, (2010);	(12) CHN
[2] OECD (2008c)	(13) RIPR
[17] Chesbrough (2003)	
[25]Chesbrough y Teece (2002)	
[30] Chesbrough,y Kardon –Crowter, (2006)	
[16] Osterwalder y Pigneur, (2010)	(14) KYR
[22]Gassman (2006);	
[3] Asakawa y Sawada. (2010)	
[16] Osterwalder y Pigneur, (2010)	(15) KYA
[2]OECD (2008c)	
[23]Enkel et al.(2009)	
[24]Schwaag (2006)	
[25]Chesbrough y Teece (2002)	
[16] Osterwalder y Pigneur, (2010)	16 (CST)

[26]Remneland-Wikhamn y Knights, D. (2012)	
[16] Osterwalder y Pigneur, (2010);	17 (PTS)
[2] OECD (2008c)	
[22]Gassman (2006)	
[27]Etzkowitz y Leydesdorff, (1995)	
[28]Tidd (2006)	
[29]Miller et al. (2016)	
[17]]Chesbrough (2003)	18 (TEC)
[40] Hopkins et al. (2011)	
[30] Chesbrough,y Kardon –Crowter, (2006)	
[31]Cohen et al. (2002)	19(STR)
[3] Asakawa y Sawada. (2010)	
[32]Rohrbeck,et al. (2009)	
[39] Yun-Hwa & Kuang-Peng H.(2010)	
[2] OECD (2008c)	
[2] OECD (2008c)	20(NWE)
[14] EIRMA (2003	
[10]Parmented (2010)	21(POBM)

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[11[Lichtenthaler (2015)	
[12]Chien-Tzu y Wan Fen (2014)	
[2] OECD (2008c)	22(RSK)
[33]Sieg et al. (2010)	
[28]Tidd (2006)	
[2] OECD (2008c);	23(OIEC)
[34]Nelson (1993)	
[37]Gassmann et al. (2010)	
[35]Docherty (2006)	
[6] Goglio-Primard, y Crespin –Mazet (2014)	
[20]Van der Borgh, et al. (2012)	
[36[Holmes y Smart (2009)	
[35]Docherty (2006);	24 (TIEC)
[36] Holmes y Smart (2009)	
[2] OECD (2008c)	
[6[Goglio-Primard, y Crespin –Mazet (2014)	
[18]Deloitte (2015)	25(GOV)

[15]Chatenier et al. (2010)	
[10]Parmented (2010)	26(PIEC)
[11[Lichtenthaler (2015)	
[12]Chien-Tzu y Wan Fen (2014)	

Notes: (1)LSP.-Leadership ; (2) T&M.-Training and Mentoring; (3) P&S.- Policies and Strategies; (4) COM.-Communication ; (5) INC.-Incentives ; (6) KC&A.-Knowledge capture & acquisition; (7) PKMG.- Performance of KMG; (8) OIO.-Open Innovation Orientation; (9) MKS.-Market Segmentation; (10) VP.-Value Proposition; (11) CRM.-Customer Relationship; (12) CHN.-Channels of Distribution; (13) RIPR.-Revenue Streams for Intellectual Property Rights; (14) KYR.-Key Resources; (15) KYA.-Key Activities; (16) CST.- Cost ; (17) PTS.-Partnership; (18) TEC.-Technology ; (19) STR.-Strategy; (20) NWE.-New Entrepreneurships; (21) POBM Performance of OBM; (22) RSK.-Risk; (23) OIEC.-Opportunities of Innovation Ecosystem ; (24) TIEC.-Threats of Innovation Ecosystem; (25) GOV.-Governance; (26) PIEC. Performance of IEC. (27)

Source: own.

We proceeded to summarize variables vs authors to prepare the account of academic vision. See Table 2.

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Table 2. Variables representing the OIN underlying factor

ID	Variables	Authors numbered as the Table 1																						Total Frequency
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
1	LSP	X		X				X	X																4
2	T&M	X		X				X	X																4
3	P&S	X		X				X	X																4
4	COM	X		X				X	X							X									5
5	INC	X	X		X																				3
6	KC&A	X				X	X			X															4
7	PKMG										X	X	X												3
8	OIO		X										X	X	X										4
9	MKS		X														X	X							3
10	VP																X	X		X	X				4
11	CRM		X														X					X			3
12	CHN																X								1
13	RIPR		X															X							2
14	KYR			X													X						X		3
15	KYA		X																					X	2
16	CST																X								1

17	PTS		X													X						X		3
18	TEC																X							1
19	STR		X	X																				2
20	NEW		X											X										2
21	POBM									X	X	X												3
22	RSK		X																					1
23	OIEC		X				X													X				3
24	TIEC		X				X																	2
25	GOV														X			X						2
26	PIEC									X	X	X												3

Table 2 (cont.). Variables representing the OIN underlying factor

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ID	Variables	Authors numbered as the Table 1																	Total
		24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
1	LSP																		4
2	T&M																		4
3	P&S																		4
4	COM																		5
5	INC																		3
6	KC&A																		4
7	PKMG																		3
8	OIO																		4
9	MKS															X			4
10	VP																		4
11	CRM																		3
12	CHN																		1
13	RIPR		X					X											4
14	KYR																		3
15	KYA	X	X																4
16	CST			X															2

17	PTS				X	X	X											6
18	TEC							X									X	3
19	STR								X	X						X		5
20	NEW																	2
21	POBM																	3
22	RSK					X					X							3
23	OIEC											X	X	X	X			7
24	TIEC												X	X				4
25	GOV																	2
26	PIEC																	3
																	TOTAL	94

Source: own

After this, we proceeded to the qualitative analysis of this research applying focus group with Delphi Panel and Analytic Hierarchy Process (AHP, Saaty, 1997) to 6 ITSMZG specialists, in the following proportion: (SME CEOs: 1; back office/ front office managers: 1; software designers: 1 and professors : 3 as an academic vision) focusing on everyone´s attention and experience, in order to ask for some suggestions to get the best grouping of factors and variables and the best names to associate them to the OIN and DBD construct. The results were, for the OIN factor: Knowledge Management (KMG), Open Business Models (OBM), and Innovation Ecosystem (IEC). See Table 3.

Table 3.- Focus Group by Delphi Panel and AHP to determine the main groups of Variables of OIN

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Objective	OPEN INNOVATION (OIN) Factor						
	ID	Name of the factor suggested by expert vision for grouping of the variables	Variables	Factor as academic vision		AHP weighing as expert vision (%)	%Difference (Academic Vision-Empirical vision)
				Frequency	%		
Alternatives	1	KMG	LSP	4	4.26	6.9	-2.64
	2		T&M	4	4.26	6.8	-2.54
	3		P&S	4	4.26	5.4	-1.14
	4		COM	5	5.32	5.4	-0.08
	5		INC	3	3.19	5	-1.81
	6		KC&A	4	4.26	4.9	-0.64
	7		PKMG	3	3.19	2.9	0.29
	8	OBM	OIO	4	4.26	5.2	-0.94
	9		MKS	4	4.26	4.6	-0.34
	10		VP	4	4.26	4.7	-0.44
	11		CRM	3	3.19	4.6	-1.41
	12		CHN	1	1.06	4.5	-3.44

	13		**RIPR**	4	4.26	4.9	-0.64
	14		**KYR**	3	3.19	4.2	-1.01
	15		**KYA**	4	4.26	4.8	-0.54
	16		**CST**	2	2.13	3.9	-1.77
	17		**PTS**	6	6.38	2.1	4.28
	18		**TEC**	3	3.19	3	0.19
	19		**STR**	5	5.32	2	3.32
	20		**NWE**	2	2.13	2.3	-0.17
	21		**POBM**	3	3.19	1.9	1.29
	22		**RSK**	3	3.19	2.5	0.69
	23		**OIEC**	7	7.45	2	5.45
	24	**IEC**	**TIEC**	4	4.26	3	1.26
	25		**GOV**	2	2.13	1.5	0.63
	26		**PIEC**	3	3.19	1	2.19
			TOTAL	94	100	100	

Source: own

Finally, we used the same procedure for DBD variables, with results showed as: User (USR), Access (AXS), Network (NET), Regulation (REG), Cost & Benefits (C&B), QoS (Quality of Service). See Table 4.

Table 4.- Panel Delphi and AHP to determine the main group of Variables of DBD

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Objective	DIGITAL BROADBAND (DBD) FACTOR		
	ID	Variable	**AHP WEIGHING**
Alternatives	1	**USR.** User	0.2
	2	**AXS.** Access	0.2
	3	**NET.** Network	0.2
	4	**REG.** Regulation	0.15
	5	**C&B.** Costs-Benefits	0.16
	6	**QoS.** Quality of service	0.09
		TOTAL	1.000

Source: own.

Thereby, we proceeded to explain every single factor and variable to determine our general conceptual model of OIN, through the literature review. For practical analysis, we excluded the PKMG, POBM and PIEC dimensions due, these are performance key dimensions of each variable. Hence, we proceeded to explain each of these factors and variables to determine our general conceptual model of OIN and DBD, through deep literature review.

Literature review

The OIN is defined as "*a distributed innovation process based on purposively managed knowledge flows across organizational boundaries*" (Chesbrough & Bogers, 2014). But, how is affected in the digital era? One of the insights, is the DBD, defined by the OECD (2008a) as: "*typically used to denote an Internet connection with download speeds faster than*

traditional dial-up connections (at 64 kbit/s*)*" and it is a key driver of economic growth and national competitiveness (Kim, et al.,2010). So, our model proposed here consists in:

Knowledge Management (KMG)

According the OECD (2003): "*It covers any intentional and systematic process or practice of acquiring, capturing, sharing, and using productive knowledge, wherever it resides, to enhance learning and performance in organizations"*. Hence, we propose a model based on a strong leadership (LSP) of its members (OECD, 2003; Mejía-Trejo et al., 2013) able to establish different mechanisms of communications (COM) to transmit the explicit and tacit knowledge, including training the personnel and mentoring the apprentices (T&M) with policies and strategies (P&S) about rewards and incentives to the personnel (INC) in inbound and outbound knowledge frontiers of the Firm (OECD, 2003; Asakawa et al., 2010; Hughes& Wareham, 2010; West& Bogers 2014). For a best knowledge capture and acquisition (KC&A) (Gassman & Enkel, 2004; OECD 2003; Goglio-Primard, & Crespin –Mazet, 2014; Keup & Gassman, 2009), the incentives to the personnel are recommended (OECD, 2003; Allarakhia et al., 2010).

Therefore, our hypothesis is:

H1. The Higher level of DBD, the higher level of KMG in OIN of ITSMZG

Open Business Model (OBM)

We consider the Osterwalder& Pygneur (2010) definition of business model: "*A business model describes the rationale of how an organization creates, delivers, and captures value"* So, with the increased adoption of open innovation practices, *"open business models"* have emerged as a new design theme (Chesbrough, 2007; Chesbrough,2007). Therefore, we propose an OBM concept associated with KMG necessary to potentiate the OI Orientation (OIO) by the definition of exploring it, as the experimenting with new alternatives and/or exploiting it, as the refining and extending of the existing knowledge (Chien-Tzu & Wan Fen, 2014,) and what kind of driver is using, such as: the purchase of technology, licensing, purchase of technology, etc. (OECD, 2008b).

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The market segmentation (MKS) as basis to define the services and products specialized to offer to the customer (Osterwalder & Pigneur, 2010) and it represents the opportunity to analyze, different applications of the technology besides the current market such as the discovering and developing new markets or for licensing other Firm's Market (OECD, 2008b; Chesbrough 2003). The value proposition (VP) is the core of any business, so it should be emphasized in different forms, such as: branding, performance, newness, etc. (Osterwalder & Pigneur, 2010; Mejía-Trejo et al., 2013) and make the user a source of innovation *to create value*, as a tool to *capture value* (Chesbrough 2003). The customer relationship management (CRM) as a tool, must be applied in different channels (CHN) (own & partners), in all its different forms, such as: personal service, automated-service, self-service, etc. (Osterwalder & Pigneur, 2010; OECD, 2008b) emphasizing the co-creation (Rayna & Styriukova, 2014) in network. The revenues streams (RIPR) represent a great chance, for the organizations based on de intellectual property rights (IPR) protection as: patents, trademarks and copyrights, for commercializing them using patent pools or cross-licensing portfolios, for instance (OECD, 2008b).

The key resources (KYR) must be recognized (Osterwalder & Pigneur, 2010) involving tangible (buildings, infrastructure, labs, etc) and intangible (data, information, talent personnel, etc.) assets. The Key Activities (KYA) mainly the R&D network, turns out to be more productive based on absorptive capacity features, knowledge and technology (OECD, 2008b). The minimum of the costs (CST), like fixed-cost, variable-cost, economy-scale, economy-scope, etc. (Remneland-Wikhamn & Knights, D. 2012).

The Partnerships (PTS) represents a solid base to do business, involving the relationship University-Government-Organization-Society (Quadruple Helix) (OECD, 2008b, Miller et al., 2016) The technology (TEC), due its capacity to incorporate it in an external or internal way to the organization and aimed to the current or different markets (Chesbrough, 2003).The strategy (STR) applied in different ways: Market-Based Innovation; Crowd-Based Innovation Strategies or Collaborative Innovation;Network-Based Innovation Strategies (Gassmann et al.2010) according different final goals to implement, such as: improvement

of revenues, performance, competitive advantage, or even more, ensure the secrecy, etc. (OECD, 2008b). Finally, the new entrepreneurships (NWE) successfully achieved are a good indicator of any OBM, such as the *spin-in*, *spin-out* and *spin-off* in certain period. (Mejía-Trejo, 2017)

Hence, our hypothesis:

H2. The higher level of DBD, the higher level of OBM in OIN of ITSMZG.

Innovation Ecosystem (IEC)

It is considered as: *"a network of interconnected organizations, organized around a focal firm or a platform, and incorporating both production and use side participants, and focusing on the development of new value through innovation"* (Autio &Thomas, 2014). This IEC in our model is proposed with the next elements to analyze: Types of risk (RSK) such as: cost, the infringement litigation with other companies in a similar and/or different product markets, etc. (OECD, 2008b). The opportunities (OIEC), based on: the potential on how well knowledge flows and the system is connected, a greater sense of urgency for internal groups to act on ideas or technology (OECD, 2008b, Lichtenthaler 2009). The threats (TIEC) such as: the extra costs of managing co-operation with external partners, the lack of control, the potentially opportunistic behavior of partners, (Goglio-Primard, & Crespin –Mazet,2014), the adverse impact of flexibility, overdependence of partners, etc. (Lichtenthaler, 2009). A system of governance (GOV) capable to be elected and recognized, as a key factor for applying the principles of behavioral rules that support and regulate all the transactions by mean of written rules, the process of election of central governance, establishing roles and responsibilities to take decisions, etc.

Our hypothesis:

H3. The higher level of DBD higher level of IEC in OIN of ITSMZG

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Digital Broadband (DBD).

One of the insights, is the DBD, defined by the OECD (2008c) as: "typically used to denote an Internet connection with download speeds faster than traditional dial-up connections (at 64 kbit/s)" and it is a key driver of economic growth and national competitiveness (OECD, 2008c; Kim, et al.,2010; Rohrbeck et al. 2009). So, our model proposed here, consists of:

The user (USR), as one of the most important and powerful agent in our conceptual model, because it is an active element involving: surveillance for security/privacy based on protocols and standards, the empowerment of SMEs and users by DBD, the tendency of users with evolving skills to create contents with diversity and new habits in the consumer, (OECD, 2008a; Bianchi et al. 2010) to find out a major communication in your IEC, major communication with the government, etc. increasing the needs of DBD (Wunsch-Vincent & Vickery (2007); Müller-Seitz.& Reger, 2009; OECD, 2006), taking and planning competitive advantage (Kim et al.2010;OECD, 2008b).

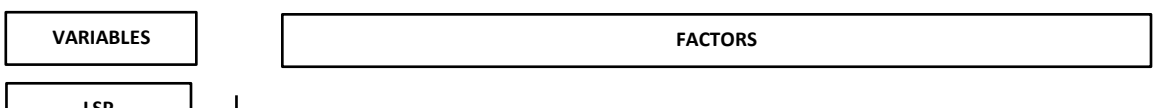
About access (AXS), as the ability to connect the backbone network of the telecom operator by mean to use the last mile (wire a non-wireless) (OECD,2008b; Kim et al. 2010) specially asking about Internet: coverage, flexibility, time, speed, cost-benefits ratio, technologies, type of device (fixed and/or mobile). According the network (NET), as the transmission media characterized by: interoperability, speed, connection, with minimum errors (OECD, 2008b; Kim, 2010). The best practices of regulation (REG) by the government (and associations), such as: the actions balance the interests of suppliers and users, protection of IPR about new contents, the promotion of competition in digital model business (OECD, 2006; Biggs & Kelly, 2006) , research & science, education, culture, health, lower prices, etc. providing the greatest benefits for users in different markets, introducing new technologies for access to the net and the universal broadband services (OECD, 2006; Biggs & Kelly, 2006; Sing&Raja (2008). It is a fact about the relation cost per benefits (C&B) increases with regulation and low prices showing in DBD: subscriptions, the network readiness, best offerings of services, etc. (Horrigan & Duggan, 2015; ITU-UNESCO, 2016)

with high quality of service standards (QoS) and service level agreements (Kim et al.,2010). Therefore, our hypothesis:

H4. The higher level of DBD, the higher level of OIN of ITSMZG

Hence, we proposed the general conceptual model (see Scheme 1)

Scheme 1. General Conceptual Model



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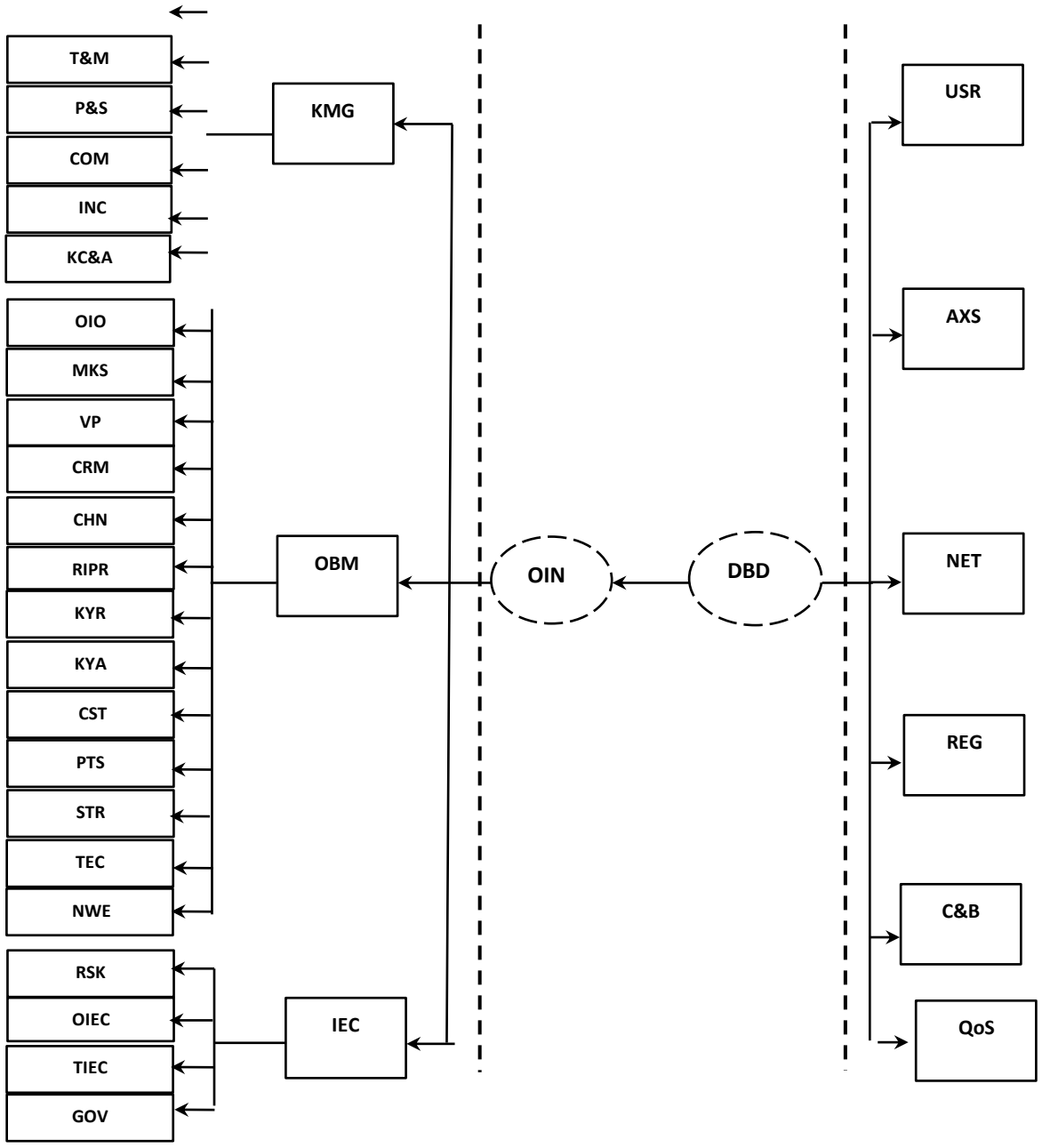

Source: -Own.

Notes: LSP.- Leadership ; T&M.-Training and Mentoring; P&S.- Policies and Strategies; COM.-Communication ; INC.-Incentives ; KC&A.-Knowledge capture & acquisition; OIO.-Open Innovation Orientation; MKS.-Market Segmentation ; VP.-Value Proposition; CRM.-Customer Relationship; CHN.-Channels of Distribution; RIPR.-Revenue Streams for

Intellectual Property Rights; KYR.-Key Resources; KYA.-Key Activities; CST.- Cost ; PTS.-Partnership; TEC.-Technology ; STR.-Strategy; NWE.-New Entrepreneurships. RSK.-Risk; OIEC.-Opportunities of Innovation Ecosystem ; TIEC.-Threats of Innovation Ecosystem; GOV.-Governance; DBD.-Digital Broadband; USR.-User; AXS.-Access.-NET.-Network; REG.-Regulation; C&B.-Cost& Benefits; QoS.-Quality of Service

And the Final Questionnaire (see Table 5)

Table 5. Final Questionnaire

OPEN INNOVATION Factor (OIN) Factor

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Knowledge Management (KMG) Factor		
Variables	**Indicator**	**Author(s)**
(1) LSP	1.-KM practices were a responsibility of managers and executives	OECD (2003); Asakawa et al. (2010); Hughes& Wareham, (2010); West& Bogers (2014); Mejia-Trejo et al. (2013)
	2.-KM practices were explicit criteria for assessing worker performance	
	3 .-KM practices were a responsibility of non-management workers	
	4.-KM practices were responsibility of the KMO	
(2) T&M	5.-Firm encouraged experienced workers to transfer their knowledge to new or less experienced workers	
	6.-Firm provided informal training related to KM	
	7.-Firm encouraged workers to continue their education by reimbursing tuition fees for successfully completed work-related courses	
	8.-Firm offered off-site training to workers in order to keep skills current	
	9.-Firm provided formal training related to KM practices	
	10.-Firm used formal mentoring practices, including apprenticeships	
(3) P&S	11.-Policies or programs intended to improve worker retention	
	12.-Values system or culture intended to promote knowledge sharing	

	13.-It's written KM (internal-external) policy or strategy	
(4) COM	14.-Workers is sharing knowledge with written documentation	
	15.-Workers is sharing knowledge by regularly updating all the databases of their projects	
	16.-Workers is sharing knowledge in collaborative work in virtual teams	OECD 2003
(5) INC	17.-Knowledge sharing is rewarded with monetary incentives	OECD(2003); Allarakhia et al. (2010)
	18.-Knowledge sharing is rewarded with non-monetary incentives	
	19.-You have a reward system to support the flow of know how between units external an internal or dual embeddedness	OECD (2008c); Frost (2001)
(6) KC&A	20.-You have a source of external knowledge based on: partnerships with external parties (alliances, joint ventures, joint development, acquisition or sale of knowledge (contract, R&D, licensing), corporate venturing (equity investments in university spin offs or in venture capital investment funds) etc.)	Gassman & Enkel (2004): OECD (2003); Keup & Gassman (2009)
	21.-You have a source of internal knowledge based on: in house innovations.	
Open Business Model (OBM) Factor		
Variables	**Indicator**	**Author(s)**
(7) OIO	22.-Your OBM is oriented more exploration in innovation	Beckman et al. (2004);
	23.-Your OBM is oriented more to exploitation in innovation	

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		Chien-Tzu & Wan Fen (2014)
	24.-Your OBM in open innovation mode is based on: purchase of technology	EIRMA (2003); OECD(2008c
	25.-Your OBM in open innovation mode is based on: joint venturing and alliances	
	26.-Your OBM in open innovation mode is based on: joint development	
	27.-Your OBM in open innovation mode is based on: contract R&D	
	28.-Your OBM in open innovation mode is based on:: licensing	
	29.-Your OBM in open innovation mode is based on: collaborations with universities	
	30.-Your OBM in open innovation mode is based on: equity in university spin off's	
	31.-Your OBM in open innovation mode is based on: equity in venture capital investment funds	
	32.-Your OBM in open innovation mode is based on: purchase of technology	
(8)MKS	33.-Your OBM determines the real needs of its consumers, classifying them on: mass market	Osterwalder & Pigneur, (2010)

	34.-Your OBM determines the real needs of its consumers, classifying them on: niche market	
	35.-Your OBM determines the real needs of its consumers, classifying them on: segmented	
	36.-Your OBM determines the real needs of its consumers, classifying them on: diversified	
	37.-Your OBM determines the real needs of its consumers, classifying them on: multisided platforms-markets	
	38.-Your OBM is only focused an makes surveillance on your current market	OECD (2008c); Chesbrough (2003); Chesbrough (2006)
	39.-Your OBM only makes surveillance for discovering and developing new markets	
	40.-Your OBM only makes surveillance for licensing other Firm's Market	
(9)VP	41.- Your OBM offers VP through newness	Osterwalder & Pigneur, (2010)
	42.- Your OBM offers VP through performance	
	43.- Your OBM offers VP through customization	
	44.- Your OBM offers VP through, design	
	45.- Your OBM offers VP through brand	
	46.- Your OBM offers VP through price	
	47.- Your OBM offers VP through cost reduction	
	48.- Your OBM offers VP through risk reduction	

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	49.- Your OBM offers VP through accesibility,	
	50.- Your OBM offers VP through convenience/usability	
	51.-Your OBM lead the VP based on User Innovation (Create Value) as a tool of Open Innovation (Capture Value)	Von Hippel (2005); Chesbrough (2003); Van der Borgh et al. (2012)
(10)CRM	52.- Your OBM is seeking to deliver requirements to your consumers by: personal assistance	Osterwalder & Pigneur, (2010); OECD (2008c)
	53.- Your OBM is seeking to deliver requirements to your consumers by: dedicated personal assistance	
	54.- Your OBM is seeking to deliver requirements to your consumers by: self service	
	55.- Your OBM is seeking to deliver requirements to your consumers by: automated service	
	56.- Your OBM is seeking to deliver requirements to your consumers by: communities	
	57 Your OBM is seeking to deliver requirements to your consumers by: co-creation	Rayna & Styriukova (2014); Osterwalder & Pigneur, (2010)

(11)CHN	58.- Your OBM seeking to be very closed to the delivery of the services to your costumers by own channels	Osterwalder & Pigneur, (2010); OECD (2008c)
	59.- Your OBM seeking to be very closed to the delivery of the services to your costumers by partner channels	
(12)RIPR	60.-Your OBM applies revenue stream of IPR by mean of: financial assets licensing and/or building a Intellectual Capital Portfolio to exploitation	
	61.-Your OBM applies revenue stream of IPR by mean of: usage fee	
	62.-Your OBM applies revenue stream of IPR by mean of: subscription fees	
	63.-Your OBM applies revenue stream of IPR by mean of: lending/renting/leasing	
	64.-Your OBM applies revenue stream of IPR by mean of: licensing	
	65.-Your OBM applies revenue stream of IPR by mean of: brokerage fee	
	66.-Your OBM applies revenue stream of IPR by mean of: advertising	
	67.-Your OBM applies revenue stream of IP by mean of trade secrets	OECD (2008c)
	68.-Your OBM to facilitate the revenue stream makes patent pools	

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	69.-Your OBM to facilitate the revenue stream makes cross-licensing	
(13)KYR	70.-Your OBM use all yours: physical key resources (buildings, labs, sites, network etc.)	Osterwalder & Pigneur, (2010)
	71.-Your OBM use all yours: intellectual key resources (relationships, databases, information systems, etc.)	
	72.-Your OBM use all yours: human key resources (its personnel)	
	73.-Your OBM use all yours: financial key resources	
	74.-Your OBM considers the rapid shift of industry and technology borders, to pose new business models	Gassman (2006); Asakawa et al. (2010)
	75.-Your OBM considers the knowledge as a factor of competitive advantage.	
	76.-Your OBM considers that a more interdisciplinary cross boarder research more partnership for innovation	
(14)KYA	77.-Your OBM uses all yours: production key activities	Osterwalder & Pigneur, (2010)
	78.-Your OBM uses all yours: problem solving key activities	
	79.-Your OBM uses all yours: platform network key activities	
	80.-Your OBM use all yours R&D located under cluster and networks innovation systems with geographical proximity because the spillovers often occur by this.	OECD (2008c); Bathelt et

		al. (2004); Enkel et al.(2009); Whelan, et al. (2010)
	81.-Your OBM making activities for a great awareness to invest in own R&D because the importance of absorptive capacity	Cohen & Levinthal, (1990); OECD (2008c)
	82.- Your OBM making activities for R&D investments in other countries, because is more the available the pool of scientist, clusters and academic institutes, than the near to markets and production facilities	Schwaag (2006); INSEAD et al. (2006); Thursby & Thursby (2006)
	83.-Your OBM attracting technology sourcing mainly, in locating the R&D activities outside the home country, and the geographic dispersion a means of knowledge creation rather than knowledge diffusion	Kuemmerle (1997)
	84.-Your OBM attracting the share of codified information and co-ordination of activities among different parties because is easier for innovations that can be pursued independently (autonomus innovation).	Chesbrough & Teece (2002)
	85.-Your OBM making activities to have benefits only realized in conjunction with complementary innovations,.Your product lifecycle is long. Less attractive	
(15)CST	86.-Your OBM minimizes your cost through: cost-driven	Osterwalder & Pigneur, (2010);
	87.-Your OBM minimizes your cost through: value-driven	

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	88.-Your OBM minimizes your cost through: fixed costs	Remneland-Wikhamn & Knights, D. (2012)
	89.-Your OBM minimizes your cost through: variable costs,	
	90.-Your OBM minimizes your cost through: economies of scale	
	91.-Your OBM minimizes your cost through:, economies of scope	
(16)PTS	92.-Your OBM seeking partners to support: optimization and economy of scale global industries results, powerful standards and dominant designs. (Globalisation)	Osterwalder & Pigneur, (2010); OECD (2008c); Gassman (2006)
	93.-Your OBM seeking partners to support: reduction of risk and uncertainty, and acquisition of particular resources and activities	
	94- Your OBM seeking partners to support: new developments in and around their industry owing is based on an industry characterized by rather short technology life cycles	OECD (2008b); Osterwalder & Pigneur, (2010);
	95.- Your OBM seeking external partners (suppliers, customers, universities, etc.) even in across countries, in an innovation ecosystem.	Gassman (2006);
	96.-Your OBM seeking the relation amongst: University-Industry-Government (the triple helix) because the collaborative innovation activities stimulates innovation; even more you're considering the social aspect (quadruple helix) benefits	Etzkowitz & Leydesdorff, (1995); Tidd (2006); OECD (2008c); Miller et al. (2016)
	97.-Your OBM seeking use venturing to find external partners for commercializing innovations that are not used internally (divestment, spin-out, spin-off)	

(17)TEC	98.-You´re implementing internal technology for your current market	Chesbrough (2003); Lichtenthaler & Holger (2009).
	99.-You´re implementing internal technology for the new markets	
	100.-You´re implementing internal technology for other Firm´s market	
	101.-You´re implementing internal/external venture handling technology to your current market	
	102.-You´re implementing internal/external venture handling technology to the new markets	
	103.-You´re implementing internal/external venture handling technology to the other Firm's Market	
	104.-You´re implementing external technology insourcing to your current market	
	105.-You´re implementing external technology insourcing to the new markets	
	106.-You´re implementing external technology insourcing to the other Firm´s market	
	107.-You´re implementing external technology for your current market	
	108.-You´re implementing external technology for the new markets	
	109.-You´re implementing external technology for other Firm´s market	

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	110.-You´re on permanent looking for external technology to bring to the company	Chesbrough,& Kardon –Crowter, (2006)
	111.-You're on permanent surveillance for IPR of other technologies	
	112.-You're implementing technology opportunistically	
	113.-You're implementing technology in formal and systematic way.	
	114.-You´re implementing alternatives technologies	
	115.-You´re implementing technologies with enough incentives	
	116.-You're implementing technologies to address an incremental product improvement	
	117.-You're implementing more proven technologies than new ones	
	118.-You´re implementing more proven technologies more than trying to develop entirely new	
	119.-You´re implementing external technologies because they represent more benefits	
	120.-You´re implementing internal technologies because they represent more benefits	
(18)STR	121.-Your OBM is designed on Efficiency-Centric Open Business Model ; hence you pose Market-Based Innovation Strategies)	Saebi & Foss (2013);

	122.-Your OBM is designed on User-Centric Open Business Model; hence you pose Crowd-Based Innovation Strategies	Gassmann et al.2010); Hopkins et al. (2011)
	123.-Your OBM is designed on Collaborative Open Business Model; hence you pose Collaborative Innovation Strategies.	
	124.-Your OBM is designed on Open Platform Business Model; hence you pose Network-Based Innovation Strategies	
	125.-Your strategy to do IPR protection registration is due: preventing copy	Cohen et al. (2002); Asakawa et al. (2010)
	126.- Your strategy to do IPR protection registration is due: preventing other companies from patenting (e.g. prevent blocking)	
	127.-Your strategy to do IPR registration is due: prevent lawsuits	
	128.-Your strategy to do a IPR protection registration is due: to use for negotiations	
	129.- Your strategy to do a IPR registration is due: the enhance of reputation	
	130.- Your strategy to do a IPR registration is due: to generate licensing revenue	
	131.- Your strategy to do IPR protection registration is due: to measure the performance	
	132.- Your strategy to do IPR protection registration is due: to get competitive advantage	Rohrbeck,et al. (2009.)
	133.-Your strategy to protect your IPR is based entirely by the industrial trade secrecy	OECD (2008c)

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(19) NEW	134.-You've got *spin in* as: an investment in technology *start-ups* (e.g. university *spin off's*)	OECD (2008c)
	135.-You've got *spin out* as: divesting internally developed technologies relates to the *inside-out* aspect of open innovation	
	136.-You've got *spin off* as: the company no longer maintains a stake in the project/company.	
Innovation Ecosystem (IEC) Factor		
Variable	**Indicator**	**Author(s)**
(20) RSK	137.-You avoid the risk of costs using innovation intermediaries	OECD (2008c); Sieg et al. (2010)
	138.-Your management of the creation of cross-licensing agreements involving the exchange of two or more patent portfolios to allow mutual use of patents by multiple patent holders in order to avoid risk of patent infringement	
	139.-Your innovation network considers the theft of IPR as the most important risk to global open innovation networks even with external partners that may later become competitors	
	140.-Your innovation network involves similar companies that focus on tactical innovation issues where the success depends on their ability to share experience, disclose information and develop trust and transparency	Tidd (2006)
	141.-Your innovation network involves collaboration between companies from a single industry or adjacent industries that co-operate to explore and create new products and processes	

	142.-Your innovation network involves collaboration between companies from different industries that co-operate to explore and create new products and processes, where sharing of information and risk	
	143.-Your innovation network involves heterogeneous companies that focus on tactical innovation issues where the success depends on their ability to share experience, disclose information and develop trust and transparency	
(21)OIEC	144.- You've got open innovation network opportunity from recognizing the potential of innovation depends on how well knowledge flows	OECD (2008c); Bathelt et al. (2004)
	145.- You've got open innovation network benefits from recognizing to be a part of an innovation ecosystem that influences your national or regional innovation system	Lundvall, (1992); Nelson (1993)
	146.- You've got open innovation network benefits from maximizing the transference of tacit knowledge residing in national innovation system	Bathelt, et al. (2004)
	147.-You've got open innovation network benefits from the ability to leverage R&D developed outside	OECD (2008c)
	148.-You've got open innovation network benefits from extended reach and capability for new ideas and technologies and create value through the knowledge	Van der Borgh, et al. (2012); Fichter (2009); Lichtenthaler (2009)

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	149.-You've got open innovation network benefits from: the opportunity to refocus some internal resources on finding , screening and managing implementation;	OECD (2008c): Fichter, (2009); Goglio-Primard, & Crespin – Mazet (2014)
	150.-You've got open innovation network benefits from : the improved payback on internal R&D through sales or licensing of otherwise unused intellectual property;	
	151.-You've got open innovation network benefits from : a greater sense of urgency for internal groups to act on ideas or technology;	
	152.-You've got open innovation network benefits from : the ability to conduct strategic experiments with less risk	
	153.-You've got open innovation network benefits from: over time, the opportunity to create a more innovative culture	
(22)TIEC	154.-You've perceived or experienced open innovation network threats from: the extra costs of managing co-operation with external partners	
	155.-You've perceived or experienced open innovation network threats from: the lack of control	
	156.-You've perceived or experienced open innovation network threats from: the adverse impact of flexibility	
	157.-You've got perceived or experienced open innovation network threats from: the overdependence on external parties	

	158.-You've got perceived or experienced open innovation network threats from: the potentially opportunistic behavior of partners	
(23)GOV	159.-You recognize the need to have written rules to exchange the information in the innovation ecosystem	Deloitte (2015)
	160.-You participate in the election of central governance system	
	161.-You participate in the development of operating procedures, that include standards for collecting, storing, and sharing data	
DIGITAL BROADBAND (DBD) Factor		
Variables	**Indicator**	**Author(s)**
(1)USR	1.-As user, you're on permanent surveillance of security & privacy of protocols & standards that support the DBD of your innovation ecosystem.	OECD (2008a); Bianchi et al. (2010)
	2.-As user, you consider that SMEs tend to be empowered by the DBD enabling them to compete with larger firms in an increasing number of markets and purchase services they previously could not afford.	
	3.-As user, you consider that is also more likely to have multiple business links, and multiple links with broadband technology improve labour productivity. Firms with a high broadband equipped labour share have higher productivity.	
	4.-As user you're prone to use open source very often to create web sites, blogs, podcasting, virtual communities, digital arts, apps, etc., facilitating the user-driven innovation to create new content; in	OECD (2003); OECD (2008a); Wunsch-Vincent & Vickery

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	other words, they are user-innovators and collectively develop new products (Create Value or *democratizing the innovation*)	(2007); Müller-Seitz.& Reger (2009)
	5.-As user, you consider that the DBD enables technologies and platforms, products and services, skills and jobs continue to emerge, bringing about new and increasingly user-driven ways of consuming, producing and innovating	OECD (2008a)
	6.-As user, you consider the broadband tend to get user-autonomy, increasing participation diversity. These result in lower entry barriers, distribution costs and user costs and greater diversity of works as digital shelf space is almost limitless.	
	7.-As user, you have high skills of your personnel to use DBD	OECD (2006)
	8.-As user, you appreciate that content is creating new user habits and a shift in focus from 'customer' to 'user. Digital technologies enable individuals to create and use their own digital content and create social, cultural, and/or economic value for themselves, their communities, or their country.	
	9.-As user, you're finding out what is going on it your innovation ecosystem	Kim et al. (2010)
	10.-As user, you're communicating with internal/ external providers and/or partners	
	11.-As user, you're finding out all news about its core research	
	12.-As user, you're sharing your views with others about key issues	

	13.-As user, you're communicating with government officials about issues	
	14.-As user, you're improving your own infrastructure and/or the last mile network	
	15.-As user, you realized that Internet connections are increasingly available as an important option for users.	
(2)AXS	16.-About Internet access increases user flexibility in time and location of use, it can be expected to add additional benefits over and above those from fixed location Internet access	OECD (2008b)
	17.-As access in the last mile you appreciate an excellent coverage, time and speed of digital access technologies (fibre, DSL, WIMAX, LTE, PLC, UMTS HSPA, etc.) of your telecom operator	
	18.-As access, the PC is the most important device used to connect to the network	
	19.-As access, the notebook is the most important device used to connect to the network	Kim et al. (2010)
	20.-As access, the smartphone, tablets and mobile are the most important devices used to connect to the network	
(3) NET	21.-As network, the interoperability of broadband services and applications on various networks and platforms is of increasing importance as users ask for the same products over different platforms.	OECD (2008b)

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	22.-As network speed, you appreciate a correct average speed (User's general perception of the average level of Internet communication speed and service delay)	Kim (2010)
	23.-As network speed, you appreciate a correct variation in speed (User's general perception of the variation of service speed (jitter, zapping delay, etc.))	
	24.-As a network connection., you appreciate a correct connection availability (Availability of channels and/or ports designated to a specific service request)	
	25.-As a network connection, you appreciate a correct connection stability (How well the connection is maintained without reconfiguring the user's network environment)	
(4)REG	27.-You appreciate about best practices of regulation in your country that business and regulatory environments are balanced: the interests of suppliers and users, in areas such as the protection of intellectual property rights and digital rights management without disadvantaging innovative e-business models;	OECD (2006)
	28.-You appreciate about best practices of regulation in your country theew content types created by network users also receives increasing government attention, through public sector information for commercial re-use, research&science, education, culture, health	
	29.-You appreciate about best practices of regulation in your country the regulatory frameworks that balance the interests of suppliers and users, in areas such as the protection of intellectual	

	property rights, and digital rights management without disadvantaging innovative e-business models.	
	30.-You appreciate about best practices of regulation in your country, promoting the competition. Multiple play can increase competition, lower prices, and drive growth—but can only begin in markets with low entry barriers. Regulatory frameworks that establish level competitive playing fields will thus provide the greatest benefits for users.	Biggs & Kelly (2006) ; Sing&Raja (2008);
	31.-You appreciate about best practices of regulation in your country, relying more on market forces. Regulation should move toward allowing innovation and competition on a level playing field, then step back from intervening unless there are market failures.	Sing&Raja (2008);
	32.-You appreciate about best practices of regulation in your country,, allowing new technologies to contribute everything they have to offer. Service providers should be allowed to fully use their networks and reduce costs—increasing business viability and making markets more efficient.	
	33.-You appreciate about best practices of regulation in your country a tendency to get universal service based on broadband	
(5)C&B	34.-About the monthly cost of broadband subscription, is too expensive	Horrigan & Duggan (2015)
	35.-About the cost, you have other options for internet access out of business less expensive	

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	36.-About maintenance cost of the internal infrastructure, is too expensive	
	37.-About cost, the tablets and smartphones does everything online that you need, less expensive	
	38.-About the cost, the service neither is available or speed is unacceptable	
(6)QoS	39.-As a user experience, you've got a remarkable profitability of your broadband service DBD to create and keep on a solid business and innovation ecosystem.	ITU-UNESCO (2014)
	40.-As a user experience, you've got a remarkable sustainability of your broadband service DBD to create and keep on a solid business and innovation ecosystem.	
	41.-As a user experience, you've got a remarkable affordability of your broadband service DBD to create and keep on a solid business and innovation ecosystem	
	42.-As QoS, service error rate has a correct frequency of disconnections, service failure or degradation due to extensive packet loss (packet loss ratio), number of retransmissions, lack of responses, etc.	Kim et al. (2010)
	43.-As a QoS you have a correct Service Level Agreement for your innovation ecosystem	

Source: own

Notes: LSP.-Leadership ; T&M.-Training and Mentoring; P&S.- Policies and Strategies; COM.-Communication ; INC.-Incentives ; KC&A.-Knowledge capture & acquisition; OIO.-

Open Innovation Orientation; MKS.-Market Segmentation ; VP.-Value Proposition; CRM.-Customer Relationship; CHN.-Channels of Distribution; RIPR.-Revenue Streams for Intellectual Property Rights; KYR.-Key Resources; KYA.-Key Activities; CST.- Cost ; PTS.-Partnership; TEC.-Technology ; STR.-Strategy; NWE.-New Entrepreneurships s. RSK.-Risk; OIEC.-Opportunities of Innovation Ecosystem ; TIEC.-Threats of Innovation Ecosystem; GOV.-Governance; DBD.-Digital Broadband; USR.-User; AXS.-Access.-NET.-Network; REG.-Regulation; C&B.-Cost& Benefits; QoS.-Quality of Service.

Methodology

We started the study involving 600 ITSZMG specialists (including: SME CEOs (120), back office/ front office managers (120), software designers (120), professors (120) and directors of business consultant firms (120) at 200 SMEs all of them grouped in the cluster "*Ciudad Creativa Digital*) during the period of September-December 2016. The data collection was made through the support of a previous agreement (type: triple helix) among the ITSZMG-PROSOFT (*Programa para el Desarrollo de la Industria del Software y la Innovación.*)-University of Guadalajara. The participants were distributed firstly, in the AHP-Delphi Focus Group, and secondly, in different seminar panels to do the survey of data in four modules: KMG, OBM, IEC and DBD.

We made the quantitative analysis of the research, in order to evaluate the reliability and validity of the measurement scales, using Confirmatory Factor Analysis (CFA) with the maximum likelihood method in EQS 6.2 software (Byrne, 2006). Similarly, the reliability of the proposed measurement scales is evaluated from Cronbach's alpha coefficient and the composed reliability index (CRI) (Bagozzi & Yi, 1988). All the values from the scale exceeded the recommended level of 0.7 for Cronbach's alpha as well as the CRI that provides an evidence of confidence that justifies the internal reliability of the scales (Hair et al., 2014). Accordingly, other methods of estimation were used when it is assumed that the normality is present. For this, we followed the suggestions from Chou, et al. (1991) and Hu, et al. (1992) for the correction of the estimation model used. In this way, the robust statistics (Satorra & Bentler, 1988) will be used to provide a better evidence of the statistical adjustments.

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The adjustments used, were: the Normalized Adjustment Index (NFI), Not-Normalized Adjustment Index (NNFI), Comparative Adjustment Index (CFI) and the Root Mean Square of Error Approximation (RMSEA) (Byrne, 2006; Hair et al., 2014). The NFI, NNFI and CFI values between 0.80 and 0.89 represent a reasonable adjustment (Segars & Grover, 1993), and a value that is equal or higher to 0.90 is an evidence of a good fit (Byrne, 2006). The RMSEA values that are inferior to 0.080 are acceptable (Hair et al., 2014). The CFA results are presented in Table 6.

Table 6. Internal Consistence and Convergent Validity Evidence of the Theoretical Model

Factors		**Variables**	**Factor Loading>0.6 (a)**	**Robust t-Value**	**Average Factor Loading**	**Cronbach's Alpha>=0.7 (b)**	**CRI> 0.7 (b)**	**AVE> 0.5 (c)**
OIN	**KMG**	**LSP**	**0.957*** **	1.000a	0.747	0.758	0.887	**0.824**
		T&M	0.682***	10.235				
		P&S	0.702**	11.367				
		COM	0.892***	13.339				
		INC	**0.570*** **	10.074				
		KC&A	0.677***	11.206				
	OBM	**OIO**	0.602***	1.000a	0.708	0.720	0.931	**0.878**
		MKS	0.785***	9.855				
		VP	0.890***	10.398				
		CRM	0.952***	9.710				

		CHN	0.892***	9.663				
		RIPR	**0.590*** **	11.224				
		KYR	0.665***	12.345				
		KYA	0.654***	9.212				
		CST	0.602***	10.278				
		PTS	0.777***	9.999				
		STR	**0.579*** **	10.016				
		TEC	0.645***	10.001				
		NWE	**0.567*** **	7.998				
	IEC	**RSK**	**0.500*** **	1.000a	0.701	0.718	0.801	**0.682**
		OIEC	0.902***	11.098				
		TIEC	0.704***	11.606				
		GOV	0.698***	12.007				
DBD		**USR**	0.786***	1.000a	0.757	0.730	0.893	**0.835**
		AXS	0.887***	13.765				
		NET	0.897***	9.765				
		REG	0.602***	8.098				
		C&B	0.789***	9.111				
		QoS	**0.580*** **	11.233				

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Results: (S-BX²) = 453.672; df=112; p < 0.000; NFI = 0.825; NNFI = 0.895; CFI = 0.883; RMSEA = 0.019 Conclusion: the relationship among KMG, OBM and IEC factors and variables have good adjustment and a good fit to the data

Notes:

(a).-Parameters constrained to the value in the identification process; *** = p < 0.0, (Bagozzi & Yi, 1988).

(b).-According Hair et al. (2014)

(c).- Average Variance Extracted (AVE), according (Fornell & Larcker, 1981).

Conclusion: These values indicate that there are enough evidence of convergent validity and reliability, which justifies the internal reliability of the scales (Hair et al., 2014).

Source: Own

The theoretical model provides a good fit of data (S-BX² = 453.672; df=405; p < 0.000; NFI = 0.825; NNFI = 0.895; CFI = 0.883; RMSEA = 0.019). As evidence of the convergent validity, the results from the CFA indicate that all the items of the related factors are significant (p < 0.001), the size of all the standardized factorial loads are superior to 0.60 (Bagozzi & Yi, 1988) and the average of the standardized factorial loads of every factor exceed without any problems the value of 0.70 (Hair et al., 2014). Finally, the average variance extracted (AVE) was calculated for every pair of constructs, which results in an AVE that is superior to the 0.50 (Fornell and Larcker, 1981).

In regard to the evidence of discriminant validity, the measurement is given in the following ways:

1.-With a confidentiality interval of 95%, none of the individual elements of the latent factors from correlation matrix contain the value 1.0 (Anderson & Gerbing, 1988).

2.-The variance extracted between each pair of constructs is superior to its corresponding AVE (Fornell & Larcker, 1981). See Table 7.

Table 7. Discriminant Validity Measuring of the Theoretical Model

Factors	KMG	OBM	IEC	DBD
KMG	**0.824**	0.073	0.116	0.185
OBM	0.130-0.410	**0.878**	0.336	0.160
IEC	0.180-0.500	0.440-0.720	**0.682**	0.423
DBD	0.330-0.530	0.340-0.460	0.590-0.710	**0.835**

Note: The diagonal represents the AVE, whereas above the diagonal part presents the Variance (the correlation squared). Below the diagonal, is shown the correlation estimation of the factors with a confidence interval of 95%.

Source: Own

Based on these criteria, it can be concluded that the different measurements used in this paper show enough evidence of reliability as well as convergent and discriminant validity.

Results

In order to prove the hypotheses, a structural equations modeling with EQS 6.2 software by means of CFA of second order was applied (Byrne, 2006) and the theoretical model was analyzed to prove the structure of the model and to get the results that could allow the contrast of the established hypotheses. The nomological validity of the theoretical model was analyzed by the chi-square performance test in which the theoretical model was compared with the measurement model. The results indicate that there are significant differences of the theoretical model are good in the explanation of the relations observed between the latent constructs (Anderson & Gerbing, 1988). See Table 8.

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Table 8. Structural Equation Modeling Results from the Theoretical Model

Hypotheses	Path	Standardized path Coefficients	Robust t-Value
H1. The higher level of DBD, the higher level of KMG in OIN of ITSMZG. The model has significant positive effect.	DBD→KMG	0.599***	4.229
H2. The higher level of DBD, the higher level of OBM in OIN of ITSMZG. The model has significant positive effect.	DBD→OBM	0.556***	3.987
H3. The higher level of DBD, the higher level of IEC in OIN of ITSMZG. The model has significant positive effect.	DBD→IEC	0.654***	6.417
H4. The higher level of DBD, higher level of OIN of ITSMZG	DBD→OIN	0.670***	7.087
Results: S-BX2=566.20; df = 210; p < 0.000; NFI = 0.810; NNFI = 0.820; CFI = 0.899; RMSEA = 0.069. Note: *** = p < 0.01. Conclusion: The model has significant positive effect among the Factors			

Source: Own

Discussion

Mexico is an emerging country and all the best practices about DBD on OIN by the specialist in ITSMZG, are still with insufficient awareness of their practice or even more, they are still ignored. Hence, the importance of this study to identify the strength and weak relationships

to determine a general conceptual model able to predict the best correlations and to improve the model. According the final results showed in Table 4 (only the factor loading > 0.6):

1. There are important issues to consider as a result of the visions comparison: academics vs. experts (See Table 3). For instance, OIEC is cited as 7.45 % importance of academic vision vs, 2% of experts' vision (5.45 as % difference amongst them). Revising the case of PTS with 6.38 % importance of academic vision vs. 2.1 % importance of experts' vision (4.28 as % difference amongst them). Other similar case is the variable CHN with 1.06% importance of academic version vs. 4.5% importance of experts' vision (-3.44 as % difference amongst them). Thus, we obtained the three main variables with higher academic differences and chances to be developed in the final OIN to be more practical to the experts' vision.
2. The main influences of the DBD on OIN practices in the ITSMZG showed positive effects for KMG factor such as the leadership (LSP), as the most important variable applied because there was a great awareness in the knowledge management practices and the communication of this (COM). This is a result of how workers are on training and mentoring (T&M) programs with policies and strategies (P&S) to promote the knowledge capture and acquisition (KC&A). However, it's important to be developed (factor loading <0.6), the promotion of incentive programs (INC) supported in reward systems to reinforce the flow of know how between units.
3. The main influences of the DBD on OIN practices in the ITSMZG showed positive effects for OBM factor in the open innovation orientation (OIN) due it is just starting in some new activities, such as: the purchase of technology, joint venturing and alliances. The market segmentation (MKS), is a real practice of needs detection of their consumers with a permanent surveillance of the current and potential market and the constant revision of the value proposition (VP) to create it through the user as a tool to capture value, reinforcing the customer relationship (CRM) to be close of them through several branches of distribution (CHN) including own channels and/or partner channels. Therefore, exist a permanent awareness to optimize the key activities (KYA) and the key resources (KYR) resulting in a remarkable reduction of costs (CST). The partnership,

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(PTS) is a key factor of the OBM because the reduction of risk and uncertainty, acquisition of particular resources and activities mainly the quadruple helix relationship. The technology (TEC) is a strategic resource due the importance of how is acquired and implemented, based on a market point of view and the internal/external resources. However, it's important to be developed (factor loading <0.6), the revenues for intellectual property rights (RIPR) because the lack of clear policies of how to get revenues for commercializing, and the link with strategy (STR) to protect the IPR to get competitive advantage. Finally, is necessary to improve the new entrepreneurships (NWE) indicator, as the ability to get: spin in, spin out and/or spin off businesses.

4. The main influences of the DBD on OIN practices in the ITSMZG showed positive effects for IEC factor in the opportunities of innovation ecosystem (OIEC), where the benefits are from several issues, such as: how well knowledge flows to influence their national or regional innovation system or how to create value through the knowledge, among others. The threats of innovation ecosystem (TIEC) are affecting the perception or experience of the open innovation network threats from: the extra costs of managing co-operation with external partners; the lack of control; the adverse impact of flexibility,etc. The governance (GOV) is well done applied in the exchange of information for the innovation ecosystem, recognizing both, the OIEC and TIEC just in time, for planning the actions in advance.

   However, it's important to be developed (factor loading <0.6), the risk (RSK) as a variable for warning of how avoid the risk of costs using innovation intermediaries; management of the creation of cross-licensing agreements, etc.

5. For DBD, due the firms are on permanent surveillance of security, privacy of protocols and standards, the user (USR) becomes in the main beneficiary. Firms with a high broadband equipped labor share, have higher productivity. The results are lower entry barriers, and lower distribution costs to the final user. Digital technologies enable individuals to create and use their own digital content and create social, cultural, and/or economic value for themselves, their communities, or their country, improving their own

infrastructure (the last mile network). The Internet connections are increasing the demand of availability as an important option for users, and therefore, is increasingly the importance of the access (AXS), with user flexibility in time and location of use, depending of speed of digital access technologies (fiber optics, DSL, WIMAX, LTE, PLC, UMTS HSPA, etc.) from their telecom operators to several different devices that are connected to the network, such as: PC, notebook, the smartphone, tablets and/or other mobile devices.

There are two important consequences: one of these, is that network (NET) must be adequate for the interoperability of broadband services and applications in several platforms to provide a correct average speed, speed variation and availability of connection and stability with compliance of all the regulations and policies (REG) and allowing finally, the competition promotion, lower prices, trusting more on market forces. The second one, are the costs & benefits (C&B) for using the DBD for instance, the monthly cost of broadband subscription or maintenance cost of the internal infrastructure.

However it's important to be developed (factor loading <0.6), the quality of service (QoS), as a remarkable profitability to be improved in sustainability and affordability of their DBD service to create and keep a solid business and innovation ecosystem; service error rate, service failure or degradation due to extensive packet loss, number of retransmissions, lack of responses, etc.

Despite all above mentioned, 5/6 DBD factors have positive effect on 18/23 OIN factors.

Conclusion

Hence, we concluded the following important issues:

1. The results of the study are important and useful for the ITSMZG specialists, because the purpose of the OIN-DBD model is to identify weak relationships, as opportunities to make suggestions on reinforcing such identified relationships, for model improvement.

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2. Regarding the Specific Research Question (SRQ1). *What are the variables proposed for the general conceptual model?* It was applied the literature review and proposed the general conceptual model showed in the Scheme 1 and the final questionnaire (see Table 5), based on AHP and Delphi techniques. This allowed us to obtain an academic and expert vision, with a great opportunity to identify and conciliate the importance of the variables among these visions, into the factors of OIN-DBD model, to do improvements on it.

3. About the Specific Research Question (SRQ2). *What are the relationships of these variables?* the findings with Confirmatory Factor Analysis (CFA), reveal the most important factors interacting with factors loading >0.6 (see Table 6). This study concluded in a proposition of DBD-OIN general conceptual model with the relationship of USR-AXS-NET-REG-C&B-QoS representing the DBD underlying factor affecting the KMG-OBM-IEC representing the OIN underlying factor.

4. The Specific Research Question (SRQ3). *What are the most relevant variables of the model?* It is showed in the same Table 6 that leadership (LSP) in knowledge management (KMG), is the most important variable in the empirical model. So, it represents to the ITSMZG an indicator very desirable to maintain, but not the only one into the model.

5. Our hypotheses (H):

H1. Higher level of DBD higher level of KMG in OIN of ITSMZG.

H2. Higher level of DBD higher level of OBM in OIN of ITSMZG.

H3. Higher level of DBD higher level of IEC in OIN of ITSMZG.

H4. Higher level of DBD higher level of OIN of ITSMZG.

Showed in Table 8, each one of them with significant positive effect among the factors confirms our general conceptual model.

6. Therefore, our suggestions for ITSMZG to reinforce the weakness relationships revealed in this current study (low factor loading levels <=0.6, see Table 6), are showed in the

discussion section, such as INC (0.570), RIPR (0.590), STR (0.579), NEW (0.567), RSK (0.500), QoS (0.580).

So, concluding in a practical contribution, we can say that: incentives to the personnel, revenues for intellectual property rights, strategy, new entrepreneurships, risk in the open innovation, they are must be improved, for future studies of the ITSMZG Managers.

For other hand, as a knowledge contribution, we can say that with the use of structural equation modeling we are able to propose a OIN-DBD model, enough to identifying the own underlying relationships to improve such model.

7. The limitations of this study are that customers, suppliers, etc. of the ITSMZG specialists were not questioned. Therefore, other studies could include them, and even more, from other regions of the country.

8. For future studies, we recommend the use of variable reduction techniques, such as exploratory factor analysis such as the Varimax main component method, was suggested as a refinement of the model.

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