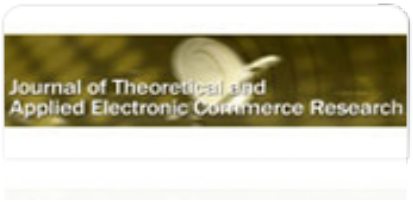

Journal of Theoretical and Applied Electronic Commerce Research
E-ISSN: 0718-1876
ncerpa@utalca.cl
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I. La Paz, Ariel; Ramaprasad, Arkalgud; Syn, Thant; Vasquez, Jonathan
Editorial: An Ontology of E - Commerce - Mapping a Relevant Corpus of Knowledge
Journal of Theoretical and Applied Electronic Commerce Research, vol. 10, núm. 2, mayo, 2015, pp. 1-9
Universidad de Talca
Curicó, Chile

Available in: http://www.redalyc.org/articulo.oa?id=96538544001

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Journal of Theoretical and Applied Electronic Commerce Research
ISSN 0718–1876 Electronic Version
VOL 10 / ISSUE 2 / MAY 2015 / I-IX
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This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762015000200001

Editorial: An Ontology of E-Commerce - Mapping a Relevant Corpus of Knowledge

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May 2015

Introduction

The development of the e-commerce field revolutionized the practice of commerce by the addition of the possibility to connect buyers and sellers in virtual environments for the trade of goods and services. The possibility to easily access information about products and reach customers globally created new business possibilities and transformed business processes. At the same time it brought important challenges about security, privacy, legal compliance, etc. -all by the simple addition of the prefix *e-* to the term commerce.

As in any emerging field, the exploration, theorization and application of knowledge requires significant efforts to systematically and systemically discover the varied avenues in which theory and practice contribute to the development and maturation of the scientific field. It also requires significant efforts to understand and document how the field impacts the economic, political, cultural, technological and societal systems. The meta-analysis of a significant and representative corpus of knowledge in e-commerce using an ontological framework can identify the concentrations and omissions within it. It can shed light on the definition of research agendas. Thus, it denotes a significant contribution for the further and effective development of a field whose scope and complexity is growing. Thus, our central questions are:

1. How to represent in a holistic and interactive framework the generation of knowledge in e-commerce?

2. Are there emphases or gaps in the knowledge created in the e-commerce realm?

The answers to these questions will help the discipline by providing a flexible and extensible framework in which the corpus of knowledge in e-commerce can be systemically and systematically described and analyzed. A logically constructed ontology based on the common body of knowledge is used to deconstruct the combinatorial complexity of e-commerce and map the 196 articles published in the Journal of Theoretical and Applied Electronic Commerce Research (JTAER) in the first 9 years of its publication to reveal the bright, light, and blind/blank areas in them. By analyzing a documented knowledge sample, the *bright*, *light* and *blind/blank* sides of e-commerce can be revealed to the academic and practitioner communities.

Theoretical Framework

From the time telecommunications technologies such as telegraph, then telephone, and today computer and mobile networks appeared, the potential for efficient trading of products and services has changed the traditional commerce in the physical marketplace through the reduction of time and cost of communication, and the increase of the benefits that such reductions provide [7]. Analog and Digital network technologies have dramatically improved information exchange between traders and improved the coordination of sellers and buyers. The evolution of information technologies has impacted organizations and transformed their business models by enhancing efficiency of inter- and intra-organizational informational processes. Electronic data interchange (EDI) and e-mail are milestones for the renewed vision of data (multimedia) exchange, setting the first basis and dependencies of today's business models and business processes [12].

Distant trading practices started long before the 1990s. A few years before that decade, some European countries created their own videotext and teletext systems in an effort to implement electronic shopping [3], [6], [13]. Nevertheless, even with reduced trading costs and times, the existing technologies at the time did not suffice to support the basic features of an electronic marketplace [5]. The authors [5] claimed that an *electronic marketplace* must allow vendors to present information in a catalog about stocks, prices, discounts, and all related to the products; meanwhile consumers may *let their fingers do the walking* by requesting multiple catalogs, thereby finding the best deal. The former became possible with the introduction of the World Wide Web by Tim Berners-Lee at The European Organization for Nuclear Research (CERN derived from its French name *Conseil Europeén pour la Recherche*

Journal of Theoretical and Applied Electronic Commerce Research
ISSN 0718–1876 Electronic Version
VOL 10 / ISSUE 2 / MAY 2015 / I-IX
© 2015 Universidad de Talca - Chile
This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762015000200001

Nucléaire) combined with the evolution and spread of Internet. Then, the concept of electronic commerce was coined in the 1990's [16] and in the recent decades its growth and pervasiveness has leapfrogged, permeating the majority of industries. In the development of the e-commerce concept as a practice and as research area, the core of the field has been the study of the impacts of the electronic and digital means on the reduction of transaction and information costs, generation of new business, and the study of the impacts on individuals from a socio-economic point of view [8].

Constructing an Ontology of E-Commerce

The emergence and maturation of a new discipline is expectedly an ill-structured and complex process. An ontology is a way of structuring and deconstructing the combinatorial complexity of the process. A detailed description of ontological meta-analysis and synthesis is provided by Ramaprasad et al., [10], [11]. Our proposal consists of the aggregation of two sub-ontologies, one to structure and deconstruct the Electronic concept, and a second for the Commerce construct.

The dimensions of the ontology (columns) are derived directly from surveying and analyzing the literature, as well as the practices in e-commerce. They are: (a) Medium, (b) Structure, (c) Function, (d) Assurance, (e) Entity, and (f) Operation. Each dimension of the ontology is expressed by a taxonomy of its constituent elements. The taxonomies are derived from the common terminology in body of knowledge on each dimension, especially in the Management, Information Systems, and Technology domains. Thus, the components of the *Medium* for the e- in e-commerce are Electronics, People and Paper – the three components on which the transactions of goods and services, or its parts, are processed. The Electronics and People are further subcategorized highlighting the importance of a more detailed deconstruction for the study of e-commerce. The taxonomy of *Structure* reveals how the components of e- can be organized for commerce. It includes Architecture, Infrastructure, Systems, Services and Processes. *Function* groups the different tasks performed in e-: Acquire, Store, Retrieve, Process, Interpret, Translate, Distribute, and Protect information. *Assurance* describes what the e- aims to guarantee: Private, Public, Reputable, Dependable and Secure information [4]. (Note: Terms used to indicate the dimensions and elements of the ontology are capitalized.)

On the Commerce side, a taxonomy categorizes the participating Entities in commerce, and a second taxonomy identifies the Operations of the entities in commerce. The *Entities* are Buyers, Sellers, Intermediaries and Regulators; while the *Operations* are Purchase, Produce, Manage, Sell, Deliver, Evaluate, Price, Publicize, and Tax [15].

The six dimensions are arranged left to right with adjacent connecting symbols, words and phrases in a way such that reading any concatenation left to right, choosing one category from each dimension, forms a natural English sentence. Each sentence is a potential component of e-Commerce. However, we note that we present *An* ontology which can be extended (scaled) or simplified by adding or removing columns and categories in the taxonomies. Figure 1 shows the ontology and two illustrative components. A total of 64,800 components encapsulated in the ontology are the logical components of the e-commerce. Thus we can systemically and systematically represent the combinatorial complexity of e-commerce concisely.

Electronic						**Commerce**		
Medium		**Structure**		**Function**	**Assurance**	**Entity**		**Operation**
Electronics	[based]	Architecture	[to]	Acquire	[+] Private	Buyers	[information on/by]	Purchase [products/services]
Fixed		Infrastructure		Store	Public	Individuals		Produce
Mobile		Systems		Retrieve	Reputable	Businesses		Manage
Network		Services		Process	Dependable	Sellers		Sell
People		Processes		Interpret	Secure	Individuals		Deliver
Individual				Translate		Businesses		Evaluate
Network				Distribute		Intermediaries		Price
Paper				Protect		Regulators		Publicize Tax

Illustrative components (total = 6*5*8*5*6*9 = 64,800)

Electronics-mobile based services to retrieve public information on sellers-business to deliver products/services
People-network based processes to interpret private information on intermediaries to produce products/services

Figure 1: Ontology of e-commerce

A component may or may not be instantiated in a sample of documented knowledge in e-commerce. With a systematic review, some components may be instantiated or mapped frequently, some infrequently, and other not at all. The proposed mapping will highlight the *bright*, *light*, *blind/blank* spots in the ontology without value judgment. A highly emphasized *bright* spot may be a critical component of e-commerce but it may also be due to common use or herd effect. An infrequently emphasized *light* spot may be appropriately so or its potential may be unrecognized and

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may deserve more emphasis. An unemphasized empty spot may have been unconsciously overlooked and hence *blind*; or, it may be infeasible and hence consciously *blank* [10]. Envisioning the e-commerce as a heat map of *bright*, *light*, and *blind/blank* spots will help develop systematic strategies and research agendas. In the following we present an ontological map of e-commerce based on the publications of the Journal of Theoretical and Applied Electronic Commerce Research (JTAER), highlight the *bright*, *light*, and *blind/blank* spots, and discuss possible reasons for the same.

Materials and Methods

This study focuses on the population of peer reviewed papers in a specialized journal on e-commerce, where theoretical as well as applied research articles are published. JTAER was created to provide an agile and flexible channel of communication to share and debate new ideas and emerging technologies in the rapid evolving field of e-commerce. Also stated in the aims of the journal is that important elements for publication are business practices, social, cultural and legal concerns, personal privacy and security, communication technologies, and mobile connectivity, relevant to an audience of researchers and professionals in computer science, information management, telecommunications, business administration, sociology, law, financial services and e-commerce specialists. Given its international nature, and is continuous improvement on performance indicators [2] the authors believe this is an interesting and representative corpus of knowledge to unveil the *bright*, *light* and *blind/blank* spots in the field.

Data Collection

The data was collected from the Scopus database, searching the International Standard Serial Number (ISSN) of JTAER and from the journal's web page for publications before 2007. A total of 27 issues were published in the period April 2006 (Vol 1, Issue N°1) to September 2014 (Vol 9, Issue N°3). During the period of data collection 190 articles, 27 editorials, 3 notes and 6 reviews were published. From among them, a total 196 articles and reviews contained title, abstract and keywords and were included in the sample for the ontological analysis.

We downloaded the 196 titles, abstracts, keywords, authors, publication volume and number into an Excel file. The file was specifically designed to code the articles onto the ontology. A column of the coding section corresponds to an element of the ontology; the columns were grouped by dimensions, and the two concepts *Electronic* and *Commerce*. Thus, an article could be mapped to the appropriate elements of the ontology by simply checking the appropriate columns.

Data Coding

We note that an article may instantiate multiple components, a component, parts of multiple components, or part of a component of the ontology. Thus, there was no restriction on how many elements of the ontology could be encoded with reference to a given article, or a requirement that a paper should be encoded to all dimensions of the ontology. In summary, an article could be encoded into: (a) an element from each dimension, (b) multiple elements from each dimension, (c) an element from some dimensions, or (d) multiple elements from some dimensions.

The coding was performed by consensus with feedback. Each article was assigned to a pair from three co-authors. Thus each of the three coders coded about 67% of the articles, half of which overlapped with one of the other coders, and the other half with the other coder. Each coder independently assigned binary codes on each component of the ontology when an element, its synonym or definition was present in the title/abstract/keywords based on the glossary of ontological elements (see Appendix A: Glossary of terms in the ontology). The coding was not weighted; each article and each element was assigned equal weight.

After the first round of coding, we generated a comparison map for feedback. Each of the three pairs of coders discussed the differences in their coding, the reasons for the same, and arrived at a consensus. Thus, each final coding was based on a consensus between two of the three coders.

The coded data were analyzed using an Excel tool developed by one of the authors. It was used to generate the following ontological maps of e-commerce in JTAER: (a) the frequency of occurrence of each element (monads) in the ontology, (b) the frequency of occurrence of each pair of elements (dyads) in the ontology, and (c) the frequency of occurrence of select triplets of elements (triads) in the ontology.

Results

Of the 196 articles and reviews, 45 were coded on all the dimensions. A total of 924 components out of the possible 64,800 in the ontology are instantiated in the corpus. The 924 instantiated components occur 1044 times in the corpus.

Journal of Theoretical and Applied Electronic Commerce Research
ISSN 0718–1876 Electronic Version
VOL 10 / ISSUE 2 / MAY 2015 / I-IX
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This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762015000200001

The ontological map of monads – individual categories in the ontology – is shown in Figure 2. The number in parentheses adjacent to the category indicates its frequency of occurrence in the title/abstract/keywords of the 196 articles studied. The bar below the category is a visual indicator of the same scaled to the maximum number of occurrences of any one category. The *bright* spots are categories with the larger numbers and bars; the *light* spots are the ones with the smaller numbers and bars, and the *blind/blank* spots are the ones with close to zeroes and virtually no bars. There are no objective frequency cut-offs between *bright*, *light*, and *blind/blank* spots. Yet, the visualization in Figure 2 clearly highlights the areas of emphases and of limited or no emphasis.

From the ontological map of monads, we can observe that from the categories, the brightest spots are Electronics-Networks, Architecture, Process, Dependable, Sellers-Business, and Manage. If we concatenate these in one sentence we get: *Electronics-Network based architecture to process dependable information on sellers-businesses to manage products/services*. This would be a major focus of publications in JTAER. On the counter side, concatenating the blind/blank spots *Electronics-fixed infrastructure to store reputable information on intermediaries to tax products/services* would be an area where a publication in JTAER is less likely to be found. However, those two examples given by the simple combination of the most and the least frequent terms are not necessarily standardized versions of articles' titles actually published by JTAER. These instances of the ontology are concatenations of all taxonomies in the ontology, but the mapping did not demand or force classification of the sample in all categories.

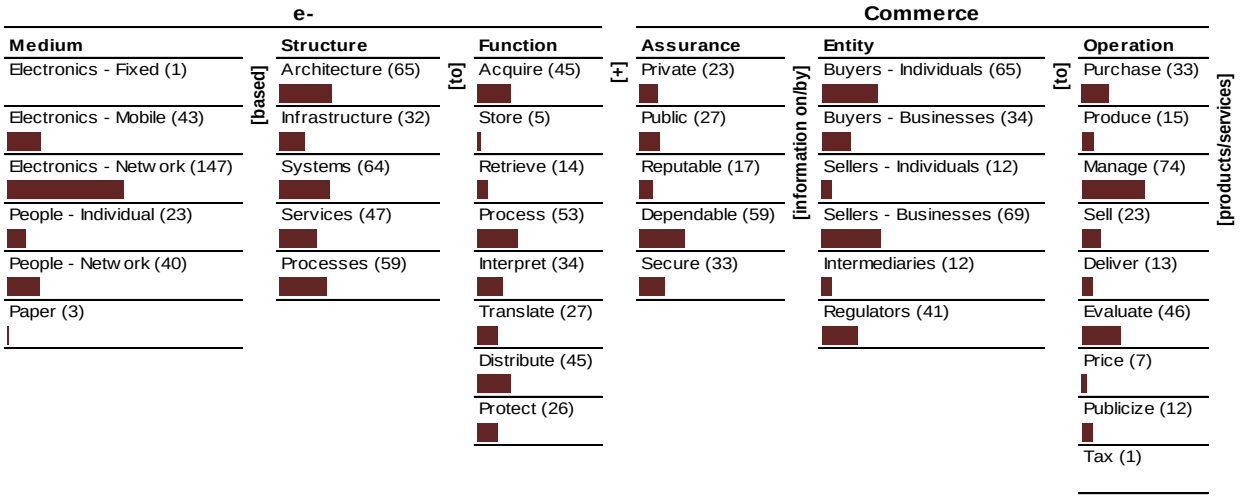

Figure 2: Ontological map of monads

The ontological map of dyads (Figure 3) profiles the article's basic information at a different level of granularity by counting paired concepts. The frequency of occurrence of each dyad is marked in the cell. The darkness of the cell indicates the relative frequency. As might be expected from the map in Figure 2 (but may not necessarily be so), the combinations of the bright spots, such as: [Electronics-network and Systems], [Electronics-network and Sellers-businesses], and [Electronics-network and Manage] are the most frequent paired concepts in the articles published. The first dyad matches two concepts from the electronics side, while the second and third match electronics and commerce concepts. It is interesting however to identify blind and blank spots, where low frequencies appear in the ontological map. For example, although there has been discussion for quite some time, the pair [Electronics-network and Tax] was found only once in the data, and even though cloud computing is changing business practices [Electronics-network and Store] was found five times out of 196 articles. The reader can identify more paired categories from the table and judge if they were blind (omitted unconsciously) or blank (deliberately skipped).

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		Medium						Structure					Function								Assurance					Entity						Operation								
		Electronics - Fixed	Electronics - Mobile	Electronics - Network	People - Individual	People - Network	Paper	Architecture	Infrastructure	Systems	Services	Processes	Acquire	Store	Retrieve	Process	Interpret	Translate	Distribute	Protect	Private	Public	Reputable	Dependable	Secure	Buyers - Individuals	Buyers - Businesses	Sellers - Individuals	Sellers - Businesses	Intermediaries	Regulators	Purchase	Produce	Manage	Sell	Deliver	Evaluate	Price	Publicize	Tax
Medium	Electronics - Fixed																																						
	Electronics - Mobile	1																																					
	Electronics - Network	1	34																																				
	People - Individual		4	21																																			
	People - Network		2	32	4																																		
	Paper		1	3																																			
Structure	Architecture	1	19	43	2	8																																	
	Infrastructure		10	26	5	2	1	10																															
	Systems		16	56	12	11	1	11	9																														
	Services		12	36	7	11		15	7	16																													
	Processes		12	46	4	13	2	16	9	14	9																												
Function	Acquire	1	15	34	5	10	2	13	10	15	9	16																											
	Store		1	5				2	2	1	1	1	2																										
	Retrieve		1	9	1	1		7	3	4	3	6	6	3																								
	Process	1	13	45	8	7	1	14	11	25	17	14	19	5	8																								
	Interpret		2	22	8	10		6	2	13	11	13	7	1	4	18																							
	Translate		5	18	3	6		6	4	12	8	8	9		3	11	8																						
	Distribute	1	9	37	3	13	1	19	10	12	13	17	19		6	9	5	5																					
	Protect		9	20	4	4	2	5	8	9	8	10	7	1	3	5	2	4	5																				
Assurance	Private		9	16	3	2		8	5	10	5	8	9		3	8	2	4	6	12																			
	Public		3	18	2	8		11	4	7	6	9	8		5	5	6	4	17	3	4																		
	Reputable		1	13	5	7		3	3	11	7	4	3		1	6	5	3	4	2	2	3																	
	Dependable		15	48	7	10	2	16	13	27	14	22	22		8	20	16	14	13	11	11	8	11																
	Secure		12	28	6	5	2	8	6	15	10	13	9	1	5	8	3	4	6	23	17	4	3	18															
Entity	Buyers - Individuals	1	14	53	17	17	1	13	5	27	19	16	17	1	1	22	19	14	11	9	8	4	10	24	14														
	Buyers - Businesses		6	30	1	5	1	13	5	13	6	9	6	1	1	10	3	3	9	1	2	4	6	8	3	10													
	Sellers - Individuals		1	12	3	5		3	2	6	1	2	4			3	2	1	2			1	5	4	2	12	6												
	Sellers - Businesses	1	14	55	6	11	1	21	8	19	18	21	12	2	2	24	15	9	17	5	5	5	5	22	8	35	31	7											
	Intermediaries			11	1	4		5	3	3	1	3	5	1		4	3	5	6	3	3	2		5	2	4	2	2	2										
	Regulators		3	28	4	6	2	21	10	12	10	15	11	1	6	7	4	6	16	6	4	14		10	7	5	4	2	6	5									
Operation	Purchase	1	8	27	11	7		9	2	16	11	6	9			17	9	9	4	3	4	2	6	11	6	28	7	7	13	3	1								
	Produce		4	8	2	4		4	2	4	1	5	3			6	3	3	5	1	3	7		2	1	3	1		6		4								
	Manage		13	55	7	12	2	27	16	24	16	27	19	3	7	26	12	12	18	11	10	8	3	26	14	15	18	1	34	5	24	5	6						
	Sell	1	6	18	3	4		9		7	7	4	4			10	7	4	8	1	2	2	6	7	2	15	5	7	17	2		12	2	1					
	Deliver		6	12		1	1	6	5	4	3	5	5		3	6		1	8	1	1	2		5	2	1	6		8		4	1	3	8	1				
	Evaluate		9	35	6	14	1	12	4	19	14	14	14		2	17	17	6	10	3	4	7	9	20	6	22	15	5	25	1	4	12	4	12	7	2			
	Price		2	7	2	1		1		5	1	2	2			3	3	2			1		1	2		4	1	3	1	3		4			4		2		
	Publicize			8	1	4		3		3	4		2		1	2	4	1	5			2	1	3		7	2		10		1	2	1	4	4		3		
	Tax			1						1						1	1					1		1							1						1		

Highest Frequency (56) — Zero Frequency

Figure 3: Ontological map of dyads

As we continue to slice the data, selected triads are presented in the following figures. The maximum frequency in any triad is 27, meaning that the *bright* spot in triads is found in the Electronics-network information on Sellers-businesses to Manage products/services (Figure 4a).

	Medium																																							
	Electronics - Fixed							Electronics - Mobile						Electronics - Network						People - Individual						People - Network						Paper					
	Entity							Entity						Entity						Entity						Entity						Entity					
Operation	Buyers - Individuals	Buyers - Businesses	Sellers - Individuals	Sellers - Businesses	Intermediaries	Regulators		Buyers - Individuals	Buyers - Businesses	Sellers - Individuals	Sellers - Businesses	Intermediaries	Regulators	Buyers - Individuals	Buyers - Businesses	Sellers - Individuals	Sellers - Businesses	Intermediaries	Regulators	Buyers - Individuals	Buyers - Businesses	Sellers - Individuals	Sellers - Businesses	Intermediaries	Regulators	Buyers - Individuals	Buyers - Businesses	Sellers - Individuals	Sellers - Businesses	Intermediaries	Regulators	Buyers - Individuals	Buyers - Businesses	Sellers - Individuals	Sellers - Businesses	Intermediaries	Regulators
Purchase	1			1				8		1	1			23	6	7	11	3	1	10	1	2	1			6		1	3	1									
Produce											1		1	2	1		4		2	1			1		1						1								
Manage								2	6		8		1	11	16	1	27	4	16	4			4		2	3	1		2	2	5		1		1		1		
Sell	1			1				4		1	5			13	4	7	13	2		2	1	2	1			2		1	2	1								
Deliver									4		5			1	6		7		4											1	1						1		
Evaluate								1	3		6			18	13	5	20	1	3	6	1	2	3			8	4	2	6		1		1		1				
Price														4	1	3	1	3		2		1		1		1		1		1									
Publicize														5	1		8			1			1			2			3										
Tax																			1																				

Highest Triad Frequency (27) — Zero Frequency

Figure 4a: Triad medium – entity - operation

In the triad Structure-Assurance-C-Function (Figure 4b), a few *light* spots can be identified with their frequencies in parentheses. They are:

- Systems to assure dependable information to evaluate products/services (13)

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- Systems to assure dependable information to manage products/services (11)
- Processes to assure dependable information to manage products/services (10)
- Processes to assure dependable information to evaluate products/services (9)

Many *blind/blank* spots of documented knowledge in e-commerce are potentially good research topics. Research on them has not been published yet in the corpus of knowledge under analysis. A small sample of blind triads in Figure 4b of interesting research topics is listed below:

- Architecture to assure Secure information to Purchase products/services (1)
- Infrastructure to assure Public information to Tax products/services (0)
- Systems to assure Reputable information to Produce products/services (0)
- Services to assure Public information to Price products/services (0)
- Processes to assure Dependable information to Publicize products/services (0)

	Structure																									
	Architecture					Infrastructure					Systems					Services					Processes				
	Assurance					Assurance					Assurance					Assurance					Assurance				
Operation	Private	Public	Reputable	Dependable	Secure	Private	Public	Reputable	Dependable	Secure	Private	Public	Reputable	Dependable	Secure	Private	Public	Reputable	Dependable	Secure	Private	Public	Reputable	Dependable	Secure
Purchase			1	4	1	1				1	3	2	4	6	5	1	2	4	5	2	2		1	2	2
Produce		1		1			1				1	1		1	1	1			1	1	1	2		1	
Manage	4	5	1	9	3	3	1	1	9	3	4	1	2	11	6	3		1	5	7	3	4		10	5
Sell	1	1	1	2	2							1	4	2		1	1	3	3	1	1			3	1
Deliver	1	1		2	1		1		2					2			1		1		1	1		2	2
Evaluate		1	1	5	1		1		3		3	4	7	13	5	1	1	3	5	3	2	2	2	9	3
Price													1	1				1	1		1			1	
Publicize		1		1								1		2					1						
Tax												1		1											

Highest Triad Frequency (27) Zero Frequency

Figure 4b: Triad structure – assurance – C-function

The analysis can be extended to study tetrads, pentads and hexads in the ontological map to reveal *bright-light-blind/blank* areas of knowledge in e-commerce. However, we will just offer a small selection of blind/blank spots for further discussion. Examples of reasonably blank spots due to feasibility and timeliness issues about e-commerce are listed first:

- Electronics-fixed architecture to store reputable information on sellers-individuals to produce products/services
- Paper based infrastructure to store reputable information on sellers-individuals to deliver products/services
- People-individual services to retrieve reputable information on intermediaries to tax products/services

Now, a list of potential topics for research and applications presenting low or zero frequency is offered:

- Electronics-fixed services to retrieve reputable information on intermediaries to price products/services
- Electronics-fixed systems to store information on sellers-individuals to deliver products/services
- Paper based processes to retrieve dependable information on intermediaries to tax products/services

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As illustrated, the ontological analysis provides a systemic and systematic method to find the bright, light, and blind/blank sides of e-commerce, and can be of use to design bibliographic analysis or identify topics for a research agenda.

Discussion

The ontology of e-Commerce provides a systemic and synthetic representation of the complexity of a growing field. Also, the ontological mapping and analysis of a representative corpus of knowledge permitted a systematic analysis that unveils the *bright*, *light* and *blind/blank* sides of e-Commerce in the sample presented at different levels of granularity by slicing the data into monads, dyads and triads.

The results confirm part of the aspirations of JTAER by being a *channel of communication in which to share and debate new ideas and emerging technologies concerned with this rapidly evolving field*. However, not all the elements recognized as important in electronic commerce rank high in frequency of articles published in the journal's lifetime. Our results identified areas in which a more prolific academic production is needed to extend and improve the use of electronic commerce for the benefit of our society. For example, dyads and triads related to Electronics-mobile appeared to be *light* in the research, but today seems to be *bright* in the practice of m-Commerce [1], [3]. In a similar way, the legal concerns, personal privacy and security, as well as mobile connectivity were found to be *blind/blank* spots. In the same vein tax, protection, privacy, and security have had low emphasis although they are very important in practice.

The nature of the field implies a relevant emphasis on the commerce side function of publicizing; but this is also a rather *light* to *blind* spot in the documented research. More knowledge generation may be needed to better understand the impacts of online and mobile information availability in customer's processing of a narrowly targeted marketing campaign [9], [14].

Finally, a marked trend in the JTAER corpus of knowledge is the publication of articles related to electronic-networks, architecture, systems and dependability, all of them in the *electronics* side of e-Commerce; on the commerce side, a heavier weight on business-seller and manage is also recognized. But again, the inclusion of other categories seems necessary to achieve a harmonic development of the discipline.

Conclusion

A complex and ill structured concept as is e-Commerce could be systemically and synthetically represented with a ontology of e-Commerce. A systematic mapping and analysis of the domain reveals the emphases and omissions in the currently published research of JTAER.

The ontology and the method proposed in this document make explicit the generation of knowledge in the field of e-commerce. Using the method of meta-analysis and ontological synthesis described by Ramaprasad and coauthors, we identified a set of elements of the field, which were reflected in the proposed ontology. This is of two sub-ontologies that allude to *Electronic* and *Commerce* functions. These contain well known taxonomies and categories in order to describe the domain at a sufficient level of detail. The proposed framework allows identifying potential research topics in the area, and in this case a total of 64,800 were detected.

The use of monads, dyads, and triads helped to identify which topics have been more and less discussed in JTAER. The *bright* and *light* sides of the field identify the bibliographic trends, while the *blind/blank* spots offer the opportunity to systematically question omissions that might be covered or incentivized to comprehensively find balances in the advances of e-Commerce. A marked emphasis on articles about electronics-networks mediums, architecture structure, process, dependable information, sellers-Business entities, and manage products/services was observed in the analysis, while topics related to legal concerns, privacy, security, and mobile connectivity appeared as blind/blank, although JTAER aspires to be a channel of communication in these subareas of e-commerce.

Key Findings

The analysis of the ontological maps provided empirical evidence for the *bright* to the *blind* areas of knowledge. Alternative types of bibliographic and bibliometric analyses could also converge with our results on the *bright* spots to identify for example that the most frequently researched keyword in e-commerce is *Electronic networks*, and that most research focused on *Electronic-networks for Seller-Businesses to Manage products/services*. However our results are unique in systematically finding the *blind/blank* areas, as we illustrate in the following list of low or zero frequency of appearance in the corpus of knowledge analyzed:

Monads:

- Electronics-fixed medium.

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DOI: 10.4067/S0718-18762015000200001

- Store information function.
- Price products/services operation.

Dyads:

- Electronic-networks to Tax products/services.
- Mobile-networks to publicize products/services.
- Electronic-Networks for reputable information.
- Protect information on/by buyers-business and sellers-individuals.

Triads:

- Electronic-Mobile for sellers-businesses to publicize products/services.
- Protect Private information on/by buyers-businesses.
- Systems to translate reputable information.
- Electronic-network for regulators to tax products/services.

Academics, researchers and practitioners in e-commerce can use the ontology and meta-analysis presented in this document to address their research agendas. In this way, new investigations would provide further insights into *blind/blank* or *light* areas.

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Journal of Theoretical and Applied Electronic Commerce Research
ISSN 0718–1876 Electronic Version
VOL 10 / ISSUE 2 / MAY 2015 / I-IX
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This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762015000200001

Appendix A: Glossary of Terms in the Ontology

Medium: Means for exchange of data, information, and knowledge.
Electronics: Devices for exchange using electrical signals.
People: Human beings in the exchange.
Paper: Physical documents in the exchange.

Structure: The structure of the means of exchange.
Architecture: The conceptual framework of the means for exchange.
Infrastructure: The physical arrangement of the means of exchange.
Systems: The logical organization of the means of exchange.
Services: Systems' output in response to users' demand.
Processes: Structured routines for providing services.

Function: The steps to assure data, information, and knowledge for commerce.
Acquire: To obtain or capture data, information, and knowledge.
Store: To accumulate data, information, and knowledge.
Retrieve: To recover the stored data, information, and knowledge.
Process: To transformation the data, information, and knowledge.
Interpret: To derive the meaning of the data, information, and knowledge.
Translate: To translate the meaning into actions.
Distribute: To distribute data, information, and knowledge.
Protect: To safeguard data, information, and knowledge.

Assurance: Assurance about data, information, and knowledge
Private: Accessibility limited to selected users.
Public: Accessibility to all.
Reputable: Reliability of the data, information, and knowledge.
Dependable: Trust in the data, information, and knowledge.
Secure: Protection of the data, information, and knowledge.

Commerce: The exchange of products and services.

Entity: The entity engaging in commerce.
Sellers: Individuals or organizations offering artifacts for exchange.
Buyers: individuals or organizations demanding artifacts.
Intermediaries: Third party individuals or organizations facilitating the exchange of artifacts.
Regulators: Organizations responsible for governance of exchange.

Function: The functions of commerce.
Purchase: To find a source, price, asses, and obtain an artifact.
Produce: To design, develop, customize, and manufacture an artifact.
Manage: To manage the quality, cost, and safety of the artifact.
Sell: To target, promote, price, and deliver an artifact.
Deliver: To pick up, track, and fulfill the sale of an artifact.
Evaluate: To assess and provide feedback on all the commerce functions.
Price: To determine the value for the exchange of the artifact.
Publicize: To promote an artifact in the market.
Tax: To define and collect a proportion of the price for the exchange of the artifact.

Artifact: The artifacts of commerce.
Products: Tangible artifacts.
Services: Virtual artifacts.