TAXOPETIC Process Design
A Taxonomy to Support the PETIC Methodology (Strategic Planning of ICT)

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Abstract: Innovations in organizations require better solutions for technology improvement, quality assurance and customers' business satisfaction. On the other hand, Strategic Planning (SP) and Information and Communication Technologies (ICT) need to be integrated and coherent, to ensure the survival of organizations. In this context, the Strategic Planning of ICT Methodology (PETIC) is a SP that carefully helps managers to identify the maturity of ICT processes required for company management. The increasing number of PETIC methodology applications in organizations has made it difficult to locate and classify the PETIC artifacts produced. Moreover, the use of taxonomies has been successfully applied for classification and information retrieval. This paper aims on proposing TAXOPETIC, the taxonomy to support the PETIC Methodology. It will also be used to implement a software called TAXOPETICWeb that will allow storage and classification of PETIC artifacts, as well as facilitate the process of searching these artifacts.

1 INTRODUCTION

Advancements in Information and Communication Technology (ICT) provide competitive advantages for companies. Thus, organizations rely on technological innovation to solve customer problems in order to ensure quality and meet their expectations.

Strategic Planning (SP) presents itself as a "tool" that guides the direction and actions of an organization in its external and internal environment. This planning can be characterized as an ongoing process that allows one to define goals and capabilities. SP strives for better resource management. Therefore, it reduces the possibility of taking wrong decisions in a highly competitive market, with short margin for error (Palmeira et al., 2012).

According to (Cassidy, 1998), there are benefits in strategic planning activities, which are: to offer improved communication between companies and organizations, designing information and processes, use of technologies, precautionary investment and ICT expenditure, reduction of strategic risks in projects, gaining competitive and best results advance.

Besides that, it is essential to use automated tools for preparation of a Strategic Planning, enabling aid strategies and actions established (Palmeira et al., 2012).

In this context, the PETIC Methodology proposes a set of standards and guidelines for the design of SP focused on ICT processes of organizations (Marchi et al., 2010).

The growing volume of artifacts produced by software applications of PETIC Methodology led to the necessity of creating a search engine that allows the systematic classification of deployments results, in order to store and retrieve information in a logical way through navigation.

Thus, an approach which has received attention is to use taxonomies for classification and information retrieval. Taxonomies are classificatory structures intended to be a tool for organization and information retrieval in companies. They have been considered as means of access acting as conceptual maps of the explored topics in an information retrieval service (Bailey, 1994).

This paper aims to search for existing taxonomies within ICT domain and propose a taxonomy to support PETIC Methodology. Among the identified advantages of using taxonomy to PETIC

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Methodology, it was noticed the ease of location and classification of PETIC artifacts produced by applying the PETIC Methodology in several organizations. Proposed taxonomy, called TAXOPETIC, has been applied in real artifacts generated by the PETIC Methodology. The TAXOPETIC structure has also been applied to create a software called TAXOPETICWeb, which supports will support the taxonomy by allowing storage and classification of PETIC artifacts, as well as facilitating their localization.

2 RELATED WORK

This section contains related work obtained through literature review. This research aimed to identify works to present taxonomies applied to SP of ICT processes. Unfortunately, it was not possible to identify specific works for these keywords. Then, the search has been expanded to locate taxonomies applied to SP in general.

For the literature review fulfillment, the question used in the protocol was: "What are the existing taxonomies for strategic planning?" To answer this question, we used the following string for queries: (taxonomy) and (strategic planning). Databases used for research were: IEEE Xplore Digital Library, ACM Digital Library, Springer and Science Direct.

The literature review resulted in (Svahnberg et al., 2010), (Pradhan and Akinci, 2012) and (Dukaric and Juric, 2013).

Svanberg's work presented a systematic review of versions (release) of SP models proposals, degree of empirical validation, factors for selection requirements and the fate of these requirements. The twenty-four models identified in the search were mapped in relation to each other and taxonomy of requirement selection factors was constructed. It was concluded that many models are related to each other and they use similar techniques to solve version planning problem. It was also possible to conclude that a number of requirements selection factors are included in different models, but many methods fail to address factors such as stakeholder value or internal value (Svahnberg et al., 2010).

Pradhan and Akinci present taxonomy of spatial reasoning mechanisms and time necessary to merge spatial data sources and time to support construction of yield monitoring. This work describes two different approaches: interpolation approaches and nearest neighbor. It can be applied to synchronize sources of temporal and / or spatial data. Taxonomy developed was validated on representative query with construction engineers and managers who have been identified in previous research studies (Pradhan and Akinci, 2012).

Dukaric and Juric interest propose a unified taxonomy and an architectural structure IaaS - Infrastructure as a Service. Taxonomy is structured through seven layers: core services layer, support layer, value-added services, control layer, layer management, security layers and fundraising. Authors conducted a survey of several IaaS systems and mapped it for taxonomy to evaluate the classification. Then, they introduced an IaaS architectural structure that depends on unified taxonomy. A detailed description of each layer and definition of the dependencies for layers and components are provided (Dukaric and Juric, 2013).

Three studies were identified through literature review and, though using taxonomy with different objective from the proposition of this paper, they have proposed taxonomies that tangentially contributed to this research.

3 CONCEPTS AND TECHNOLOGIES

3.1 PETIC Methodology

PETIC Methodology has the following components: PETIC artifact, ICT Process Catalog, importance of graphics versus cost and Gantt maps of information systems pillars (Palmeira et al., 2015): Software, Hardware, Telecommunication, Data and People.

PETIC artifact is created during the implementation of PETIC Methodology in an organization, PETIC artifact is generated from ICT Process Catalog, Maturity Analysis of ICT processes and compilation of Improvement Actions suggested to ICT organization processes (Marchi et al., 2010).

The steps to design the PETIC artifact are: (i) identifying / updating ICT unit objectives in the organization; (ii) analyzing ICT processes catalog of PETIC; (iii) defining levels of maturity of ICT processes in the organization; (iv) defining relevance of ICT processes of the organization; (v) defining actions catalog for each process or critical priority ICT; (vi) analyzing importance of graphics versus cost; (vii) discussing results with other stakeholders; (viii) designing Gantt charts; (ix) documenting PETIC artifact and (xi) reviewing PETIC artifact annually.

It can be concluded that the PETIC Methodology assists in the preparation of SP, in order to help the manager in the decision making processes of ICT (Palmeira et al., 2012).

3.2 Taxonomy

Taxonomy is a system to classify and facilitate access to information that aims to: (i) representing concepts through terms; (ii) streamline communication for specialists and also among experts and other stakeholders; (iii) finding consensus; (iv) proposing ways to control the diversity of significance; and (v) providing an area map that will serve as process guide knowledge (Bailey, 1994). Therefore, it is a controlled vocabulary of a particular field of knowledge and, mainly, an instrument or design element which allows one logically allocate, retrieve and communicate information within a system.

Within ICT domain, taxonomies can be compared to classificatory structures such as leaderboards, which aim to bring together a logical and classified document form. Currently, taxonomies gather all types of digital document and allow search strategies, immediate access to information. Unlike tables that provide an address (notation) that locates documents on the shelves, taxonomy dispenses notation (Gilchrist, 2003).

Metadata is data that identifies and describes information. They can be used to safely obtain characteristics such as where and when information was captured. They may also be associated with different types of media such as documents, videos, images, audio, books and many other files. (Linfoot, 2009).

For an implementation approach of taxonomy, tags are important tools in categorization process. After structuring taxonomy, tags and metadata can be applied to optimize accuracy in document searching (Linfoot, 2009).

3.3 Methods for Construction of a Taxonomy

According to Reamy (Reamy, 2007), in order to create quality taxonomy, a defined development process must be followed. Like any process, the development of taxonomy requires a well executed plan, a development cycle and initial requirements. However, unlike the normal processes, the development process of taxonomy never ends.

Authors (Delphi Group White Paper, 2002), (Dutra, 2003), (Woods, 2004) and (Kremer, 2005) propose practices and steps for building taxonomies. Unlike these authors, (Bayona-Oré et al., 2014) analyzes the practices and steps proposed by several authors, including the aforementioned, and propose a development method of taxonomy.

Bayonne-Oré proposes a taxonomy development method created from a literature review on methods and guidelines used to build taxonomies. To create this method, nine different authors have been analyzed and proposed steps to build taxonomies (Bayona-Oré et al., 2014).

3.4 Bayona-Oré Method

The method proposed by (Bayona-Oré et al., 2014) consists of five stages and twenty-four activities. These five stages, objectives and generated products are:

1. Planning: This stage aims to establish the work plan that defines project activities which allow to design and implement taxonomy. Products gotten in this stage are: (i) working plan and (ii) working group for taxonomy development.

2. Identification and Information Extraction: This stage aims to align the working plan with the information needs of the organization. At this stage, the sources of information are identified. Products of this stage are: (i) inventory for construction of taxonomy, (ii) policies for use of taxonomy, (iii) characteristics of technology used and (iv) representative lists of all areas involved.

3. Design and Construction Taxonomy: This stage aims to design and build the taxonomy using terms extracted in the previous stage. At this stage, products designed are: (i) categorization of terms of first level, (ii) general structure of taxonomy and (iii) dictionary of categories and subcategories.

4. Testing and Validation: This stage aims to ensure that designed taxonomy is useful for users to achieve their goals. Products of this stage are: (i) validated taxonomy, (ii) validated category dictionary and (iii) validated sub-dictionary.

5. Implementation of Taxonomy: This stage aims to ensure the implementation of taxonomy in organization. This step is obtained with the staff qualification in taxonomy and availability of taxonomy for users. Products designed at this stage are: (i) users trained in taxonomy and (ii) taxonomy available for users.

4 TAXOPETIC PROCESS DESIGN

The growing volume of PETIC Methodology artifacts resulted in the need for measures of storage, classification and location of these artifacts. Thus, the creation of a taxonomy called TAXOPETIC serves as a storage, classification and easy location of artifacts obtained by applying PETIC Methodology in several organizations.

For the creation of proposed TAXOPETIC, we analyzed the methods of building taxonomies proposed by (Bayona-Oré et al., 2014). It was decided to follow (Bayona-Oré et al., 2014) method for three reasons: this is the most recent method described in literature; it proposes a stage dedicated to "Test and Validation", aiming at improving taxonomy with test results; and, it has a stage of "taxonomy implementation" with a series of activities aimed not only in availability, but is concerned on usability, management and maintenance of the taxonomy.

Thus, the following (Bayona-Oré et al., 2014) method for the construction of TAXOPETIC has performed the five stages listed as follows:

4.1 Planning

At this first phase, following products were obtained:

i. The roadmap containing working plan - roadmap presented duration of TAXOPETIC construction phase in a period of four months, i.e., from August to November 2015. Below periods, the five phases that must be followed for TAXOPETIC construction are sequenced. Each phase and products obtained are listed as depicted in Figure 1.

ii. Working group for the construction of TAXOPETIC - group is formed by coordinator and members of the (GPES - Software Engineering Research Group at at UFS - Federal University of Sergipe).

4.2 Identification and Information Extraction

At this stage the following products were obtained:

i. Inventory for the construction of TAXOPETIC - PETIC Methodology artifacts were found distributed in several storage media. This demanded quite operational work to locate and catalog the

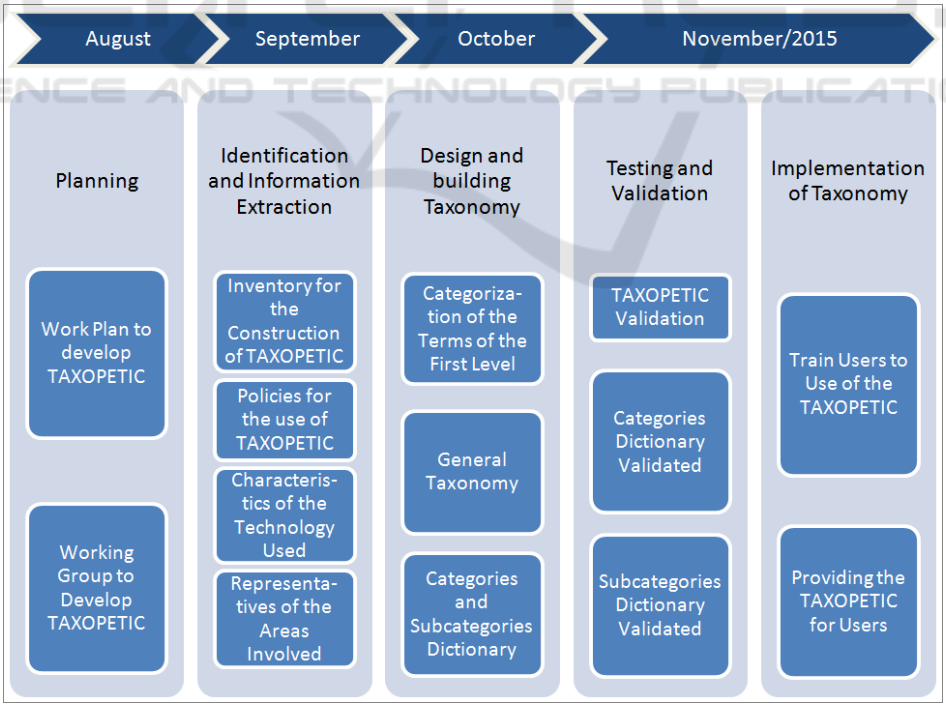

Figure 1: Building plan Roadmap of TAXOPETIC.

artifacts. They were distributed in the following storage medias: folders on Dropbox, Web links and attached in e-mails.

ii. Policies for TAXOPETIC use - access levels have been defined. They are: registration and query. The GPES members have full access to perform insert, update and delete PETIC artifacts. After PETIC artifact inclusion, these are available on the Web for unrestricted access of other organizations.

iii. Characteristics of technology used – softwares which have been used: Drupal (7:41 version) and MySQL (version 5.0.11) to create the TAXOPETICWeb. Drupal is a content management software that provides features such as: easy content creation, reliable performance and excellent security (Drupal, 2015). Drupal enables the use of taxonomies, tags and metadata for content classification (Drupal, 2016). MySQL is an open source database. Because of its proven performance, reliability and easy usage, MySQL has become the main database choice for Web-based applications (MySQL, 2015).

iv. Representatives list from all areas involved: Coordinator and members of the GPES.

4.3 Design and Taxonomy Construction

At this third stage of TAXOPETIC construction, the following products were designed:

i. First level terms categorization - Analysis of artifacts, needs reported by GPES members and survey applied on organizations helped to define TAXOPETIC first level categories. They are: (i) Service Organizations (ii) Public Organizations, (iii) Mutual Benefits Associations and (iv) Commercial Stakeholder Organizations. Each category has a number of subcategories that are associated according to each category purpose. Other categories and subcategories may be added upon identified needs after TAXOPETIC implementation.

ii. General TAXOPETIC structure - Figure 2 shows all TAXOPETIC categories and subcategories.

iii. TAXOPETIC categories and subcategories dictionary: The construction of a dictionary has been carried out as follows:

Default category, called SP dimensions of ICT in organizations, includes all TAXOPETIC categories and subcategories.

Service Organizations - a category that represents types of organizations where the main beneficiaries are the customers. Subcategories of this category are: (i) schools, (ii) universities, (iii) religious organizations, (iv) social agencies and (v) Non-Governmental Organizations.

Public organizations - represents types of organizations where the main beneficiary is the public. Their respective subcategories are: (i) legal institutions, (ii) health institutions, (iii) public security (iv) military and (v) post office.

Mutual Benefits Associations - represents organizations where the main beneficiaries are organization members themselves. Subcategories of this category are: (i) trade unions, (ii) cooperatives, (iii) consortia and (iv) professional associations.

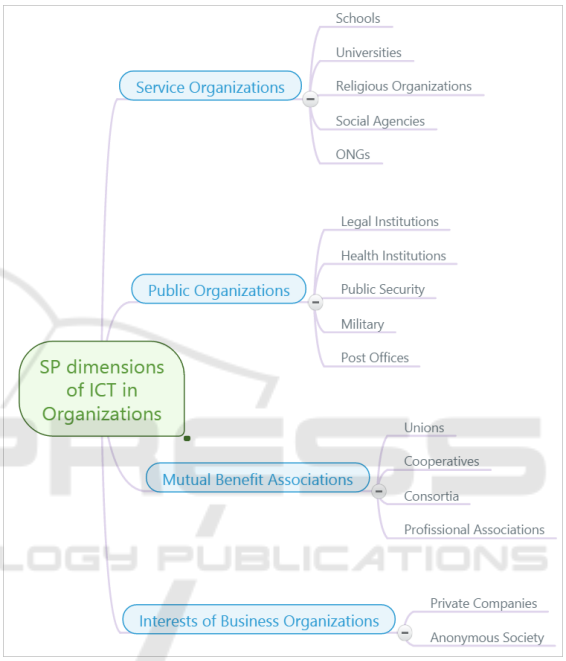

Figure 2: TAXOPETIC categories and subcategories.

Commercial Stakeholder organizations - category representing organizations where the main beneficiaries are owners or shareholders. Its subcategories are: (i) private companies and (ii) anonymous society.

Subcategory dictionary construction has not been necessary, because each subcategory represents Organizations artifact that are directly linked to their nomenclature purpose.

4.4 Testing and Validation

At this TAXOPETIC test and validation phase, following products were generated:

i. TAXOPETIC Validation - TAXOPETIC was tested by coordinator and members of GPES UFS Tests ensured the viability of proposed structure

enabling the storage, easy categorization and artifacts location to its users.

ii. Validate categories Dictionary - Categories dictionary construction has been validated with TAXOPETIC users.

iii. Validate subcategories dictionary - There was no need for subcategories dictionaries validation, because its nomenclature already defines its purpose.

4.5 Taxonomy Implementation

At this last TAXOPETIC construction phase, the following products were generated:

i. TAXOPETICWeb user training - At the training plan for users, it was defined training sessions in different shifts in order to cover all TAXOPETICWeb users. At the training storage practices, categorization and artifact location has been held to optimize learning. In these trainings, users also received an operating manual for future reference.

ii. TAXOPETICWeb Availability for users - TAXOPETICWeb was available on the GPES's internal network using the infrastructure of the Computer Science Department.

5 TAXOPETICWEB TOOL

For TAXOPETICWeb creation, Drupal content management framework and MySql database are used as development tools because both are open-source software and meet the research needs.

Figure 3 shows an artifact location through the categories and sub-categories classification or TAXOPETIC tags. Tag blocks containing elements of PETIC Methodology have been presented vertically on the TAXOPETICWeb homepage.

For example, it is displayed Service Organizations category and Universities subcategory to access the UFS PETIC artifact. In the Fig. 3B is called Computer Science Department from UFS artifact. The location of that artifact can also be performed using tags: areas, sub-areas, processes and PETIC Methodology improvement actions.

For storing and cataloging a new artifact in TAXOPETICWeb the following metadata has been defined: (i) organization name, (ii) organization logo, (iii) artifact description, (iv) organization category and subcategory that applied the PETIC Methodology, (v) Federative Unit organization, (vi) year when artifact was generated, (vii) document containing artifact, (viii) artifact version number, as depicted in Figure 3.

Figure 3: PETIC artifact categorized in TAXOPETICWeb.

Figure 4 also shows tags designed to facilitate location of artifacts, they are: (i) PETIC fields, (ii) PETIC subfields, (iii) PETIC processes and (iv) improvement actions belonging to artifact.

6 DISCUSSION AND ANALYSIS

Faced with many needs to be supported, including to store, classify and find artifacts produced during application of PETIC methodology in organizations. Identified need to propose taxonomy to support PETIC. The five proposed steps were used in method created by (Bayona-Oré et al., 2014) for TAXOPETIC construction.

Bayoná-Oré proposes a method with five steps and twenty-four activities. Following this method it was possible to conceive TAXOPETIC as they have

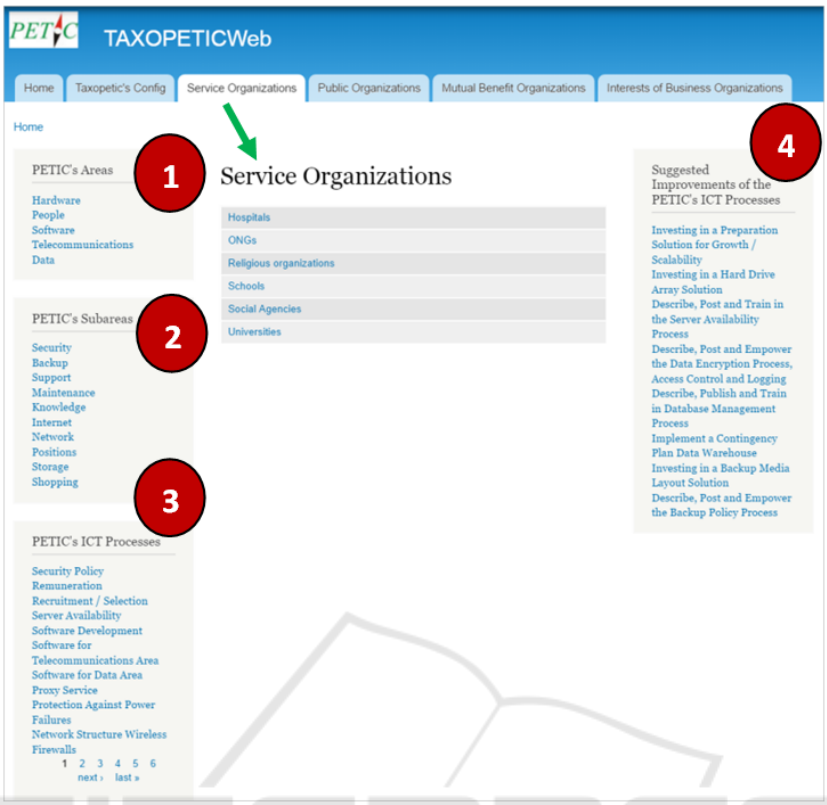

Figure 4: PETIC artifact categorized in TAXOPETICWeb.

been obtained products of each step (Bayona-Oré et al., 2014).

To Shaw, a good research requires not only a result, but also clear and convincing result evidence. Some research validation techniques are used in software engineering (Shaw, 2002). They are: analysis, experience, example, evaluation, persuasion and affirmation act. In this context, we use an example to validate TAXOPETIC. To illustrate this article, we explore Services Organizations category and its Universities subcategory.

The structure of TAXOPETIC allowed to create an application named TAXOPETIC. Creation of TAXOPETICWeb allowed us to analyze an example, as proposed by (Shaw, 2002).

It was necessary to catalog manually all PETIC Methodology artifacts store artifacts in the TAXOPETICWeb. This procedure required a high cost search because those artifacts were also distributed in several different storage media. Thus, TAXOPETICWeb made possible to find, store, and catalog the several PETIC Methodology artifacts spread in organizations from Northeastern Southeast and North Regions of the country.

After cataloging PETIC artifacts, TAXOPETICWeb storage was performed using metadata and tags. Basic data of the organization and file containing PETIC artifact have been used as metadata. For tags it has been used the PETIC Methodology processes catalog (areas, sub-areas, processes and improvement actions).

Tags are used to facilitate the process of searching for an artefact, having selected tag in stored file. Thus, TAXOPETICWeb enables artifacts location through TAXOPETIC structure and defined tags in artifacts storage.

7 CONTRIBUTIONS AND FUTURE WORK

PETIC Methodology proposes standards and policies set for design an organization Strategic Planning of ICT. PETIC application in organizations has resulted in the difficulty of localizing and classifying the produced PETIC artifacts.

Main contributions of this article are:

(i) Conducting a literature search to identify and present existing taxonomies within ICT domain;

(ii) Taxonomies construction proposals analysis for creation, analysis and selection of a taxonomies construction method;

(iii) Application of Bayoná-Oré method step (Bayona-Oré et al., 2014) in the construction of the TAXOPETIC and the TAXOPETICWeb tool;

(iv) Selecting a content management framework and a database for TAXOPETICWeb implementation;

(v) Creation of a tool to validate the structure of TAXOPETIC;

(vi) Creating and analyzing an example in order to explore a TAXOPETIC category and subcategory.

In future works we intend to evaluate usability of TAXOPETICWeb. This review will be carried out using usability heuristics for inspection interfaces proposed by (Nielsen, 1995). It is also planned to integrate TAXOPETIC and TAXOPETICWEB to the PETIC Methodology Knowledge Portal.

REFERENCES

Palmeira, J., Neto, A. C., Nascimento, R. P. C do. PETIC Wizard Proposal: a Software Tool for Support PETIC Methodology. In EATIS 2012 Conference. Spain 2012.

Cassidy, A. A Practical Guide to Information Systems Strategic Planning. Washington: St. Lucie Press, 1998.

Marchi, L. de; Cassimiro, A.; Nascimento, R. P. C. do. Suggestions for PETIC 2.0: New Framework, Maturity Levels and Strategic Aligment. In EATIS 2010 – Euro-American Conference on Telematics and Information Systems. Panama, 2010.

Palmeira, J., Neto, A. C., Nascimento, R. P. C do. PETIC 3.0 Proposal: Upgrading an ICT Strategic Planning Methodology. CONTECSI. 2015.

Bailey, K. D. Typologies and taxonomes: an introduction to classification techniques. New Bury Park: SAGE, 1994. 96 p.

Svahnberg, M., Gorschek T., Feldt R., Torkar R., Saleem S. B., Shafique M. U. A systematic review on strategic release planning models. in Information and Software Technology, 2010. Butterworth-Heinemann Newton, MA, USA, Volume 52, Issue 3, March 2010.

Pradhan, A.; Akinci, B. A taxonomy of reasoning mechanisms and data synchronization framework for road excavation productivity monitoring. Advanced Engineering Informatics 26 (2012) 563–573. USA, 2012.

Dukaric, R.; Juric, M. B. Towards a unified taxonomy and architecture of cloud frameworks. Future Generation Computer Systems 29 (2013) 1196–1210. Slovenia, 2013.

Gilchrist, A., Thesauri, taxonomies and ontologies – an etymological note, Journal of Documentation, 2003., Vol. 59 Iss: 1, pp.7 - 18.

Reamy, T. (2007). Taxonomy Development in Enterprise. Retrieved December 22, 2014, from <http://www.kapsgroup.com/presentations/Taxonomy Development in Enterprise.ppt>.

Delphi Group White Paper. Taxonomy and content classification. 2002. November 11, 2015, from <http://goo.gl/xyvoz2>.

Dutra, J., Busch, J. Enabling knowledge discovery: taxonomy development for NASA. 2003. November 22, 2015, from <http://goo.gl/xumM7J>.

Woods, E. The corporate taxonomy: creating a new order. KMWorld, Camden, v.13, n. 7, July/Aug. November 22, 2015, from <http://goo.gl/88guHh>.

Kremer, S., Kolbe, L. M.; Brenner, W. Towards a procedure model in terminology management. Journal of documentation, Bingley, v. 61, n. 2, p. 281- 295, 2005. November 22, 2015, from <http://goo.gl/v8pbSc>.

Bayona-Oré, S., Calvo-Manzano, J. A., Cuevas, G., & San-feliu, T. (2014). Critical success factors taxonomy for software process deployment. Software Quality Journal, 22, 21–48. doi:10.1007/s11219-012-9190-y.

Linfoot, S. L.; Coughlin, T.M.; Cowell, J., A need for improved standardization of metadata for consumer devices, in Consumer Electronics, 2009. ISCE 2009. IEEE 13th International Symposium on , vol., no., pp.196-200, 25-28 May 2009.

Drupal - Content Management Software. 2015. November 15, 2015, from <https://www.drupal.org/>.

Drupal - Organizing content with taxonomies. 2016. November 10, 2015, from <https://goo.gl/b6t4AI>.

MySql - About MySQL. November 12, 2015, from <https://www.mysql.com/about/>.

Shaw, M. What makes good research in software engineering?, International Journal of Software Tools for Technology Transfer, 2002, vol. 4, no. 1, pp. 1-7.

Nielsen, Jakob. How to Conduct a Heuristic Evaluation. January 1, 1995, from https://www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/.