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DEVELOPMENT OF SUPPORTING DOCUMENTATION FOR CRITICAL PRODUCT FEATURES IN A DESIGN DEPARTMENT

PREPARATION OF SUPPORTING DOCUMENTATION OF CRITICAL PRODUCT FEATURES IN A DESIGN DEPARTMENT

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Abstract -- This article presents the procedure for the preparation of Supporting Documentation for critical characteristics of an export product. In this case, the Supporting Documentation is understood as the set of documents with information related to the specifications and critical characteristics of the product and the materials necessary for the design of manufacturing processes and database updating. The purpose is to standardize the different characteristics, which would allow using this documentation to support different business centers of the company located in other countries. The expected benefits of standardizing the critical characteristics of a product are: elimination of additional documentation, elimination of errors due to interpretation of information and better communication between different business centers in different countries.

Keywords: Documentation, Agile Methodology, Critical Design Features

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Key words - Documentation, Agile methodology, Critical design features.

INTRODUCTION

Effective knowledge management produces benefits to the organization such as reducing errors, redundancy (repetition), faster problem solving, improved decision making, reduced R&D costs, increased worker independence, improved customer relations and better service [1, 2].

From a design point of view, Technology Innovation Management (TIM) is an important aspect of contemporary business and a fundamental driver of competitiveness for companies in a wide variety of industrial sectors [3]. According to Dodgson [4] competition in industry has led to increased supply and demand in a knowledge market, which has produced two types of knowledge: Traditional knowledge and New knowledge (broader, transdisciplinary and highly contextual in form).

In the literature, it is possible to observe the continuous mention of some critical success factors of the IWM, among them: technological planning and monitoring, absorption capabilities, innovation capabilities, analysis and decision making, information system, human resource management, which are important factors, as well as those of Technological Capabilities.

TC are the technical, managerial or organizational skills, which the company needs to efficiently use technology equipment and information; to carry out any technological change [5]. The definition of technological capabilities implies knowledge and skills to acquire, use, absorb, adapt, improve and generate new technologies and that support the central concepts to offer products [6, 7].

Based on this definition, it is understood that technological capabilities include innovation capabilities and absorption capabilities [8].

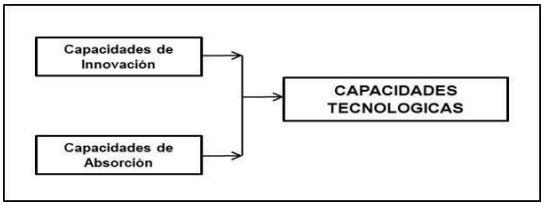

Figure 1.- Classification of Technological Capabilities. Source: Own elaboration.

Knowledge Absorption Capacity is defined as a firm's ability to value, assimilate and apply knowledge from external sources for commercial purposes [9].

In recent years, definitions of absorptive capacity have highlighted its power to convert knowledge acquired from external sources into usable ideas, products, goods, services and models [10, 11].

e assert that the more companies are able to learn from the interaction with external resources, the greater the pressure for followers and the better the innovation capacity of these companies and the system as a whole [12].
Key functions in the Innovative Capacity in Mexican companies are: leadership; generation of new concepts, generation of new

Therefore, Innovation Capability is a fundamental strategic asset of companies to sustain competitive advantage [14], it is the ability to continuously transform knowledge and ideas into new products, processes and systems for the benefit of companies, are a set of organizational capabilities and resources, highly dynamic in nature with the purpose of managing and deploying innovation strategies, seeking the creation and development of sustainable competitive advantage required to provide adequate and flexible responses to market challenges [15], includes the skills of people and their better organization [8].

Due to the above, organizations need new forms of knowledge management that are innovative, flexible, imaginative and creative in order to face the challenges faced by companies and governments, one of which is innovation.

An important aspect of knowledge in organizations is the elaboration of documents and databases, and for the purposes of this work, we will call support documentation. Supporting documentation is a series of documents, lists and drawings that provide important information to the different functions of the organization, and especially important for the design department, as input in the development of new or improved products and manufacturing processes.

In the company under study, the innovation department is made up of designers and engineers who are trained to create new projects and present them to the group of local and international managers to decide whether to plan the launch of the new product or not.

The different areas or work teams of the design department have a common manager, who is the union of all categories, departments, areas or teams with other functions of the organization. For the creation or development of a new product, months of design, configuration and testing are needed before launching the product, being necessary to have a database and the programs working at 100% with the

configurations and restrictions necessary for testing and templates.
The "test" is to run the program in both digital and physical design. The "templates" are the possible configurations that the user can make.

Every time a business plan is made for a new product, the areas involved start planning what should be done, that is: what should be done, who should do it and how long it should take to be done. The design department is in charge of proposing designs that can be a winning idea in the end.

Each person involved must estimate the activities and time required to complete the project. For this purpose, a series of documents and databases must be available so that each designer of the different areas can make their designs and future proposals.

Given the amount of information contained in different documents and systems, necessary for the planning and execution of pilot testing of new designs, there is an opportunity to integrate this information into supporting documentation that supports the main activities of the design department.

Table 1. Steps of the method used.

Step	Activity
1	Review of databases
2	Review of documents required prototype design
3	Review of procedures and/or systems company's internal
4	Elaboration of documentation support of proposals
5	Update of base of database and procedures

Source: Own elaboration.

The main objective of this work is to reduce the number of documents, database and procedures required for the design and pilot run of the proposed prototype, thus reducing efforts and launching times.

Each company has its own organizational development methodology. However, there are different ways of to have the same process for the preparation of supporting documentation. Standardizing a process results in efficiency and effectiveness in a final result. Although each company must comply with a series of requirements and conditions, when implementing a methodology that meets the needs and requirements in a standardized manner, the result of the stated objectives can be satisfactorily achieved.

The company in which the mentioned documents were made is a world leader in the manufacture and installation of XYZ. Commonly called XYZ, which is a vehicle or device whose function is to transport goods vertically [16]. Supporting documents were created for a new elevator, which will compete with the cost of hydraulic elevators, but being fully electric.

DEVELOPMENT

To prepare the supporting documentation to support the design and implementation of prototypes, the steps shown in Table 1 were followed.

The method for the preparation of supporting documentation began with the review the databases of all critical characteristics of the main products. Subsequently, the required documents were reviewed and the procedures and databases were revised. Supporting documentation was prepared for review and authorization by management. Finally, the databases and procedures were updated based on the supporting documentation.

In step 1. Review of the databases. The databases and their status in relation to the update (version 2019) were reviewed, identifying that for some critical product characteristics of each database a different number was assigned.

In the review of the documents required for the prototype design (stage 2), repeated documents were identified, some with previous revisions; as well as unnecessary documentation to identify the critical characteristics required for the prototype design.

In step 3. Review of internal procedures and/or systems, all procedures and systems, both internal to the company and external (corporate offices and other business units) that involve the design of prototypes and their relationship with other procedures and systems were reviewed.

With the above information, we proceeded to step 4.- Preparation of the proposed supporting documentation, which consisted of unifying criteria in the identification of critical characteristics, as well as the assignment of an identification number, and the unification of similar documents or documents with complementary information. The proposed supporting documentation for product XYZ was submitted to management for review and authorization.

In step 5. Updating the database and procedures, after authorizing the supporting documentation from the design management, we proceeded to update the database and procedures for the design of prototypes. In this case, we only focused on the XYZ product family, being one of the three families with the highest sales.

Each of the documents used, as well as the database, must be created, in some cases from scratch, in order to comply with the established requirements.

The documents are the central basis for updating the database of the programs used in the company, as well as updating, if necessary, the database used by the software, as well as the database of the values to be implemented or added as external programming that will be reflected in the user interface screen.

For the above, it was necessary to use the company's methodology YYYY, which is an agile methodology (Agile Methodology), highly recommended because in recent years, agile methodologies appeared as a reaction to traditional forms of software and recognized the need for an alternative to heavy and documentation-based software development processes [17].

Agile development methodologies are becoming more and more popular due to their focus on managing time-to-market constraints and the ability to adapt to changes during the software development life cycle [18].

To create the support documents it is important to divide them into two parts, since one of them is internal and the other is the one that the user or client will be observing. It should be known that there are two types of features used in the programming of any portal, program or platform.

Some are especially for programming that will calculate everything that is selected in the interface. The others are features that are displayed on the platform to make the selections and options that the customer wants. In a nutshell, some store data and others do calculations.

DISCUSSION AND ANALYSIS OF RESULTS

The following are the main activities that were carried out in this work for the benefit of the design department:

- Development of the XXY database for new products using Excel, with a series of o documents. Although later new features were created for the new project.
- Update of an XYX database to categorize each feature (active, retired or undefined), and identify which ones could be used for new models. This database is visible to the entire corporation.
- A list of main features was added in the YXX, where restrictions, rules, characteristics, material selection and layouts are indicated for each of the elements contained in an elevator.
- Creation of the master table, where each of the characteristics is classified and categorized, indicating where each of them is used. The table is divided by modules and each one of them is a specialized department for a product family.

CONCLUSIONS

The supporting documentation developed in this study demonstrated the use and benefits of having standard documentation, for example: the timely completion of the project.

is, as planned with no need to request time extensions or additional resources to complete the design project.

The projects are carried out by means of a "sprint" with a determined duration. Each sprint has an objective as a team and each member makes known the tasks in general, those that must be done, those that are in verification (those that were finished, but are awaiting confirmation or some other modification) and those that are finally finished.

The issue of time and money is, and has been, a factor of competitive advantage for companies, mainly in the area of designing new or improved products.

Recommendations.

In relation to the elaboration of support documentation (documents and databases), the use of Agile Methodology is highly recommendeddue to its importance in the reduction of project time and for the personal growth of each team member.

To be able to observe how these tools benefit those involved by facilitating their work is impressive, since this methodology can also be implemented in daily life.

When continuous improvement and the completion of pending tasks can be graphically visualized, the result is gratifying for both team members and management personnel.

Also, supporting documentation can be a strategic element of training and development of professional competencies [19] of the personnel involved in the design areas.

Explanatory Note.

This work was carried out in a transnational company located in the state of Coahuila, and for confidentiality reasons, names of the main products, documents, databases and software used have been omitted.

supporting documentation for product and/or process design.

We thank the reader for their understanding for having limited and, in some , omitted information and examples that, without a doubt, could have helped the reader to better understand this article.

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BIBLIOGRAPHY .

[1] Rodríguez Gómez, D. (2006). Models for knowledge creation and management: a theoretical approach.

[2] Gottschalk, P. (2000). Knowledge management in the professions: the case of it support in law firms. In System Sciences, 2000. Proceedings of the 33rd

Annual Hawaii International Conference on pp. 10-pp). IEEE.

[3] Tidd, J., & Bessant, J. (2009) Innovation - What it is and why it matters. Managing Innovation: Integrating Technological, Market and Organizational Change, 3-43.

[4] Dodgson, M., Gann, D. M., & Salter, A. (2008). The management of technological innovation: strategy and practice. OUP Oxford.

[5] Morrison, A., Pietrobelli, C. and Rabellotti, R. (2008). Global value chains and technological capabilities: a framework to study learning and innovation in developing countries. Oxford development studies, 36(1), pp.39-58.

[6] Afuah, A. (2002). Mapping technological capabilities into product markets and competitive advantage: the case of cholesterol drugs. Strategic management journal, 23(2), pp.171-179.

[7] Bell, M. and Pavitt, K. (1995). The development of technological capabilities. Trade, technology and international competitiveness, 22(4831), pp.69-101.

[8] Lugones, G.E., Gutti, P. and Le Clech, N. (2007). Indicators of technological capabilities in Latin America.

[9] Cohen, W.M. and Levinthal, D.A. (1990). Absorptive capacity: A new perspective on learning and innovation. Administrative science quarterly, pp.128-152.

[10] Zahra, S.A. and George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. Academy of management review, 27(2), pp.185-203.

[11] Zahra, S.A., Van de Velde, E. and Larraneta, B. (2007). Knowledge conversion capability and the performance of corporate and university spin- offs. Industrial and Corporate Change, 16(4), pp.569-608.

[12] Fagerberg, J. and Godinho, M.M. (2004). Innovation and catching-up. Georgia Institute of Technology.

[13] Güemes, D. and Rodríguez, M. (2007). The relationship between competitive intelligence and the innovative capacity of Mexican firms. Puzzle Revista Hispana de la Inteligencia Competitiva, 6(26), pp.15-20.

[14] Ponta, L., Puliga, G., Oneto, L. and Manzini, R. (2020). Identifying the determinants of Innovation Capability With Machine Learning and Patents. IEEE Transactions on Engineering Management.

[15] Robledo Velásquez, J., López, C., Zapata Londoño, W. and Pérez, J.D. (2010). Development of an Innovation Capability Assessment Methodology.

[16] Vox, D. M. (2007). The Free Dictionary. Retrieved from The Free Dictionary: http://es.thefreedictionary.com/elevador

[17] Ilieva, S., Ivanov, P., & Stefanova, E. (2004). Analyses of an agile methodology implementation. In Proceedings. 30th Euromicro Conference, 2004 (pp. 326-333). IEEE.

[18] Cao, L., Mohan, K., Xu, P., & Ramesh, B. (2009). A framework for adapting agile development methodologies. European Journal of Information Systems, 18(4), 332-343.

[19] Longoria de la Torre, A., Pineda Armendáriz, E.R., Poblano Ojinaga, F.A. (2012). Design of support documentation as a strategy to support the training of students in Computer Integrated Manufacturing (CIM), Case: IT de la Laguna. AcademiaJournal Cd. Juarez International Research Congress. ISSN 1946-5351 ONLINE.