Design and Analysis of Documentation Engineering Process Using Research and Development Approach

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Abstract: In this research, with a concentration on the approaches and the expected functions from documentation and the organizational structure, a method has been presented for documentation of the research and development procedures using the approach of organizational structure and here we will discussion its variables of modulation. In fact, the purpose of study and creation of a new mechanism should be a subject beyond the documented studies and the presentation of the simple procedures. This study should be done with the maximum amount of contemplation in a way that includes its raison dieter, goals, policies, interactions of its constituents, and the management theories in the framework of organization, so that the following results to be obtained: (1) Correct information to be given to the proper individual in proper time and by a proper cost (with exact estimation). (2) To be led to the augmentation of the confidence coefficient in decision-makings and the betterment and development of the quality of decisions. (3) To be led to the augmentation of the capacity of admitting the task drifts in present and future. (4) To cause the capacity to do a lucrative task more than before. (5) To cause the augmentation of the organizational productivity and self-sufficiency in the critical and strategic industries.
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1. Introduction

In today's world, information technology and the information systems are no longer instruments for a task or a source out of production sources, but it's a new job area. This new job area has set the stages for some wonderful evolutions and developments in the organizations, some of these developments are some change in the type of organizing and presenting the new organizational forms such as a science-based organization, grid-like organization, virtual organization, and etc. [4]

During the past three decades, multiple studies have been done but the findings obtained in these studies are contradictory. On the other hand considering the evolutions and changes in the types of IT, information systems and changes in the manifestations and the capabilities of IT and the information systems generalization of the research findings in this domain has been reduced. For this reason, it is necessary to carry out some new studies based on the new manifestations of IT and the information systems such as several information systems, internet, intranet, extranet, videoconference, e-mail, and etc.in order that one comprehensive model to be determined to consolidate and give coherence to the literature of the research in the domain of the theory of organization through identification of rate of impact of IT and the information systems on the organizational structure and the identification of the factors modulating the impact of IT and the information systems on the organizational structure. [2&3]

2.0 Review of Literature

2.1 Advantage and Disadvantage of using the model

Today, the pioneer organizations for the improvement of the function of business are going to pass the era of accumulation of personal knowledge toward the era of preserving the knowledge for the collective benefit. This issue has been led to the systematic preservation of backgrounds and the worthwhile experience and their correct transfer to the staff in the vast organizational dimensions and will bring out multiple advantage such as saving time, prevention of repeating the prior destructive methods, prevention of hardware and software costs to achieve an experience and/or an event.[6]

Also, the organization's necessity and need top reserve and manage the educational procedures in an optimal manner, optimal merging of classical educational textbooks with the native or internal situations and the creation of synergy, sustaining the procedures in the section of professional trainings, getting aware of the successful and unsuccessful experience on the procedures of needs analysis, planning and evaluation, establishing a framework for the indigenous knowledge exchange with other

organizations, providing a groundwork for the augmentation of creativity and innovation in managers and experts in educational centers as well as orientation of the educational system to register the experience, the necessity of paying attention to and the utilization of documentation.[4]

To sum up we can state the advantages of this deed as follows:

1-Operational Advantages: prevention of the repetition of procedures, exploiting data and re-data for the coming projects.

2-Management Advantages: System's Learning from past procedures and exploiting re-data for the back-up systems of decision-making in order to identify the strengths and weaknesses of an organization by the managers.

3-Strategis Advantages: organizational elevation and system's independence from the individual in the long term.

We can mention the heavy costs of software and hardware operating and also the fairly long time for training the manpower among the biggest weaknesses of these procedures.

2.2 Information Technology and Information Systems

According to the studies conducted and pursuant to the MIL-STD-756 Reliability modeling &prediction, IT and the information systems can be viewed as a series of techniques and instruments which are utilized for the optimization and supporting the activities of an organization based on information and knowledge. In this study information technology was evaluated utilizing factors such as internet, intranet, extranet, e-mail, videoconference, and etc. [5&17&18].

From technical viewpoint, we can define an information system as the fragments of the coherent units performing the function of collecting, processing, preserving, and distributing of the information in order to assist in the decision-makings and controlling the organization. From Laudan's view information systems are divided into six following groups based on the organizational level. [2]

2.3 Preparing Documentation Patterns

According to the carried out studies by Dr. Ja'afari Moghaddam in the essay titled "Documentation of the Managers' Experience", from the time taking action for establishment of the documentation system, in accordance with the requirements of the concerned organization, a specific pattern for some documentations has been devised and utilized. It is worth mentioning that preparation of the documentation pattern has been done by viewing the conceptual pattern or schema of an organization and the intended patterns are compatible with its specific framework and the physical format and the hierarchy of the standard of the patterns in terms of micro-patterns toward the macro-patterns is as follows: [19].

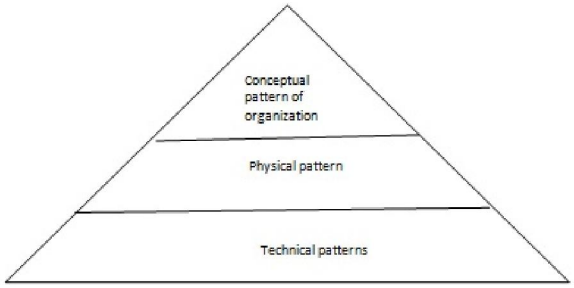

Figure1: micro to macro pattern in organizations

2.4 Documentation and Configuration Management

Configuration is the technical description and order or combination of items and fragments and cases which are deserved to fulfill the defined needs based on the feature and designs of the product and involves whole physical and functional features and the existing or designed relations which are related to the hardware, software, and/or any combination of them having been defined in the technical documentation of a product and we achieve them in the product. [20]

According to the executed standardization in the LARC Institute in NASA Corporation, steps to configure and manage the configuration are classified as the following in order to have a better control of the procedures leading to production in the field of aerospace products:

Identification of the configuration itself involves 4 subcategories: [21]

1- Determination of the structure of the product.
2- Selection of the items of configuration.
3- Determination of the documentation of configuration.
4- Determination of the basis for configuration.
5- Marking the items and documentations.
a- Controlling the configuration.
b- Evaluating the configuration situation.
c- Auditing and acknowledging the configuration.

3. Research Method & Results

In general, the analysis of the procedures of designing a system (here means R&D), should be changed into alternative main tasks and mini tasks which from their total sum a total procedure is achieved. Analysis of the structure alludes to the natural analysis of the project and is performed as follows:

1- Dividing systems into Microsystems.
2- Dividing subsystems into tasks.
3- Dividing tasks into mini-tasks.
4- Dividing mini-tasks into minor tasks.

The above-mentioned steps are considered as keys to prevent the complexity of a system and a positive factor in the coherence of the procedures which throughout the four fixed functional procedure by noting the enterprise of an airline, are viewed as the main pillars of designing an R&D procedure in a company and lead to a comprehensive model:

a- Studying and investigating feasibility
b- Conceptual design (prototype design)
c- Descriptive design (technical)
d- Establishment (exploitation)

Later we shall describe defined mini-tasks for each above-mentioned items and necessary requirements for them.

3.1 Study and scrutinize the feasibility of defining a research project

After doing the needs assessment for the project in cases which there are still some vague points or it doesn't have a proper level of technical readiness the needs assessment step will be done in order that the project gets more complete. The output of this deed's phase is a technical proposal or suggestion in which four social, operational, technical, and economical areas are minutely determined. The technical proposal of series of technical documents and deeds should include technical information and deductions, priority of designing and documents for the product. This document is devised based on the analysis of the work stages and the claims document and also modern studies are determined in it. Feasibility step or the temporal technical proposal will be done when we get the question and when there are some ambiguities in its execution. Thus, the key function of a technical proposal is to determine the claims in the question exactly and remove their ambiguity in order that step of preliminary design to be started. The output of the step of feasibility will be presentable in the form of a booklet after executing the steps of the task and the mini-tasks which shall be described in the following:

First task: studying the organizational objectives and the issues related to the twenty-year prospect of the company based on localization of knowledge of repairing, and preserving the multi-purpose aircrafts.

First mini-task: Interviewing managers and studying the internal documents related to the subject to be discussed.

Second mini-task: Investigating the operational problems based on the organizational in-sourcing and/or outsourcing in the form of a contractor located in the series.

Third mini-task: assessing the competitive situations.

Second task: Studying the company's sources and opportunities.

First mini-task: Assessing the company' sources including financial, technical, etc. resources.

Second mini-task: Studying the needs and inclinations of the environment.

Third mini-task: Scrutinizing and studying the informational frailties and failures.

Third task: Studying the hardware capabilities (peripheral equipment and the man power skills)

Fourth task: Preparing a research proposal.

3.2 Conceptual Design

Conceptual design is a series of documents which should include the principles solutions for designing which give a general picture of the product and the principles of doing it, objective, main parameters, and the dimensions and sizes of the product. Principled solutions and the general imaginations of the product are for instance to determine whether the airplane is military transmit aircraft, or a surveillance aircraft and also the function of each fragment which is defined in the project in order to observe their impact on the function of the product.

The key objective of the preliminary design is to make a final decision on the principled solutions. In this step the final shape of the product will be determined. Of course, in the preliminary design step two variances will be analyzed for the goal product and the subsystems. Another task in this step is to hold sessions and negotiations with the contracting institutions and presenting the preliminary information to them concerning the parameters of dimension, mass, volume, mechanical and dynamic parameters and etc. while performing the main operation of the product.

The output of the step of conceptual design is feasible in the form of a handbook after the execution of the steps of the tasks and the mini-tasks which shall be explained in the following.

First task: Identification of the required subsystems. (Information needs)

First mini-task: studying the task flow and identifying the natural borders of the areas concentrated on specific skills.

Second mini-task: Determination of the other features of the sub-systems.

Third mini-task: Designing comprehensive systems based on the inventory of the features of sub-systems.

Fourth mini-task: Determination of the job limits which should be executed (based on the need of the company and estimating the resources dedicated to the project)

Fifth mini-task: Preparation of a comprehensive plan (which illustrates the fundamental aspects of the project, organizational changes, computer equipment, and the required software).

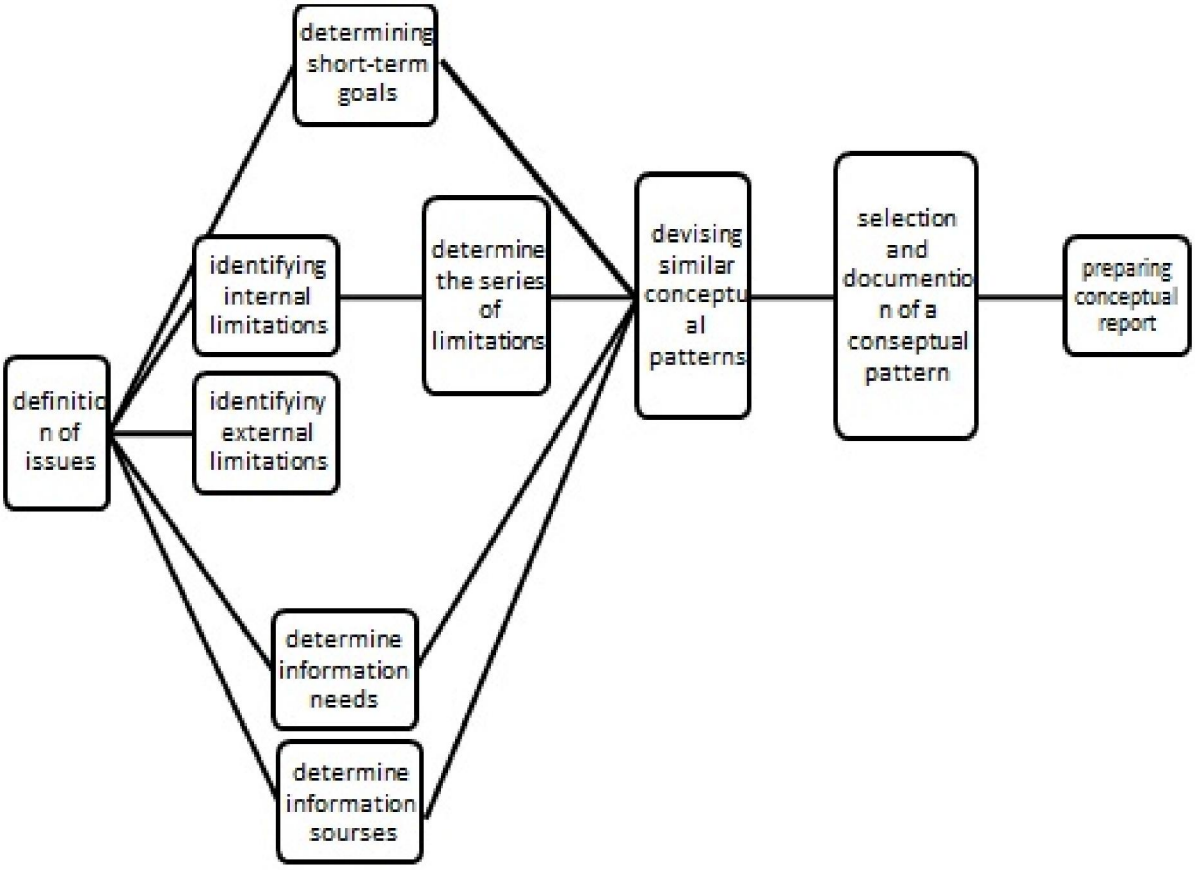

Figure 2: Steps of the conceptual project.

3.3 Detailed designing of the system

It is a series of technical documents and containing the solutions and the final decisions on designing and in addition to presenting a general picture of the product; it contains complete information for devising the documents about manufacturing or the technical knowledge as well. At the end of this step a complete view on the product should be achieved. The main document in this step is the technical conditions document in which the specifications or features and the technical conditions and the required guidelines are presented for the department of manufacturing documents in which it says how and on what basis the documents should be tested and undergone the quality control.

The output of the detailed designing step will be accessible in the form of a booklet after executing the steps of the task and the mini-tasks which shall be described in the following:

Task number one: Analysis and separation of the organization and determination of the final essence of the project.

Task number two: Re-defining the micro-systems in more details.

First mini-task: Drawing the operational scheme (flow diagram) of the systems operating.

Second mini-task: Interviewing the key managers and employees in the executive section.

Third mini-task: Drawing the scheme of the information flow (information flow diagram).

Third task: Determination of the rate of feasibility of the automaticity of the operation. (For any kind of business).

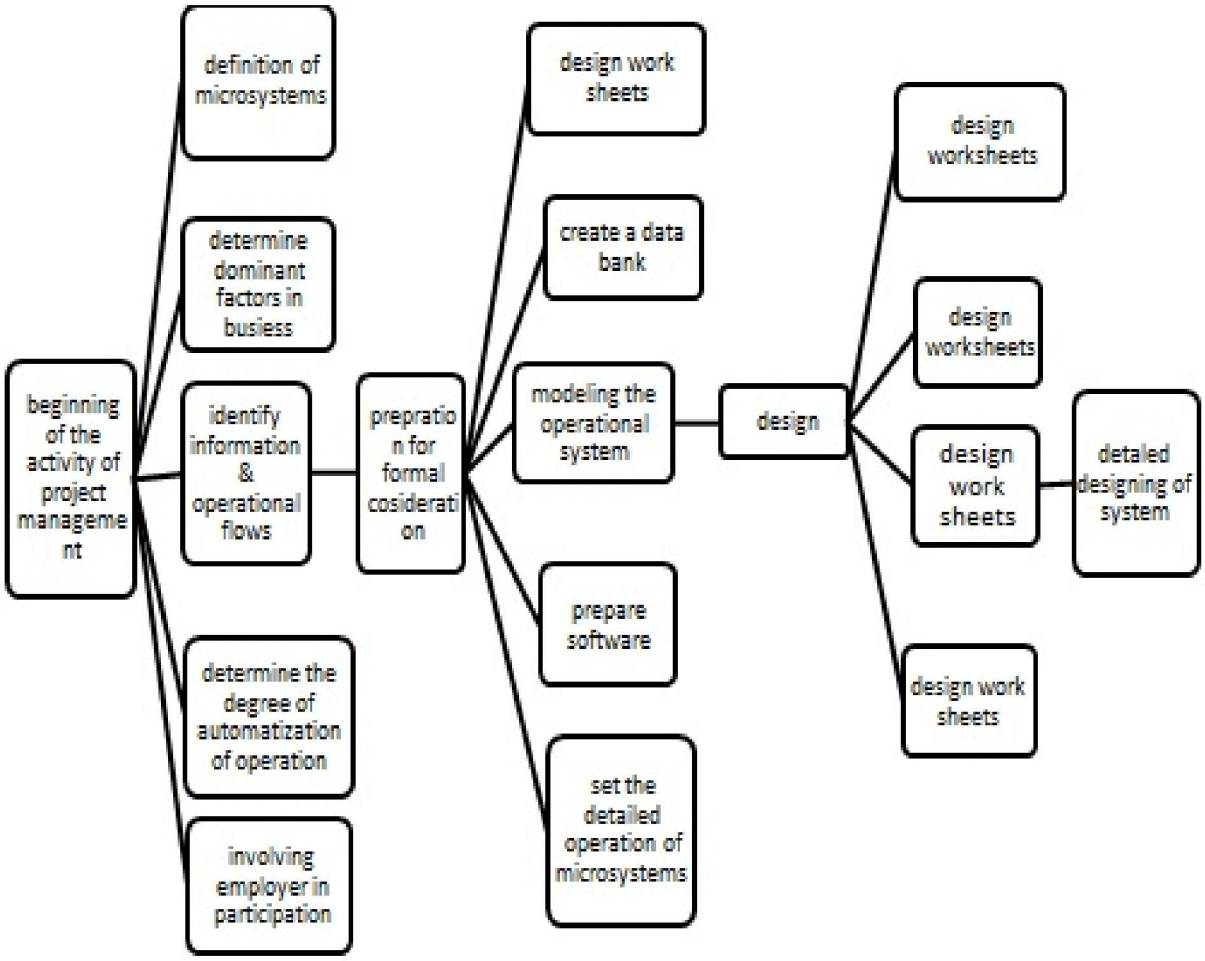

Figure 3: Steps of the detailed designing of the system

3.4 Establishment step

In the last step out of the main defined four steps we reach the mechanism of establishment. In this process the keys and critical documents and the documentaries including the documents on the illustrative documents, several phases of designing, documents on the technical knowledge, manufacture, assembly, and the user's guide together with the appendices must be collected in a package and finally to be used after final confirmation and annunciation of the product. In the final step, the necessary conditions for the self-correction of the system of research and development must be provided as well.

Task number one: Designing the sequence type in establishment

Mini-task number one: Identifying the establishment tasks.

Mini-task number two: establishing a relationship between the mini-tasks and the tasks.

Mini-task number three: Devising a plan (function, cost, time)

Task number two: Organizing the way of establishing a system.

Task number three: Planning for the type of preparing the equipment and the process of installing them.

Table 1: checklist of necessary documents to be submitted

Row	Name of document	Feasibility					Conceptual (primary) pattern					Detailed and technical design					Transfer of the technical knowledge and experience				
		Land equipment	appendices & Airplane	Engine & appendices	Instrumentation	Electrical,avionic& arms	Land equipment	Plane & appendices	Engine & appendices	Instrumentation	Electrical ,avionic & arms	Land equipment	Plane & appendices	Engine & appendices	Instrumentation	Electrical, avionic & arms	Land equipment	Plane & appendices	Engine & appendices	Instrumentation	Electrical, avionic & arms
	Mapbooks																				
1	Generalmap		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2	Dimensionalmap	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3	Mapof fragments											*	*	*	*	*	*	*	*	*	*
	Schemes book																				
4	Structural scheme			*	*	*			*	*	*	*		*	*	*	*	*	*	*	*
5	Functional scheme								*	*	*	*		*	*	*	*	*	*	*	*
6	Principles/ scheme(total)								*	*	*	*		*	*	*	*	*	*	*	*
7	Assemblage scheme											*	*	*	*	*	*	*	*	*	*
8	Connectionscheme								*	*	*	*	*	*	*	*	*	*	*	*	*
9	Side scheme								*	*	*	*	*	*	*	*	*	*	*	*	*
10	Technical conditions						*	*				*	*	*	*	*	*	*	*	*	*
11	Listof formulate documents	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12	Technical designbook	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13	Tables	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14	Calculationbook	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15	Researchtestplan&instruction						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16	Give used standard design	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

3.4.1 Classifying the documents and the sequence in their formulation and presentation

Cases having been presented in the sections of feasibility, conceptual designing, detailed designing and the discussions related to the tests and establishment will be systematized for classifying and sequence of the task as he following in order to prevent the performance of recurring tasks and the creation of any missing information or defect in the documents.

3.4.2 Observing the procedure of documentation system

At the end of presentation of the documentation model, a mechanism and a ranking must be considered in order to use information and with the objective of elevating the back-up systems of decision-making so that managers to be able to observe it as a coherent information processing system from A to Z of the project.

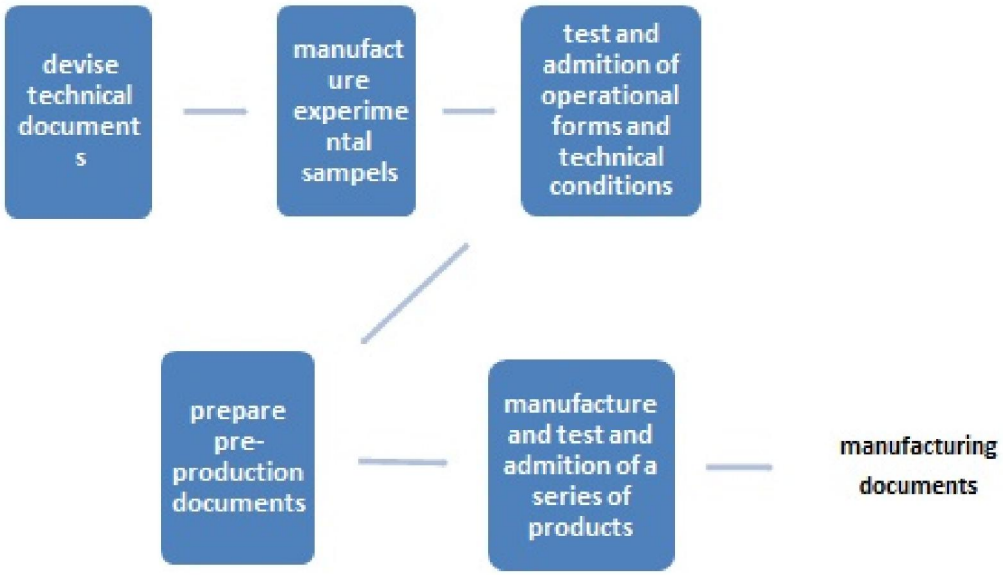

Figure.4- Classification of the documents in the lifecycle of products

3.5 Type of coding the documentations

In order to preserve the integration or coherence and the standardization of coding the intra-organizational documentations, an general instruction for the projects of research and development was merged with American standards, later we will study their methods and principles:

3.5.1 General method

The code for each document having been prepared by the airline is a series of numbers and letters in a general form in which:

XXX-YYYZZ-PPPP-QQQ/RR (M)

XXX: a code illustrating designing book and has prepared the document.

YYY: A three-digit number which indicates the respective project code.

ZZ: is a two-digit number which indicates the document belongs to which phase of the project. These phases can represent conceptual design, detailed design, etc.

PPPP: A series comprising of 2 to 4 characters which indicates the type of document. This series of characters can for instance be TR meaning technical report and/or PROC meaning procedure.

QQQ: A three-digit number which is the exclusive code for any kind of document in each phase of the project having been prepared by each one of the designing offices.

RR: A number which is at most tow-digit and is the feature of the document which are conceptually interrelated. For instance, two documents having been devised by one designing office but one is related to the calculation of aerodynamic forces without considering the friction and the other the same item by considering the friction force. Both of them are the same before the RR code but RR for one of them is 1 and for the other one is 2.

M: It's one of the English letters which indicates the order of editing the document. For instance, letter B indicates the second edition of the document.

But concerning the documentations which are devised by contractors and out of Aviation Company, coding the documentations will be done as it is said above except that the numbers YYY and ZZ are separated by a dash and ZZ instead of indicating the phase of the project indicates the contract code.

3.5.2 American method

In the second section the standard coding of the America air force should be added to the general section. XXYY-ZZZZZZ-M-N

XX: This section is relevant to the main category numbers which are under discussion. For instance, (0) for catalogues, appendices, and the tables, (00) for the general technical instructions, (1) for the airplane, (2) for the airborne planes and its relevant equipment, (5) for the exact airborne tools, (6) for the fueling system of airplane and missile, (7) for the lubricating systems of the airborne engines, (12) for the airborne electronics equipment, (15) for the temperature and pressure controlling equipment, ventilation systems, cooling and heating systems of missile and airplane, (21) for rocket and missile, (31) for the land and air electronics equipment, (33) for testing equipment, (38) for the non-airborne engines.

YY: These numbers indicate the subdivisions of the main part. For instance, for the code number 2, four subdivisions are defined in a standard manner.

G: Auxiliary gas turbine engine

J: Jet engine

K: Booster and rocket engine

R: Reciprocating engine

ZZZZZZ: This section indicates the number of the model for the equipment.

M: This number indicates the number of fragment and/or the Part number.

N: The last number indicates the respective instructions such as repairs and etc.

At last the instruction of general coding and the American standard consecutively shall be applied and exercised for the documents related to the research and development projects. Thus, in this manner coding the documentations will be normally exclusive in this system and it will be a safe password for their retrieval. Also, the viewpoint of the documentary producer in explaining this system isn't merely the viewpoint of the document management but also the Content Management is intended, in the more developed manner it can be a strategy for the Enterprise Content Management.

4. Conclusion and Discussion

Documentation as one of the main elements in the procedures related to the domain of business has always been considered important. The key point in this regard is that its completion and updating never come to its end and there shall always be a necessity for completion and updating in alignment with the growth and development of the organization workspace. It is evident that the complete execution of this model involves spending a high primary cost and the expertise execution. On the ground that the airline has had no experience in performing the research and development projects, first actions must be taken to implement this model piloted and temporarily, so that in the case of probable failure much damage not to be imposed on the company.

Future Recommendations

For a better establishment of this comprehensive model, and making it possible for the system to be able to learn from its procedure, this model must be implemented for each one of the current procedures in the company in a practical manner for the commercial and non-commercial planes in order that the model's failures and deficiencies to be properly identified and actions to be taken to remove and settle them.

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