

Process Development and Management: towards the maturity of organizations

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Abstract—The basic process principles are defined through the concept, values and theories of statistical control, which is used in many fields, regardless their type of operation. Processes development, maintenance, enhancement and management is not a formality issue for virtual organizational quality control and assurance. Process development and standardization is considered the ability to reproduce the consistent high quality levels of a service or a product with the ability to develop optimum work methods or process and equipment conditions, to codify them, to be able to translate them into effective practices, and then to create the organizational circumstances to gain long term adherence to these optimum methods and conditions. Process development and management falls into the category of unavoidable infrastructure. Leadership within organizations need to understand the true role played by processes and standards besides the consistent, predictable and probably successful organizational performance, but towards achieving via, the process, the organizational maturity needed not only to progress, but also to survive.

This paper presents a comprehensive approach around the process development and management concept which troubles heavily all technology intensive organizations in their attempt to achieve consistency and manage complexity.

Keywords— Process Engineering, Project Management, Software Engineering, Systems Development, Maintenance, Methodologies.

I. INTRODUCTION

The term process seems to be defined more or less with out any significant variations from technical and non

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technical dictionaries and glossaries. Oxford dictionary defines the 'process', as a course of action or proceeding, a series of stages in some operation. Technical references, such as IEEE, define the process as a set of actions, tasks and procedures that when performed or executed obtain a specific goal or objective [1], [2].

In information technology project management, systems development and operations management, a process similarly defined as a set of tools, methods and practices used to execute, one or many, tasks in an order.

The objective of a process is to support the production and operations of an organizational unit or an organization as a whole, to plan, and at the same time to improve the organizations' capability to produce better products and services [3].

The basic process principles are defined through the concept, values and theories of statistical control, which is used in many fields, regardless their type of operation. A process is stable under statistical control if its future performance is predicted with established statistical limits [4]. On the other hand process control is solely based on measurement. Measurement allows an organization to understand a case, a situation and an incident, based on numbers, facts, more or less known but never recorded and analyzed systematically.

Processes development, maintenance, enhancement and management is not a formality issue for virtual organizational quality control and assurance, but a much more philosophical and technocratic oriented initiative, which identifies not only the proper organizational operations and behavior, but above all the maturity of the organizations to perform as expected, probably by individuals who never estimated the importance and existence of the process in the organizational operations models [5].

II. PROBLEM FORMULATION

Based on the definitions of the term 'process', the components of the process are sets of elements and rules. A process is disciplined when it specifies a set of rules that could result in behavioral consistence with those rules and also be aligned with the process objectives that could be wider than the one deriving from the rules, incorporating organizational needs and visions.

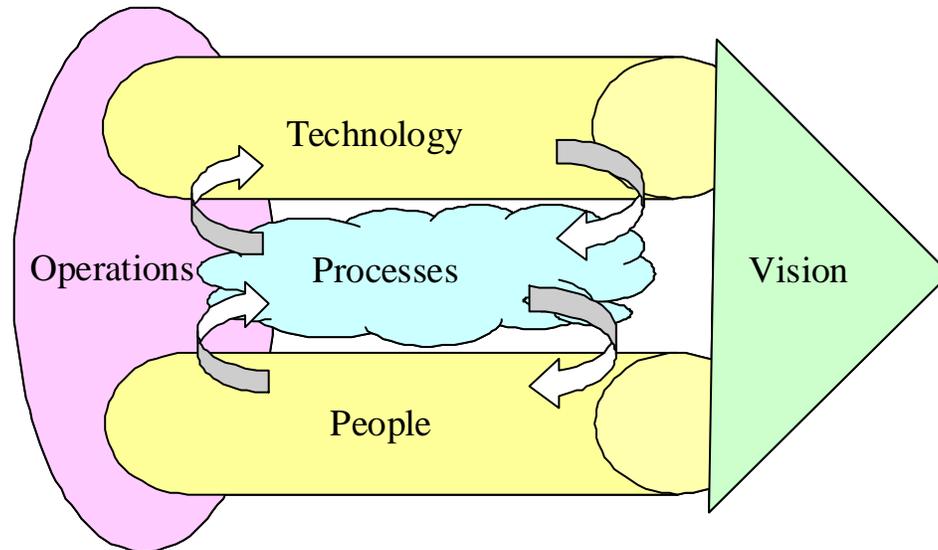


Fig.1 Organizational development based on process maturity.

A disciplined process is a mature process [6]. The term 'mature', on the other hand is sensible, wise, duly careful and adequate. The difference between a mature and an immature organizational process is simply the capability of the organization to understand, use, and benefit from the process. The structure of a process impacts on the organizational structure, which impacts on the organizational goals, which impacts on organizational vision [7].

Process discipline is even more critical to software intensive organizations where technology supports all organizational activities. Such category of organizations, which include almost all modern organizations, use the processes as the only effective communication mean between the two core dimensions of organizational development, the people and the technology[8]. Figure 1 presents the role of the processes in organizational development environments, where processes support the achievement of the perfect balance needed between human resources and technology towards achieving organizational goals.

On the other hand processes can not be effective if they are not mature. Process maturity is the effort on the development of such processes that can be executed with discipline. Process discipline results in collective pattern behavior, increases team capability and supports problem resolution in critical situations.

III. PROCESS DEVELOPMENT, EVOLUTION, TRANSFORMATION AND MUTATION

Process development is characterized by the continuous effort required for a process in order to initially develop and constantly evolve successfully. Since processes must reflect the organizational environment, maturity, strategy, goals and

visions, their development and evolution around such restrictions is very difficult, if not impossible to be achieved at once.

Process evolution, transformation and mutation is more risky and complex than the original process development [9]. The risk is related on the process mutation period. During process evolution the process passes through unpredictable and uncontrolled mutational stages all part of the process attempts to be adjusted to continuously changing environments [10].

On the other hand, during process transformation a process is scheduled to be transformed and to achieve adaptation goals within a controlled environment. Such process changes are triggered by events based on the way a process is conceived by the organization.

Organizations with process maturity treat differently the process from others; understanding that changing a process under evolution, transformation or mutation is based on conditions whose management can be a different project. Figure 2 presents a process change model based on four process development dimensions where each one contributes differently but significantly, to process change stages.

The first dimension which defines the processes as 'perceived' refers to the processes an organization believes that follows, and executes. This process dimension can be risky since it usually hides the big gap between what an organization believes is doing, and especially the management, and what is actually being doing.

The second dimension defines the processes as 'actual' and covers the processes who define what is actually being done.

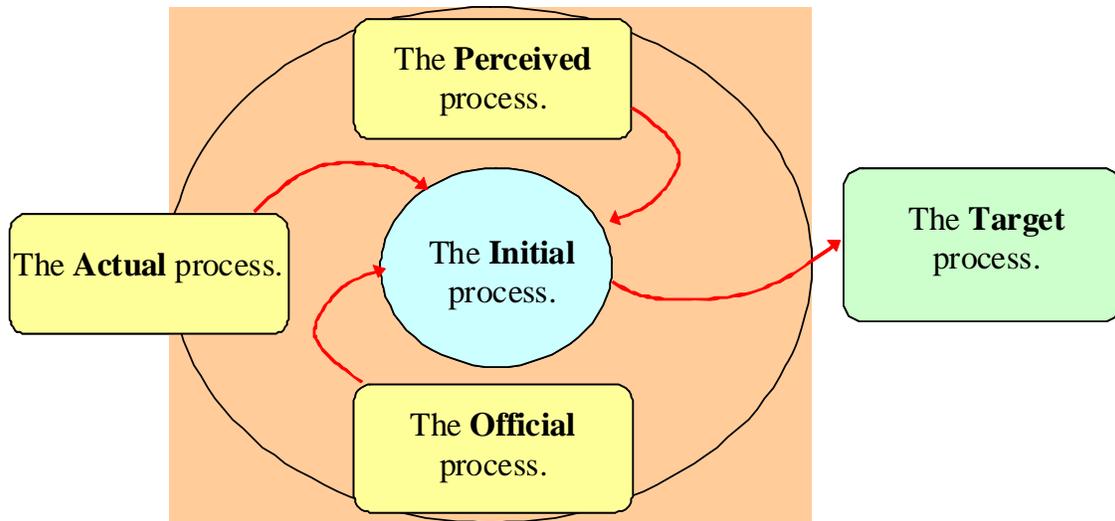


Fig.2 Process Dimensions and Relations.

Such processes can significantly contribute to the organization if they are approached with honesty and integrity.

Unlike the actual process, a third process dimension defined as the 'official' processes supports the obligatory requirements an organization must follow based on

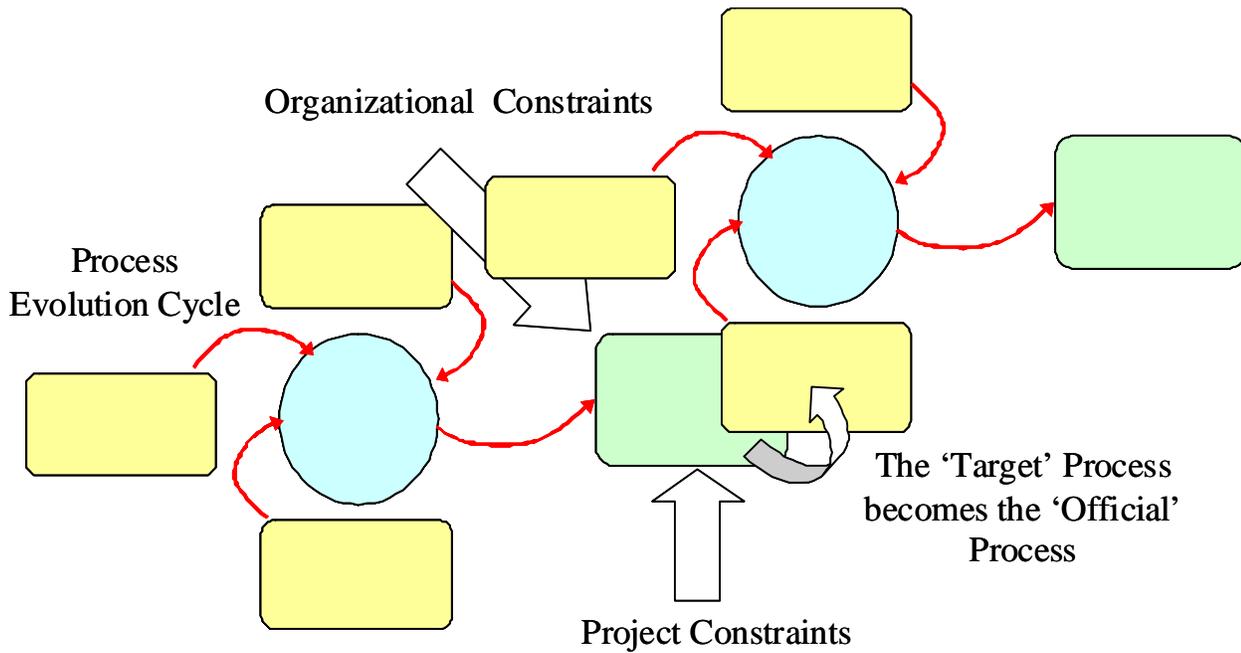


Fig.3 Process Change Model.

'regulations', the 'book', the 'rule', the 'law', or sometimes the 'competition'. Such processes are usually outdated, impractical, bureaucratic, but on the other hand is what the management wants to define as a process in order to be safely evaluated by bureaucratic or incapable inspectors, auditors, business analysts, risk analysts, and other type of evaluators, irrelevant with the organizational process expertise and strategy.

All the previous process dimensions have an impact on the fourth process dimension defined as the 'initial' dimension which is the one that currently exists and moves towards a change. Depending on the effect each process dimension has on the initial processes, the new processes that will derive from a process change will have mostly their characteristics.

Those new processes form the new dimension defined as 'target', covering the new goals and objectives of the organization from the process change. Since all process dimensions are based and act on the existing 'initial' processes, the 'initial' processes are the ones being actually changed, and become again new 'initial' processes after being for an instance 'target' processes. That is regardless the number of changes, the 'initial' processes; remain 'initial' since they constantly remain current after each evolution period [11]. It must be noted that the transition of the old 'initial' process to the new 'initial' process requires the identification of the 'target' process who will inherit via the process change its characteristics to the new 'initial' process.

Figure 3 presents this process change approach followed either evolutionary mutational or transformation changes, ending only with the end of the project the process is developed to serve.

Process changes is a very risky attempt since it is often recorded gaps between what the management wants to do with a process, and what the organization is capable to do with a process. The processes defined based on management goals are influenced more from the 'perceived' processes, can be considered far from the capabilities and maturity of the organization to follow.

That is the management is more 'perceived' process thinkers based on vision while the productions is more 'actual' process thinkers based on requirements [12].

Management, technical capability, and other constraints influencing the process dimensions are characterized as project and organizational constraints affect significantly the maturity of the organization towards and its capability to perform process management towards process implementation management.

Organizations constraints are characterized by the maturity of the organization to use a specific process, while project constraints are characterized by the project characteristic in terms of complexity, technology, and recourses. [13]

IV. THE PROCESS MUTATION

Today, agile methodologies allow some type of process change based within the logic, objectives and processes of the methodology. The capability to integrate methodologies in order to successfully approach a project goal or objective can be very risky but also necessary.

Dynamic organizational environments are continuously changed, and the project management processes on these environments shall be adjusted to these changes. The adjustment of the project management processes is based on the freedom and capability of the project management methodology used [9].

As project management facets and dimensions change over the project implementation period there is also a need for changes in the methods and practices used to manage the implementation process of the project. This need can be viewed as process mutation, where processes are evolved from different methodological approaches into one management model using different processes from different methodologies on different project management phases and stages.

Figure 4 presents the mutations of an agile project management framework towards the management of an information technology systems development project [14].

Figure 5 shows the project development cycle.

The notion of mutation was always as a means of interpreting, and sometimes misinterpreting complex information technology problems. The Formal Transformation Model [15], for example, does nothing more than restraining a project's development to a finite set of technical stages, and reapplying them, thus gradually forming the final outcome, through a so called transformation.

The Evolutionary Development Model [16] functions similarly; it also breaks a project down to numerous subprojects, the latter being defined by specific development phases, and managing each subprojects individually.

According to the previously mentioned examples, the implementation of a project can be evolved through its implementation stages differently. This project process evolution can be characterized as an implementation process mutation on the project implementation phases and constraints.

It is commonly used in a project, to define the planning activities for its execution as the first project implementation phase. When a project is in the phase of planning, then several methodologies, such as the SDPP, RDPP, COCOMO, Function Point Analysis, 5 Step and others, which base the management effort primarily on the planning activities, could be possible used alone or in conjunction with other methodologies such as the PROMPT, PRINCE, PRODIGY, SUPRA, etc, which base the management effort primarily on the project organization activities. The combination of such

methodological approaches in the project planning phase could be an ideal one, preparing the project to move into more technical phases where other type of methodologies could possible take over the project management support.

A possible project implementation phase following the project planning phase could be the project implementation

estimation phase, where the input of the planning phase is used to identify quantitative and qualitative implementation and

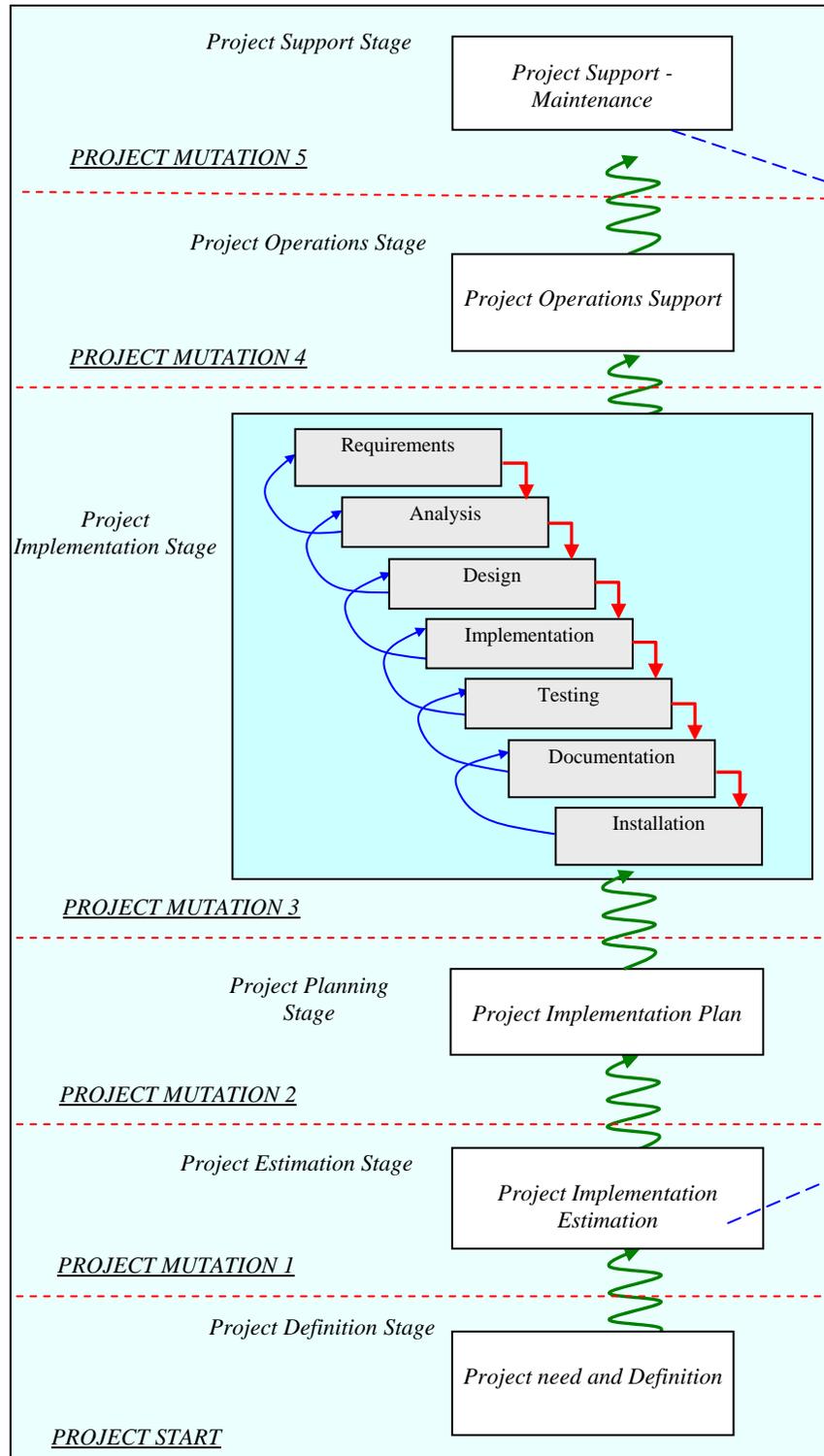


Fig. 4. Project management mutational model for implementation process of information systems.

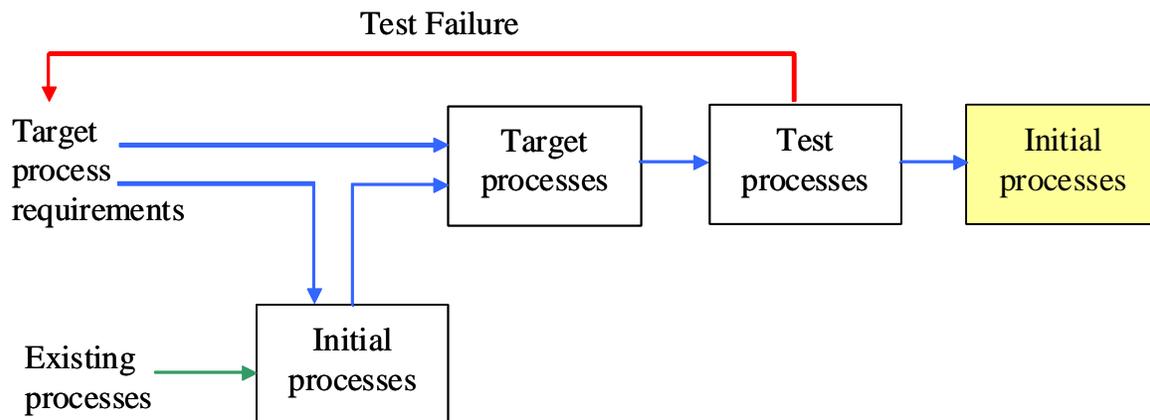


Fig. 5 Process development cycle.

management goals and targets. Possible methodologies that could be used in this phase could be the SCALABLE, TENSTEP, BPMM, RDPP, SDPP, Ariadne-PM, IPM and other, specialized on project implementation estimation.

After the project planning and implementation estimation phases the project moves in to the more technical and engineering phases which manages the actual realization of the project requirements and development of the project deliverables. Those implementation phases which can be the requirements management, systems analysis, systems design, coding, parameterization, system testing, system integration, system documentation and others can be very well supported by technically oriented management methodologies such as I.E., LCM-AIS, DoD-STD-2167A, SEFER, WWPMM, DSDM, SDLC, AIM, ITPM, and other.

It is clear that over the years different methodological approaches have been developed in order to solve one part or hopefully the entire management process in the implementation of an information technology project [4]. Unfortunately the crisis in information systems project management, and even more in software project management was, is and seems that will still be [5].

The integration of processes deriving from different methodologies not only in specific project phases, but even in specific activities within a specific project phase can significantly support the management effort. This process selection, per case can be considered as an activity with surgical sensitivity on selected project needs and constraints. On the other hand the determination of the selected processes form specific methodologies for specific project activities can not be predefined since the determination of the way the environment of the project will change or react on different types of changes can not be predicted. The project

management processes will be mutated based on the behavior or the project environment and the project progress. This mutation will be the one that will realize the needs for specific processes on specific project implementation activities.

V. PRACTICAL PROCESS DEVELOPMENT APPROACH

The most difficult task a process needs to achieve in order to reach a maturity level is usability and simplicity. It is very frustrating for the process users to execute specific processes within given definitions and procedures that they can not primarily understand and also accept [17]. The distance between writing a process and executing it substantially is very big. There is no value in defining steps in great detail if a simple summary, a form, or a diagram can provide instead all the needed information.

Process development is based on the identification of the organizational needs culture, and maturity to adopt a process, and benefit form its usage. Such conditions are difficult to be converged under a common goal, making process adaptation and management a very difficult organizational goal.

Process development starts with the identification of the activity or project the process will be applied. If this activity or project has a previously defined set of processes then this set can become the initial set of processes that will be developed through process transformation, evolution or mutation to new processes based on the activity or the project that will be supported.

Having identified the need for the development, the 'target' process outcome needs also to be defined. Process databases can be very significant tools in process development projects not only as processes repositories but more as process metrics and history facilities.

In the case of new process development no process evolution, transformation or mutation exists, so the desired process is already the 'target' process. Once the start and end points of the process development initiative are known, the selection of the processes that will be developed as starting processes is wise to derive from the ones with the most clear target characteristics and requirements.

Starting from what is known can lead to what is the unknown. Complexity derives from simplicity, and by managing simplicity complexity can be controlled and managed as well [18].

Developing the starting process can be achieved by process reusability or by original process design. Every version of each process developed need to be evaluated by a process development team or software engineering process group (SEPG) [19]. Based on an incremental process development approach the target processes are defined.

The pre-final version of each process need to be tested by process users not participated in the process development effort.

The results of the tests will determine the iterations of the process development process until the 'target' processes developed become the 'initial' ones.

VI. PRACTICAL PROCESS DESIGN TECHNIQUES

Mature processes need more than clear definitions and objectives. Fuzzy process descriptions often help towards staying within bureaucratic process objectives but fail in performance and effectiveness.

The design of a process needs to include components that can promote practicality and completeness.

In order to avoid errors and misconceptions, processes can be designed to operate and to be used through two types of documents.

The first type of document can be the process description in text following all formalities in structure, style and detail. The second type of document can be a form which corresponds exactly to the articles of the process described in the text document.

Figure 6 presents this process component correlation. The usage of forms corresponded with form descriptions assure that the processes will be executed every time and by every one involved in a project using the specific process, the same way like any other without and deviations from the quality, consistency and correctness of the information.

Despite the fact that this technique sounds primitive it can assure success since quality is not achieved by managing the complexity but managing the simplicity. It is the simple things that make the difference and it is the simple things missing most of the time from the complex models.

Having a process graphically and textually interpreted makes its evolution or mutation much easier since what will be changed as well as the changes that take a process from one stage to another can be documented.

VII. PROCESS MAINTENANCE PHASES

While the evolution of the technology oriented processes is a long lasting effort, the maintenance of the processes follow in the same pace. Regardless the number of evolutions in a process, its maintainability remains parallel to the life of a process. Process maintainability does not necessarily trigger process evolution. Organizations without significant changes on their operation procedures, type of operations, type of work and goals and targets do not need to evolve their processes like organizations operating in more dynamic environments. On the other hand this does not mean that processes have to be outdated. The process maintainability model presented in

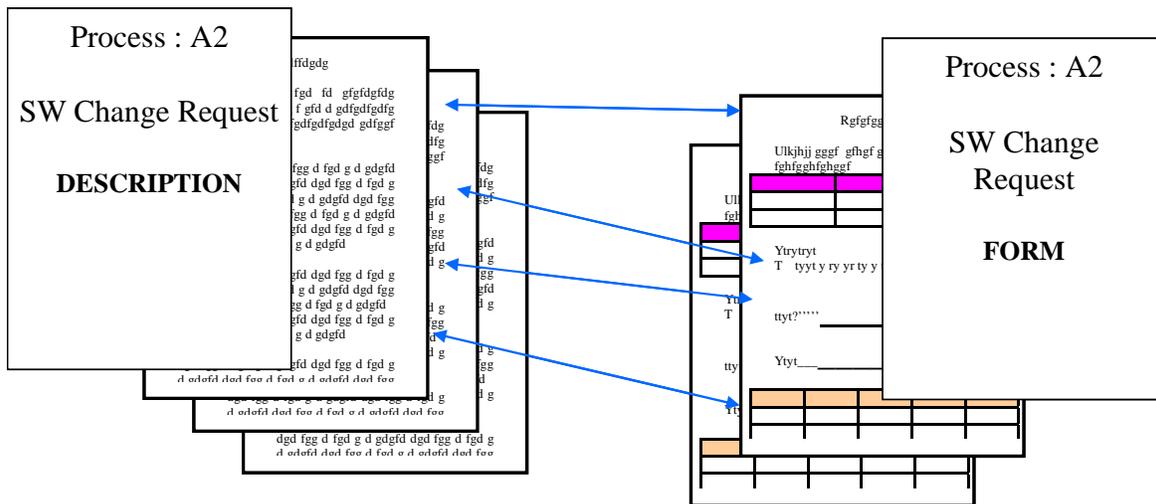


Fig. 6 Data relations among the process components.

figure 7, is based on process assessments that controls the usage, effectiveness, deviations, consistency and quality of each process [20].

The specific process evolution model is totally aligned with the process maturity and process discipline concepts, contributing to the organizational operations and strategy as well.

From the overall process evolution model, the dissemination of the knowledge, results, new process and strategy are significant benefits deriving from a process based organizational maturity attempt. Besides continuous training, knowledge dissemination and knowledge management systems can also support the process development management and evolution initiatives combining techniques such as data mining, data warehousing, statistical control and others. The integration of such technologies in the process development an management projects can help identify the behaviors of the process users which is a silent factor of the success and effectiveness of a process.

VIII. PROCESS MISCONCEPTIONS, RISKS AND CONSIDERATIONS

Process development and change management depends heavily on realism. If the current processes are not taken into consideration, along with the maturity of the organization to move towards more aggressive development plans based on realistic views, it is easy to succumb to wishful thinking or

overly optimistic schemes[21]. Misconnections on the organization process restrict rational and creative thinking [22]. A common misconception is that organizations tend to develop processes as directed by different types of external factors such as legislation, regulatory authorities, best practices, and other factors which promote primarily formality instead or creativity and productivity. In an attempt to reduce the process development costs not specialized personnel, contractors or subcontractors are usually assigned for the development of a specific type of processes.

All processes are not the same, and expertise on their approach, development and management is often required.

On the other hand process auditors, inspectors, and particular internal auditors within an organization do not have the capability and skills to understand all the types of processes. As a result of this knowledge gap, they measure the size of the process (in pages, articles, etc) and formality of the process treating them as checklist items and not as living organisms vital to the success of the organization.

From the management perspective, managers often believe that if more qualified personnel existed in their organizations there will have been less effort in process management adaptation and development, since their experience will overcome process errors or needs and knowledge gaps.

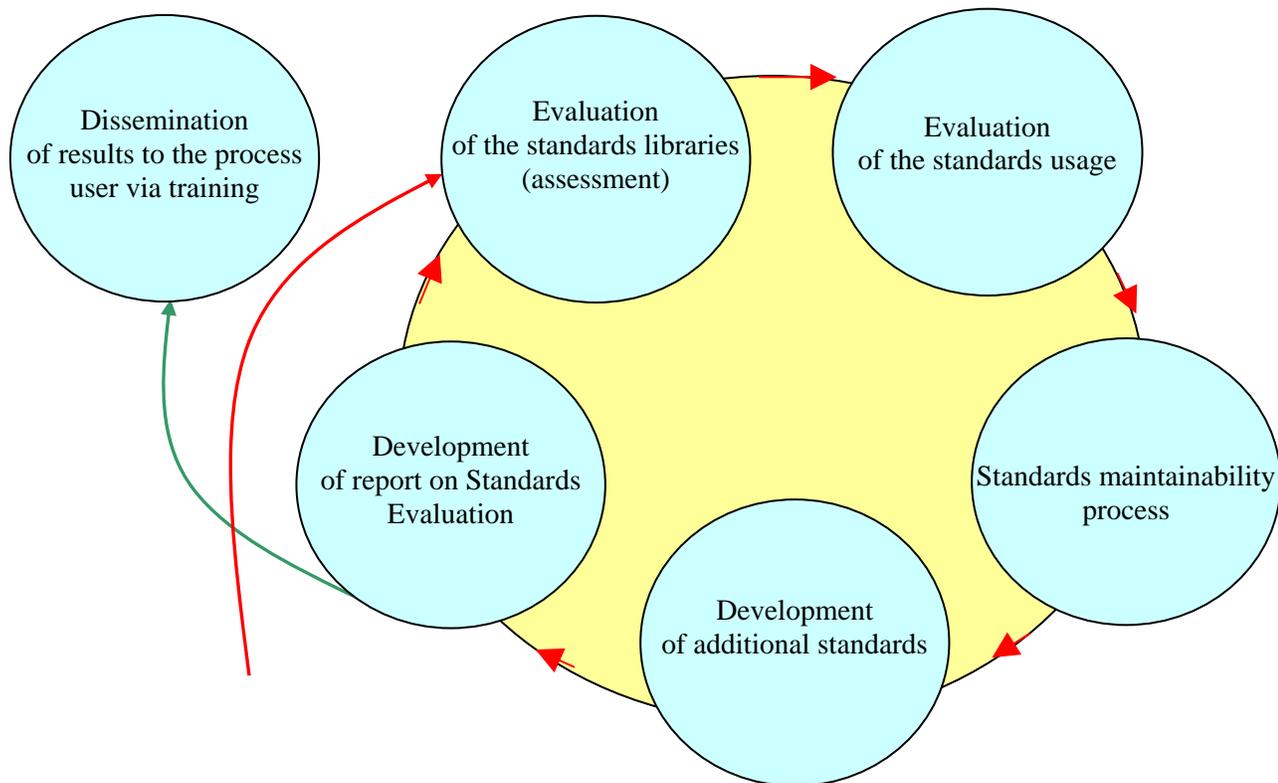


Fig. 7 Processes Maintainability Model.

Usually organizations are satisfied with their existing processes pass formal evaluations and accepted by some type of inspection process, believing that a process passed an inspection is a good process. Process management and process change is considered as great risk by insecure organizations, believing that once process passed by some type of inspection, it will pass and the next one also, such as there is a risk to change an accepted process regardless the quality of the process or even need to change the process.

Most of the misconceptions about organizational process management are constantly created and updated by organizational insecurities and fear to move beyond the formality forced by external factors or by quality assurance programs followed not to assure the productivity of the organization but the coherence and compliance to quality standards again for formality reasons [23].

IX. CONCLUSION

Process discipline is the alignment of the process with the organizations goals, vision, strategy, people and technology. Process development, evolution, transformation and mutation need to be based primarily on clear goals, visions and strategy shared throughout the organization [24].

On the other hand a process is a live organism within an organization and needs to be transformed and mutated from phase to phase, project to project and user by user. Process development in our days is a more complex, structured and

comprehensive initiative that it was some time ago. Process engineering is the discipline of creating processes based on organizational maturity, strategy and measurements. Processes are not developed to support procedural formalities but to guide the organizations towards creative and productive development, incorporating all organizations elements, resources and plans. Process maturity and process discipline can be obtained once the freedom to perform innovative and processes management approaches exists, away from formalities and bureaucratic mentalities.

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