CONCEPTUAL MODEL OF INSPECTION PROCESS (CMIP)

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Abstract: Software quality development is a great challenge to achieve as it requires utilization of standard techniques and procedures. The inspection process is effective, challenging and important technique for software quality assurance. The inspection aims to identify defects as early as possible from the artifact produced during software development. Conceptual modelling is the bridge between the goal and the real world representation of the actual system**.** It enables the identification of problems by conceptualizing. This paper proposes a conceptual model of inspection process that assists the researchers to understand the core objects of inspection process and relationship between them. The proposed conceptual models is evaluated by mapping the core objects of proposed conceptual model with the fundamental elements of existing inspection processes.
Keywords: Software Quality; Inspection Process; Artifact; Conceptual Modelling; Defect

1. Introduction

Software quality is a crucial factor for the sustainable success of a software product. It is defined as conformance to standards and customer needs [12]. Satisfaction of customer need is an influential key to success [17].Therefore to develop high quality software there is dire need to focus towards standards and customer satisfaction.

Work products developed during software development process are needed to be verified. Inspections can be used to detect defects from the software artifacts. It is a process to to identify defects from artifact at the end of any software development phase [18].

Through detection of defects improvement of software quality is supported by inspection approaches. Inspection can be performed at any stage of software development. Inspections also help in reducing the rework if applied early in the software development [13].
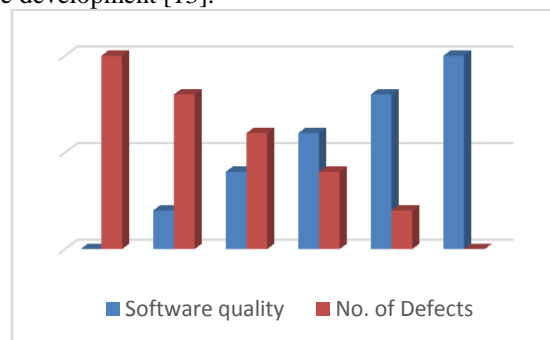

Figure 1. Relationship between software quality and defects

The quality of the product is low as the number of the defects are high. The quality can be enhanced by reducing the number of defects. "Fig 1'" shows the relationship between software quality and defects.

Software Inspections are effective but difficult to understand by researchers [15]. There is dire need of conceptual model for inspection process to make it clear and understandable. Conceptual models are representations that supports in understanding the problem domain and providing the solution in abstract manner. Conceptual modelling is usually link with representing and describing the system concepts/objects in the real world. The conceptual modelling improves the vague natural language statements [10].

The paper is organized as in section 1 brief introduction of inspection and conceptual modelling is given. Section two constitute the related work information. Section three provides the details of proposed inspection conceptual design. Section four contains details of mapping of existing inspection processes with the proposed conceptual design. The future work recommendations are given in section five.

2. Background

The various review procesess have been developed since 1976 like Fagan inspection process, Active design review process, N-fold inspection process, Two person inspection process, Gilb &Graham inspection

process, Phased inspection process, Humphery's inspection process, Effective hybrid review process etc [6,7,8,9,11,13,14]. Each process have different set of activities, different set of people involved with various roles and their associated responsibilities. Different inspection processes aim to review different types of artifact. The end product of the inspection processes could be the defect list, lesson learned, root cause analysis of defects etc. The entire research focuses on the effective defect detection strategies either by changing the sequence of activities or by reducing the number of activities. The general activities of inspection process are planning, overview, review meeting, rework and follow-up. Different inspection processes have suggested variations of activities to increase the defect detection rate. The researchers have also focused on the different descriptions and combinations of roles with their associated responsibilities and effective team size to increase the defect detection rate. Some researchers have stressed upon providing the supporting material like checklist to help in defect detection. Other researchers have shown intensive attention towards the development of tools for automating the inspection activities [12]. Researchers have presented the details regarding the inspection processes [13].

The discussion above demonstrated that although various researchers have highlighted different areas of inspection [6,7,8,11,12,13,14] but none of them have attempted to develop a conceptual model of the inspection process that may assist in understanding the key concepts of the inspection process. Conceptual modelling provides a clear understanding of complex concepts that helps in understanding the fundamental elements of inspection process [16]. There is a need to design a conceptual model of inspection process so that profound and novice researcher in the field of software engineering may understand its key concepts and their relationships. The conceptual model may help the researchers to further improve the inspection process. This paper proposes a conceptual model for modelling the fundamental elements of the inspection process and their relationships.

3. Conceptual Model For Inspection Process (Cmip)
The proposed conceptual model for inspection process is systematized around the listed eight objects and their relationships.

The objects are goal, procedure, people, roles, and responsibilities, artifact to review, Inspection work product and Inspection support. The objects are shown in "Fig 2".

Goal represents the inspection work product. Goal initiates the multiple procedural activities to accomplish the objective. The procedural activities defines the role to execute the activities. The role have associated responsibilities. Each role can have multiple responsibilities. Role are also assigned to the people who are the actual engine to conduct the inspection process. Every person is allocated to role. People can generate inspection work product. People may develop, review and modify the artifact. People may use and develop inspection supporting material like checklist, forms and tools. The details of the key objects of the inspection process is given in subsections.

3.1 Goal
The purpose of goal is to define what the inspection process is expecting to accomplish. It defines the objectives of the inspection process. Generally one of the goal of the inspection process is identification of the defects from artifact produced during software development thus making the artifact defect free. Another goal is to find the root cause of identified defects etc.

3.2 Procedure
The procedure involves certain activities, task and steps needed to accomplish the objectives of the inspection process. The general tasks and steps for the inspection process include planning, overview, preparation, review meeting, individual review, group review, rework and follow-up. These activities can vary with respect to inspection process and can be conducted formally or informally [6, 7, 8, 9,11,12,13]. To execute the activities different roles are required.

3.3 People
People are the actual engine to conduct the review process. People are most important key concept in inspection process. Background experience, knowledge and skill of people are important factors to execute the inspection process effectively.

3.4 Role
Role refers to the titles associated with the people. Role may include author, moderator, reviewer, recorder etc. Researchers have suggested various review process roles are identified based on the activities involved in the procedure [6, 7, 8, 11, 12, 13]. The roles are assigned to the people with associated multiple responsibilities.

3.5 Responsibilities

The responsibilities are the tasks needed to be performed with respect to specific role. Different types of responsibilities the people have to perform during different procedural activities under different roles. Each role may have multiple associated responsibilities such as author is a role with multiple responsibilities for example to develop the artifact to be reviewed, to present the artifact, to address the queries of their team members regarding artifact to be reviewed and to modify the artifact according to the comments and the suggestions of the team members [6].

3.6 Inspection Work Product

Inspection work product defines the outcome of the inspection process. It is ultimate realization of the inspection process goal. Work product represents the goal of the inspection process. The work products are produced by task associated with different activities. The task are performed by people to generate the work product. The work product of the inspection process may include the defect list, artifact with changes, learns in term of root cause of defect and issue with executed inspection process.
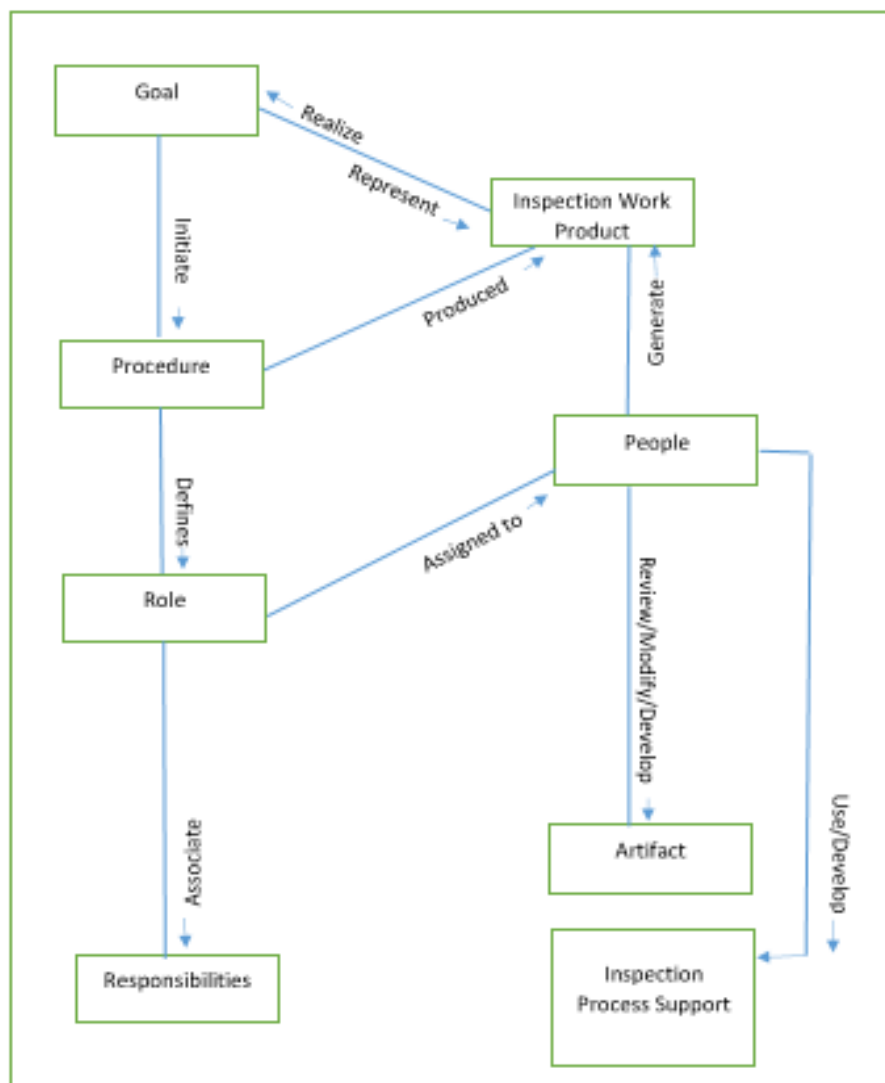

Figure 2. Conceptual Model of Inspection Process

3.7 Artifact

The artifact is the work product developed during software development life cycle and needs to be verified for the absence of defects. To make the artifact defect free the complete inspection process needs to be conducted. The artifact is reviewed by reviewer for the identification of the defects. Author develops the artifact before the start of the inspection process and modifies it based on the inspection work product i.e. defect list.

3.8 Inspection Process Support
The inspection process support is the important key concept for successful conduction of inspection process with effective results. It involves the supporting substantial's that may help in inspection process such as checklists, forms to enter the details of identified defects and computer support for automating the activities of the inspection process. In fact the computer support is also effective for distributed review activities.

4. Evaluation of Conceptual Model of Inspection Process (Cmip)

Conceptual model for inspection process (CMIP) is evaluated by mapping the key objects of the proposed models with fundamental elements of existing inspection processes like Fagan Inspection process [6], Two-Person Inspection Process [3], Phased Inspection Process [9] and N-fold Inspection Process [11]. Table 1 given on page 4 depicts that each existing inspection process has same core objects as proposed in CMIP like goal, procedure, people, roles, responsibilities, inspection work product, artifact and inspection process support .

Each inspection process defines the goal that is defect detection. The procedure is also a core concepts in all inspection processes. Different processes have different procedural activities like planning, overview, review meeting, examination, control review, rework etc. Similarly each inspection process have define certain roles such as moderator, author, leader etc. with multiple associated responsibilities.

5. Conclusion

The research has contributed in the field of conceptual modelling. It has proposed a conceptual model of the inspection process that may facilitate researchers in understanding of research regarding the core objects of inspection process. CMIP is an initial step to guide the researcher by the abstract representation of inspection process. The model is evaluated by mapping CMIP core objects with the core elements of the existing review processes identified from the literature. In future the proposed conceptual model may further be evaluated and improved.

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Table 1. Mapping of CMIP key objects with the key concepts of the existinginspection processes

Software Inspection / Key Concepts	Fagan Inspection Process[6]	Two-Person Inspection Process[3]	Phased Inspection Process [9]	N-Fold Inspection Process [11]
Goal	Defect Detection	Defect Detection	Defect Detection	Defect Detection
Procedure	Planning, Overview, Preparation, Review Meeting, Rework, Follow-up	Overview, Preparation, Review Meeting, Rework, Follow-up,	Overview, Inspection Examination, Inspection, Reconciliation Rework, Follow-up,	Planning, Overview, 1..N Parallel review, Collation, Rework, Follow-up,
Role	Moderator, Author Reviewer, Recorder Reader	Moderator Author Reviewer	Presenter Reviewer	Moderator Author Reviewer
Responsibilities	Moderator (to manage complete inspection process, to verify changes made by author Author(to develop artifact, to modify artifact) Reviewer (to identify defect from artifact, solution for defect.) Recorder (to record inspection result) Reader (to present artifact)	Moderator (to manage complete inspection process, to verify changes made by author Author(to develop artifact, to modify artifact) Reviewer (to identify defect from artifact, solution for defect.)	Presenter (to present artifact, to distribute artifact Reviewer (to identify defect from artifact, solution for defect.)	Moderator (to manage complete inspection process, to verify changes made by author Author(to develop artifact, to modify artifact) Reviewer (to identify defect from artifact, solution for defect.)
Inspection Work Product	Defect List	Defect List	Defect List	Defect List
Artifact	SRS, source code, design.	SRS, source code, design	SRS, source code, design	SRS, source code, design
Inspection Process Support	Checklist	Checklist	Checklist	Checklist