Development of online tool using Social Network Modeling concepts and Quality Control tools for faster product development

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1) Primary Information:

a) Project Title: Development of online tool using Social Network Modeling concepts and Quality Control tools for faster product development.

2) Background:

Earlier engineering was done by few people. But now with ever increasing knowledge base with the public, there is need to tap that source.

But this tapping of knowledge base of the public cannot be done in technical terms. There is need to express knowledge in non technical terms by use of logical reasoning, modeling of ideas, etc.

Seeing these non technical details on website, some people can even put their responses, or ask for clarification of some points. Now if designers see this information they can answer those queries. Modern engineering is not limited to the handful designers alone, country has a large knowledge base in public, but a company cannot hire all people, so there needs to place a mechanism by which designers can come in contact with the people, understand and incorporate their feedback and answer their queries.

Quality control tools (like flowchart, Cause-effect or fishbone diagrams, force field analysis, interrelations digraph, affinity diagram, and variability matrix) have been quite popular as they explain the engineering processes in a non technical way, yet they analyze the underlying process thoroughly.

With the advent of modern computers, a new paradigm has been opened in terms of Social Network analysis, which connects people in a faster manner and lead to quicker information flow.

In this project we propose to use the above mentioned Quality Control tools with Social Network modeling concepts to bring every bit of information available with the people at lower working level in a systematic and structured manner in the front of senior decision making level.

3) Description:

The technique used tries to simulate how mind acquires and retains knowledge.

The technique used divides people into a hierarchy with project leader at top followed by Chief Design Engineer, Associate Design Engineers and Assistant Design Engineers.

Now each of those people use graphical techniques (like flowchart, Cause-effect or fishbone diagrams, force field analysis, interrelations digraph, affinity diagram, and variability matrix, etc.) to represent and analyze the problems and solutions related to their work. These diagrams act as a sort of mind map of how a person working in a hierarchy sees the entire project from his position.

A person will be able to see mind maps of all his juniors. When a person moves from one project to other within the same company, the mind maps which were visible to him in earlier projects would be still visible to him.

4) Expected Outcome:

a) An online tool where engineers and scientists create the graphs of their ideas using the following tools.

- i. Flowchart
- ii. Cause-effect or fishbone diagrams
- iii. Force field analysis
- iv. Interrelations digraph
- v. Affinity diagram
- vi. Variability matrix

b) The online tool will provide facility for the formation of quality circles of engineers and scientists from Industries, Universities and other design teams.

5) Utility of the Project:

The utility of this project can be summarized in following points:

1) The presentation of ideas in terms of tools like Flowcharts, Cause-effect or fishbone diagrams, Force field analysis, Interrelations Digraph, Affinity Diagram, Variability Matrix etc.

- 2) A social network based tool which systematically and in structured way circulates and documents above mentioned tools.
- 3) It brings every bit of information available with the people at lower working level in a systematic and structured manner in the front of senior decision making level.
- 4) It helps to form an online Quality Circle of the people related to every aspect of the problem. (as explained in the Implementation section below).
- 5) It brings designer in contact with all the people involved in the life cycle of the product, so it helps him in getting faster feedback making him responsible for safety, quality, productivity and maintenance.
- 6) It helps individual engineers to connect to the designer on an online platform.
- 7) As this online tool organizes the information systematically about the entire product, the people at the top can see that every aspect under them is covered by one or the other engineer.
- 8) The information flow in an organization set up is key to its development, the formation of online quality circles and use of social network modeling concepts makes this entire process structured and systematic.
- 9) The information is arranged in a documented manner, so it can be used for assuring safety at every level.
- 10) This method provides an additional insight using social networking concepts and presenting the ideas at every level in terms of Flowcharts, Cause-effect or fishbone diagrams, Force field analysis, Interrelations Digraph, Affinity Diagram, Variability Matrix etc.

6) Implementation

The implementation is based on the fact “Computer helps to do things faster, it doesn’t help to do things.”

So we try to simulate the real world interactions and collaborations on a computer bringing the designer in contact with other people involved in the life cycle of the product.

Two tier model is considered in order of priority where first tier is industry and second tier is university professors.

The software recognizes people in industry and university in the following levels:

Notes on Implementation:

- i) The software recognizes people in the order Project Leader – Chief Design Engineer – Principal Design Engineer – Associate Design Engineer – Assistant Design Engineer.
- ii) Each of the above people can login to the software and create Flowcharts, Cause-effect or fishbone diagrams, Force field analysis, Interrelations Digraph, Affinity Diagram, Variability Matrix.
- iii) Each of the diagrams created by a person would be visible to himself, and his all the respective higher levels, but the diagrams created at a higher level would not be visible at the lower levels as is the case in the real world where a superior is having all information of the works the people under him are doing, but the people under are not having information about all the other projects his superior is handling.
- iv) When a person moves from one project to other within the same company, all diagrams visible to him in the previous project still remain visible to him, this helps him in understanding of next project.

v) But if a person resigns from company and goes to another company, the diagrams visible to him in previous projects in previous company are no longer visible to him.

vi) We provide this facility as people login to the software using their email ids, these email ids are approved by the company for login into the software. Email id of a person resigning is removed from the list of approved ids. The person can still login with same email id from other company but the diagrams of previous company are not visible to him.

vii) The point is that as people move within the company the knowledge they created on the previous projects is still visible to them and then they add to that knowledge. This way as people move within the company more knowledge is created, circulated and documented.

viii) Now comes how knowledge is to be shared with university professors and other outside designers. For this we use the concept of Circles.

ix) If a person wants some information to be visible to some other outside university professor or some outside designer he has to click “share” with that person or group of persons. This “share” would have to be clicked “approved” by one of the respective senior, for example, if associate design engineer shares some information, then it will go to his principal design engineer page asking for approval. The list of people with whom information is shared is also pre-approved by the project leader for that project and the juniors select only from that preapproved list for sharing.

x) This way the information from people who are implementing the project becomes visible to the designers and increases his influence in delivering functional requirements, lowering life cycle costs, and safety.

xi) NOTE: The people working in the implementation teams may not be trained enough to draw the mentioned diagrams, so for this purpose we would train entry level graduates to assist others in creating Flowcharts, Cause-effect or fishbone diagrams, Force field analysis, Interrelations Digraph, Affinity Diagram, Variability Matrix.

xii) This would also help them understand all the engineering processes and activities occurring and make them an asset for the company in future.

7) Importance of Quality control tools in industrial decision making

The issues in an industry are time/productivity, quality and costs. If an engineer approaches a project leader the questions that comes to him are can engineer do something that could reduce the time of the project, increase productivity, maintaining the quality and keeping the costs in control. Time, quality, costs are three such things that if one tries to control one then other two

go out of hand. So we have to go for an optimum solution. This optimum solution cannot be found by just looking at the problem, we need quality control tools like Flowcharts, Cause-effect or fishbone diagrams, Force field analysis, Interrelations Digraph, Affinity Diagram, Variability Matrix etc, so that a decision which is supported by scientific analysis can be reached. The solution provided by this method will not solve 100 percent of the problems, but will point to 20 percent of the causes which are responsible for 80 percent of the problems, which is the Pareto rule, to narrow down to the problems which are root causes, which if remedied will solve other problems also. This scientific way of narrowing down the problems can be provided by Quality control, and Statistical quality control tools.

8) Quality Control as effective Human Resource tool.

How the information flows in an organization is key to its development. Though organization may be working on machinery but it is the people who operate them. When a new product developed in a laboratory is to be launched in market, there are issues other than design issues for example, supply chain management (SCM) and logistics issues. The product developers need to quickly understand the logistics and SCM problems their product is going to face during its life cycle. This information is very distributed, it lies with the people who will manufacture and install the product, and the people who will use the product. These people who manufacture and install the product, and the people who use the product are the very important resource known as “Human Resource”, and the designer needs to get the information which is available with these people. The quicker he gets the information, the earlier he would be able to bring the product successfully in the market.

9) What do designers get out of this project

It provides information to the designer about the entire life cycle of the product, and increases his influence in delivering functional requirements, lowering life cycle costs, and safety.

10) What does industry get out of this project

- i) **Knowledge Management:** Effective way of how knowledge is created, circulated and documented.
- ii) The use of Quality Control tools like Flowcharts, Cause-effect or fishbone diagrams, Force field analysis, Interrelations Digraph, Affinity Diagram, Variability Matrix etc, provide a method so that a decision which is supported by scientific analysis can be reached.
- iii) Increase in productivity.

AG Piping - Fabrication Yard

Cause and Effect diagram for RETAKE (RADIOGRAPHY)

Quality is about controlling the variances, so the variances occurring at each step are identified

Improper Procedure*

		Skill of Welder*																				
		Different Material Width*																				
x		Edge Preparation																				
x		Fit-up*																				
x		x Root Gap																				
x		Voltage																				
x		Current																				
x	x	Speed																				
x		Electrode Baking																				
x		Preheat																				
x		Gas Purging																				
x	x	Arc length																				
	x	Frequent Discontinuity/Smooth Run																				
x		Interpass Temperature																				
		Interpass cleaning/Grinding																				
		Environment/Dust/Confined Space/Humidity																				
		PWHT*																				
x	x	Weaving																				
x		x	Hardness*																			
		Radiography Interpretation*																				
x	x	x	x Crack																			
x	x	x	x Tungsten Inclusions																			
x	x	x	x Lack of Penetration																			
x	x	x	x	x Lack of Fusion																		
x	x	x	x Porosity																			
x	x	x	x Slag Inclusion																			
x	x	x	x	x	x Undercut																	
x	x	x	x SS Chromium Oxide																			

Key Variance Control Worksheet - welding defects

Analysing flowchart for AG piping operations for process repeats (rework), also using variance matrix

for welding operation, following key variances are identified and a control worksheet can be developed to control those variances.

Key Variance or Cause	Where it occurs	Where it's observed	Who observes it	Who tries to control it	How do they try to control it
Improper Procedure					Welding Procedure Qualification
Skill of Welder					Welder Qualification Test
Different Material Width	Material purchasing				Incoming Material Inspection
Fit-up	Fit-up operation	Fit-up inspection	Fit-up inspector	Fit-up crew, Fabrication execution	Redo/Corrective action
Electrode baking					Baking ovens
Dust					Covering welding area
Surface weld defects	welding operation	Weld visual examination	Weld visual inspector	Fabrication execution	Regrinding, Capping
PWHT					PWHT procedure qualification
Hardness		Hardness Testing			Stress relieving
Weld defects	Welding operation	Radiography interpretation	Radiography film interpreter, level-2	Fabrication execution	Repair, Dressing, Grinding

So following the process of flowchart, cause effect diagram, variance matrix and variance control sheet we can assure the quality of the process.