

# Unravelling the Factors Leading to The Success of Automated Software Projects

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## Abstract

Software projects are becoming more complex and dynamic in the current global scenario, and consequently understanding the factors which affect the success of such complex projects becomes critical. Lot of research work has been done in this area, and high failure rate of software projects was reported. This study tries to understand the impact of various factors like process guidance by the tool, integration of task and information, work flow, transparency of information, and visualization of analyzed information on the success of the software project.

**Design/Methodology/Approach:** The success of the project, work flow, transparency of information, process guidance by the tool, visualizations of analyzed information and integration of task and information are measured through 30 items. The questionnaire measured all items on seven point Likert scale, and multiple regression was applied to find the impact of process guidance by the tool, integration of task and information, work flow, transparency of information, visualization of analyzed information on success of the software project.

**Findings:** Process guidance by the tool, integration of task and information, work flow, transparency of information, visualization of analyzed information of the project management software used in a software project have impact on the success of the software project. The study further establishes that process guidance by the tool has highest impact, integration of task and information has second highest impact, work flow has third highest impact, transparency of information has fourth highest impact and visualization of analyzed information has the least impact on the success of the software project. All these five factors explain 83.9% of the variation of success of the software project.

**Research Limitations/Implications:** The data were collected from 150 respondents and the size of data can be increased for better result. Process guidance

by the tool, integration of task and information, work flow, transparency of information, visualization of analyzed information, with respect to project management tool are only some of the factors considered in the paper to understand the software project success; other factors could also be combined to understand it in a better way. It could be studied in other countries as well.

**Practical Implications:** The findings show the impact of process guidance by the tool, integration of task and information, work flow, transparency of information, and visualization of analyzed information of a project management software, on success of software project which will help project managers in handling the team in a better way, and management in providing improved working situation for the software developers and project managers for good results in the software projects. They will also be guided for purchase decision of project management software. Guidance is not only provided to project managers but also to vendors dealing in such tool, as to what factors should be emphasized while developing such project management tools.

**Originality/Value:** Lot of work has been done to understand the factors affecting the success of software projects, but only few studies have conducted such study, with special reference to process guidance by the tool, integration of task and information, work flow, transparency of information, and visualization of analyzed information, and that to in the Indian context.

**Keywords:** Software Project Success, Flow, Transparency, Process Guidance, Visualizations and Integration, Software Developers and Project Managers.

## INTRODUCTION

Software project management plays an important role in providing framework of planning, control and analysis of a software project. In spite of application of proper software project framework, high failure rates are

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reported in software development projects (McManus & Wood-Harper, 2008; Nasir & Shabuddin, 2011). As far as the classical definition of the software project success is concerned, a successful project is defined as the one which is completed within time, budget and pre-decided functional specifications (Nokes, 2007; Moran, 2009). Thus it is important to understand the various aspects that make a software project successful. Planning and organization are important factors that affect the success of the software project (Nasir & Shabuddin, 2011; Goparaju, 2012). However (Mahanti & Evans, 2012) observed that the use of automated/ technology tools provide managers with improved guidelines for identifying the most important factors that will lead to successful implementation of the software project. Apart from improved planning use of such tools creates satisfaction among the software developers, which leads to project success (McMurtrey, Grover, Teng & Lightner, 2005).

Project management software applications help the organization to manage projects from start to finish, and allow employees at different levels to have an input into the process. Project applications help in scheduling, cost control and budget management, resource allocation, collaboration, communication, quality management and documentation or administration. The use of these packages helps to handle all aspects and complexities of larger projects and helps keep costs down. In the present time projects are generally complex and dependent on many different factors, departments, and outcomes. Project software helps in determining which events depend on others, and what happens if things change or go wrong. In addition, they can schedule people to work on various tasks, and detail the resources – physical, financial or any other type of resource. Project managers also use project management software to deal with uncertainties in the estimates of the duration of each task, arrange tasks to meet various deadlines, and juggle multiple projects simultaneously as part of an overall objective. The project management software can be based on desktop, client server, web based or integrated. For example, Microsoft Project is one of the most popular mid-range project management packages, and the likes of Primavera are popular at the higher end. Matchware MindView is an easy-to-use spreadsheet-like layout, and its mind map option lets managers to see the project in visuals, which is reminiscent of brainstorming bubbles. Project Kickstart is an easy-to-use project management package that integrates

with other applications like PowerPoint, Outlook, Excel, Word, Microsoft Project, and ACT. RationalPlan Multi Project has features to manage resources and budgets as well as multiple projects. It has an interactive Gantt chart, normally available only in higher-end suites. Basecamp is a low-cost web-based project management and collaboration package which is gaining popularity. Free and open source project tools are also available.

This paper tries to study impact of process guidance by the tool, integration of task and information, work flow, transparency of information, and visualization of analyzed information on the success of automated software projects.

## LITERATURE REVIEW

The use of software, especially the project management software, in all business functions has become crucial to gain competitive advantage. The project management software not only helps in planning the project but also in estimation, scheduling, cost control and budget management, resource allocation, collaboration software, communication, decision-making, quality management and documentation or administration systems.

The nature of software projects has become multi-dimensional, multi-purpose oriented, and highly collaborative in nature, and hence the importance of automated planning for the software project was well understood by the researchers. Allnoch (1997), Romberg (1998) & Bates (1998) have highlighted the use of automated project management tools for achieving success. According to Quinn (2010), founder and executive director of Idealware, project management software help in planning the project, managing the task, share and collaborate on documents, sharing calendars and contact list, managing issues or bugs and tracking time. Automation of all these steps in project management also helps in taking better decisions and in making a software project successful. Haughey, (PMP), suggests the use of Microsoft project for planning and establishing the amount of effort for each task, working out the effort required for each delivery, and an accurate delivery date. Updating the project deliverables section with the more accurate delivery dates is also available.

The planning has shifted from manually drawn charts, and use of spreadsheet to the use of automated tools. The

Program Evaluation Review Technique (PERT) charts are used to plan the projects. The complex, enterprise-wide processes are easily planned and logically sequenced by using the automated planning tools (project management software). These tools help in proper tracking of activities with clear precedence relationship (Katzel, 1999).

The success of a project majorly depends upon the efficiency of planning. By the use of project management software analysis of critical schedules and resource details become very easy and effective. It enables the team to plan and control the work. Centralized and continuous progress of a project can be efficiently monitored. It also helps in forecasting trends and hence, in managing time constraints. Cross functional and cross project flow of information provide better planning (Smith, 2002). Better planning leads to a successful project. Importance of software based planning for cross project view was also emphasized by Moore (2003). He suggested the use of Microsoft Project for getting proper status report and managing role based permissions.

Kauffmann (2003) suggested application of strategic project management for the organizational success. Since strategic project management involves consideration of the big picture, it requires coordinated approach, especially since the nature of project is varied. According to him automation of project management activities make the work effective and efficient, thus leading to better decision and outcome. Proper planning with the help of software also helps in reducing the overall project cost and leads to Total Quality Management.

It was emphasized by Davis (2005) that it is important to develop full set plans, with milestones, task schedules, and budget control. According to him, the use of automated project management makes all these activities efficient, leading to successful outcome of the project.

Fox & Spence (2005) also suggested the use of project management tools as critical requirement for successfully managing software development projects. In order to study the importance of project management tools in development projects, they conducted a research for Microsoft Project®. The focus of the study was to understand the mapping of project manager's decision style and the working of the project management tool. ANOVA was applied to analyze the data.

Burns (2008), president of 180 Systems, mentioned that

project management can make or break any project. Hence project managers must carefully plan the project. He also suggested the use of Microsoft Project® for managing all data related to project like tasks, duration, dependencies between tasks, resources, and cost. According to him good software not only gives a big picture of the project to the manager but also the details and platform for effective communication.

Project managers should make use of established project management tools & techniques and project management software package for creating a project plan and monitoring the progress of the project (Oren, 2009). Oren suggested use of Microsoft Project® and Primavera for doing these activities.

According to Jessen (2011) managing large projects involving different groups of people and complex tasks can be challenging. The solution is to use project management software, which allows one to manage projects more efficiently. He suggested use of Open Source Project Management Software as it is cost effective in comparison to other established packages.

A study was conducted by Margea & Margea (2011) to understand the impact of using technology in modern project planning on project success. The study was done by comparing previous two studies and the result show that use of technology in general in projects has a significant, positive impact on what and how people learn from project work.

Centeno-Gomez, Alexander, Anderson, Cook, Poole & Findlay (2004) pointed out that with increased access to project data, sound decisions can be made. Project managers can plan the proper and timely use of all resources and thereby ensure schedule commitments. Cost information enables project managers to plan, direct, and control the project within the budget. Project status can be reported in a consistent and timely manner. Potential project risks can be identified and mitigated in a timely fashion. According to them, the characteristics of a good tool are: multi-user capability, multi-project capability and support, easy-to-use, intuitive and quick to learn, scheduling, cost, resource, reporting, risk management functionality, earned value analysis, flexibility, ability to integrate user-defined parameters and which interoperable with desktop tools.

Importance of automation in software project management

is well established, but there are very few studies highlighting the impact of characteristics of project management software on project success. This paper tries to measure the impact of Flow, Transparency, Process Guidance, Visualizations, and Integration on the success of automated software projects.

## HYPOTHESES

H1: There is a significant positive relationship between the success of the software project and process guidance provided by project management software.

H2: There is a significant positive relationship between the success of the software project and integration of task and information provided by project management software.

H3: There is a significant positive relationship between the success of the software project and work flow provided by project management software.

H4: There is a significant positive relationship between the success of the software project and transparency of information provided by project management software.

H5: There is a significant positive relationship between the success of the software project and visualization of analyzed information provided by project management software.

## RESEARCH DESIGN

The present research is causal in nature, which tries to figure out the impact of process guidance by the tool, integration of task and information, work flow, transparency of information, and visualization of analyzed information on the success of automated software projects.

### Sampling Design

The research was carried out in the software organization of India. We have taken the sample of software professionals by dint of stratified random sampling, resulting into total sample of one hundred and fifty. Respondents were given the questionnaire over electronic-mail and were required to rate the questions on a seven-point Likert scale. Thirty questionnaires were sent to each IT organization and the

final number of respondents who participated in the study by returning the self-administered questionnaire was 150.

### Data Collection Design

The data were collected from five leading software companies of India through a questionnaire where each item was measured in seven point Likert scale. In total, thirty items are used to measure the success of the project, the process guidance by the tool, integration of task and information, work flow, transparency of information and visualization of analyzed information.

The success of the project from the respondent's perspective was measured through one item:

1. All in all, the project has been a great success from my point of view.

The work flow was measured through eight items:

1. The project management tool had 24/7 access.
2. The project management tool was easy to try, easy to use, easy to subscribe and unsubscribe.
3. The project management tool had very quick response time.
4. The project management tool required minimal mouse clicks, prompts, and dialogs.
5. The project management tool mostly had direct user entry resulting in automatic saving without having to click "O.K."
6. The project management tool had multiple undo/redo required to make automatic save acceptable.
7. The project management tool had rapid startup and shutdown.
8. The project management tool had minimal maintenance requirements.

Transparency of information was measured through three items:

1. The project management tool used to show automatic status updates in most of the cases.
2. The project management tool used to show dashboard type status readings in most of the cases.
3. The project management tool mostly had positive return on investment for participants to have status visible to others.

Process Guidance by the tool was measured through eight items:

1. The built-in workflow capability in the project management tool was up to the mark.
2. The project management tool had high intelligence to decipher the status in the project workflow.
3. The project management tool had high intelligent access control and user rights.
4. The project management tool was highly intelligent about what individuals can and can't do based on current project position and their individual role and activity.
5. The project management tool provided suggestive guidance that did not limit choices but rather makes some choices more obvious than others.
6. The project management tool provided mandatory guidance when necessary.
7. The project management tool provided instructional capability that can react to different levels of expertise by providing the appropriate level of guidance, in essence educating while the work gets done.
8. The project management tool filters information to provide useful guidance rather than information overload

Visualization of analyzed information was measured through six items:

1. The project management tool provided high quality graphics.
2. The project management tool provided subtle animations where appropriate.
3. The project management tool provided professional quality icons, glyphs, and other graphics that convey meaningful information at a glance.
4. The project management tool provided graphics that imitate reality.
5. The project management tool provided high level of drag and drop creating an intuitive "hands-on" feel.
6. The project management tool provided ability to run on a large format touch-screen for presentations or for continuous interaction by various participants on "permanently on" screens in various places in the project war rooms, development rooms and offices.

Integration of task and information was measured through four items:

1. The project management tool provided deep integration points with the development cycle.
2. The project management tool provided intelligent processing of incoming information.
3. The project management tool provided intelligent filtering into useful diagrams, reports, and dashboards.
4. The project management tool provided intelligent updating and automatic information processing to reduce inbox and replace to-do items with done items.

### Statistical Design

Multiple regression was used to assess the impact of Flow, Transparency, Process Guidance, Visualizations and Integration on success of software project, where success of software project is the dependent variable, and Flow, Transparency, Process Guidance, Visualizations, and Integration are the independent variable.

### Model and Variable Definitions

The following model is used for testing hypotheses:

Success of the Project =  $\beta_0 + \beta_1$  Work flow +  $\beta_2$  Transparency of information +  $\beta_3$  Process guidance by the tool +  $\beta_4$  Visualization of analyzed information +  $\beta_5$  Integration of task and information.

The variables are explained as following:

### Success of the Software Project

Successful software projects are often defined as meeting business objectives, deliver on time and within budget, and meeting requirements (Nasir & Sahibuddin, 2011).

### Work Flow

The principle of flow states that, all other things being equal, it is more valuable to deliver smaller batches of functionality more frequently than bigger batches of functionality less frequently (Beck, 2001).

**Table 1: Correlations**

		<i>Success of Project</i>	<i>Integration</i>	<i>Process Guidance</i>	<i>Flow</i>	<i>Transparency</i>	<i>Visualization</i>
Success of Project	Pearson Correlation	1	.829**	.871**	.826**	.777**	.730**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	150	150	150	150	150	150

\*\* . Correlation is significant at the 0.01 level (2-tailed).

**Table 2: Coefficients<sup>a</sup>**

<i>Model</i>		<i>Unstandardized Coefficients</i>		<i>Standardized Coefficients</i>		
		<i>B</i>	<i>Std. Error</i>	<i>Beta</i>	<i>T</i>	<i>Sig.</i>
1	(Constant)	-.633	.231		-2.737	.007
	Integration	.186	.074	.163	2.517	.013
	Process Guidance	.474	.071	.431	6.710	.000
	Flow	.171	.074	.160	2.298	.023
	Transparency	.155	.069	.140	2.261	.025
	Visualization	.140	.055	.128	2.549	.012

a. Dependent Variable: The project has been a great success from my point of view.

## Transparency of Information

The ability of the project management software to convey information about status, work, progress, and activities without manual input, or where manual input is required, that input must be very quick and easy (Challenges of Software Process Management, 2011).

## Process Guidance by the Tool

The guidance provided by the project management that leads the project manager and users along the path of best practice while shielding them from unnecessary complexity (Challenges of Software Process Management, 2011).

## Visualization of Analyzed Information

It is defined as the ability of the software project management tool to incorporate intuitive graphical user interfaces that enable the users to grasp and utilize the full functionality available, without becoming confused (Challenges of Software Process Management, 2011).

## Integration of Task and Information

This property of the software project management tool facilitates deep integration points with the development

cycle. Integration helps in processing the incoming information against the process guidance to translate the flood of incoming decisions into completed actions (Challenges of Software Process Management, 2011).

## EMPIRICAL RESULTS

### Correlation Matrix

The correlation between variables indicates how much of variables changes are explained by other variables which is between 1 and -1. The correlations among the variables are shown in Table 1.

The results provided in Table 1 reveal that the correlation coefficient between the success of software project and integration of task and information is .829, the process guidance by the tool is .871, with work flow as .826, the transparency of information is .777 and the visualization of analyzed information is .73. All the correlations are found to be significant ( $p < .05$ ). This gave us a confidence that we have chosen a fairly good set of predictor variables for our regression.

Table 2 reveals that Integration ( $t = 2.517$ ,  $p < .05$ ), Process Guidance ( $t = 6.710$ ,  $p < .05$ ), Flow ( $t = 2.298$ ,  $p < .05$ ), Transparency ( $t = 2.261$ ,  $p < .05$ ), and Visualization ( $t = 2.549$ ,  $p < .05$ ) individually leave a statistically significant impact on the success of the software projects.

**Table 3: ANOVA<sup>b</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	207.263	5	41.453	156.135	.000 <sup>a</sup>
	Residual	38.231	144	.265		
	Total	245.493	149			

a. Predictors: (Constant), Visualization, Process Guidance, Transparency, Integration, Flow.

b. Dependent Variable: The project has been a great success from my point of view.

**Table 4: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.919 <sup>a</sup>	.844	.839	.515

a. Predictors: (Constant), Visualization, Process Guidance, Transparency, Integration, Flow

Table 3 further reveals that all the five variables taken together make a statistically significant impact ( $F=156.135$ ,  $p < .05$ ) on the success of the software project and thereby the model stands statistically significant.

Table 4 reveals that a significant regression was achieved with adjusted  $R^2$  of 83.9% which shows that 83.9% of the variation of success of software project is explained by process guidance by the tool, integration of task and information, work flow, transparency of information, and visualization of analyzed information.

Since each of the variables considered in this study is significant as shown by the result of t-test, the model is significant as per the result of ANOVA, and the variation explained by all the independent variables on the dependent variables is 83.9%, hence we can form the regression equation from the Table 3 as follows.

Success of the Software Project =  $-.633 + .171$  Work flow +  $.155$  Transparency of information +  $.474$  Process guidance by the tool +  $.140$  Visualization of analyzed information +  $.186$  Integration of task and information. The regression equation could intelligently be used to bring success of the automated software project. Further implications of the results are discussed in the next section.

## DISCUSSION

Use of automated project management is highly beneficial for project managers. The results of this research reveal

that the project management software must have efficient process guidance by the tool, integration of task and information, work flow, transparency of information, and visualization of analyzed information. The results show that there is a significant impact of effective Flow, Transparency, Process Guidance, and Visualizations and Integration on success of the software project. It further reveals that the process guidance has the highest impact. The error in managing task can be minimized if the software effectively provides guidance for improvement of existing process. Process guidance helps in improving the existing process, by providing information about work coordination in a team project, and is useful in clarifying the use of the document in the overall project life cycle. Transparency is the key to performance which finally leads to a successful project. The second highest impact on project success is that of integration. Project managers need a tool that provides deep integration points with the development cycle, and that processes the incoming information against the process guidance to translate the flood of incoming decisions into completed actions. Sharing and collaboration of centrally located documents is another essential requirement as it substantially increases the productivity of the team. This is possible only when integration is proper. The impact of flow in an automated package and is next to process guidance. Good flow is desirable as it not only breaks the task to make deliverables small, but also helps in identifying who is responsible for which aspects of the project, a time estimate for each task and links between dependant tasks. It is

important for project management software to breakdown the tasks to be completed in detail, thus maintaining the flow efficiently. Importance of transparency comes next to flow. Transparency is the key to performance which finally leads to a successful project. Transparency in terms of coordination, collaboration and availability of information is highly recommendable for process improvement and finally for good project result. Out of the five factors the one having least impact is visualization. Presently most of the time the nature of software projects is dynamic and the amount of information is vast. These projects are also associated with complexity and uncertainty. In this scenario project manager is challenged by the conflict between the dynamic and evolving nature of project information. Effective visualization helps in minimizing these problems and helps the project manager in taking appropriate decisions. All the five factors are, with their respective impact, are highly desirable for effective planning, which definitely is an important factor for the success of the software project.

## CONCLUSION

Fixing the problem of software mismanagement is a global challenge and automated software project can help in combating this challenge. The research in the area of understanding the benefits of various aspects of project management software is in the developing stage. And use of such automated tools helps in increasing the success rate of software projects. Though there are lots of project management tools available, there are only few which have all the five features highlighted in this study. Through automation of project management activities, the error in terms of schedule and cost overrun can be minimized. Although there are a number of characteristics of project management tool, these five factors are very essential, with the impact in the following order: process guidance, integration, flow, transparency, and visualization. This means that success can be achieved by using project management software which can be accessed any where any time, have quick response time, minimum maintenance, automatic dashboard type updates, show workflow capabilities, help in correcting existing processes, represent the valid information in easy to understand graphs and charts, and help in integrating all the project activities. This not only speeds up the project but also helps project manager in planning and executing the project efficiently. And for this, the tool must have

all these five properties. The study has some limitations in terms of data size and the geographical coverage. The sample size is 150; more data could have been across the globe. The findings of the research will help project managers in selecting the project management software, with the properties and qualities which will make project management activities and decision making efficient, thus increasing the success rate of the software projects. Guidance is not only provided to project managers but also to vendors dealing in such tool, as to what factors should be emphasized while developing such project management tools, thus making it highly useful for the project managers.

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