Virtual Visual Planning: A methodology to Assess Digital Project Management Tools

Stefano Biazzo[1*], Alberto Fabris[2] and Roberto Panizzolo[3]

[1,2,3] Department of Management and Engineering, University of Padova, Italy

Abstract.

In contemporary Project Management literature and practice, it is possible to distinguish two paradigms: the algorithmic-rational paradigm and the relational paradigm. The algorithmic-rational paradigm is characterized by a sequence of programming methodologies that constitute the classic corpus of knowledge on Project Management (WBS, CPM, PERT, Gantt diagrams). Following the diffusion of Agile methods, dissatisfaction with the algorithmic-rational paradigm has spread and a Visual Planning approach, based on the decentralization of planning and control and the abandonment of algorithmic techniques (such as CPM and Gantt diagrams) in favour of simpler, visual and physical tools, has become increasingly established. Visual Planning is the concrete manifestation of a relational project management paradigm.

In this work, through an analysis of the key practices characterizing Visual Planning, we have identified the five fundamental principles that define this approach to project management. Then, to structure and guide the choice of a software application that can support Visual Planning, we have (1) identified several features which allow distinguishing one software from another, and (2) created a correlation matrix between the core principles of Visual Planning and the software features. Through this matrix, it is possible to evaluate and measure the adherence of project management software applications to the logic and practices of physical Visual Planning.

Keywords: lean project management, agile, visual planning, virtual project management

1. Introduction

The classical Project Management paradigm is characterized by an algorithmic-rational approach and a specific sequence of planning and control methodologies (see Wysocki, 2014 and Loch et al., 2011):

1. the structured breakdown of the project in order to define all the actions to be carried out to achieve the objective (WBS - Work Breakdown Structure): the fundamental aim of the breakdown is the identification of the elementary work packages, which represent those activities that can be managed independently and assigned to a single manager;
2. the elaboration of the network of activities, defining the logical constraints of precedence between the various work packages and estimating their duration;

3. the calculation of the start and end dates of the various activities typically using the "critical path method" (CPM) or PERT (Program Evaluation and Review Technique - which adopts a probabilistic model for estimating the duration of the activities based on three values: optimistic duration, pessimistic duration and average). These methods determine the margin of flexibility of the individual activities, i.e. how much it is possible to postpone the execution of the activity without affecting the end date of the project;
4. checking the progress of the project, through the verification of deviations from what has been planned with the aid, for example, of a time-scale task bar chart (Gantt diagram).

The application of such methodologies has often proved to be very disappointing (De Meyer at al., 2001; Lenfle and Loch, 2010; Saynisch, 2010; Salameh, 2014; Marle and Vidal, 2016): rational planning techniques do not give the expected results, CPM schedules prove unrealistic and not very useful to manage the progress of the project, turning into documents that are detached from reality or occasionally updated for mere reporting or external communication purposes.

This dissatisfaction with the traditional and rational approaches to Project Management, has stimulated the birth of numerous attempts to innovate the planning and control methods and the advance of the Agile movement in the world of software development (see Highsmith, 2009; Schwaber and Beedle, 2002; Cobb, 2011). In the context of physical product development projects, the Lean Product Development movement has made significant contributions to the evolution of Project Management systems (see, for example, Mascitelli, 2011, Hoppmann et al., 2011, Lindlöf and Söderberg, 2011; Lindlöf and Trygg, 2012, Radeka, 2012).

What Lean and Agile inspired "project management reform" initiatives have in common is the abandonment of the image of the project as a network of activities (to estimate durations and determine objective links of interdependence), to leave room for the idea that the project is, first of all, a network of people. Two are the fundamental consequences of this new paradigm, which we can define as relational: (1) planning cannot be separated from action and therefore: it is not possible (and it makes no sense) to plan the whole network of activities at the beginning; planning is a continuous event and details are progressively formed over time (plans must therefore be of the rolling wave type); the act of "planning" is a coordination activity that must be carried out by those who carry out the operational work; (2) the project is a network of discussions, commitments and actions and therefore: planning must be a collaborative and social event, it is a "conversation" in which those responsible for the activities assume mutual commitments on the performance of tasks; the temporal relationships between activities are the result of a "bargaining" between those responsible for the activities themselves (and not an intrinsic attribute of interdependence between abstract activities); the duration of an activity is also (naturally within a certain range of values) the result of a "bargaining" that depends on the needs of the "customer" downstream.

2. A relational paradigm to Project Management: Visual Planning

The relational paradigm of Project Management is centred on the decentralization of project planning and control and the rejection of classical algorithmic techniques: a team of "responsible experts" (Ward and Sobek, 2014) plans and controls its work with the help of simple and visual tools: the term "Visual Planning" is precisely used to highlight the centrality of the tools that serve to make immediately visible and transparent information on the progress of the project. It is an approach that deeply takes into account the nature of people and their organisational behaviour (Hines, et al. 2006; Mascitelli, 2011).

The ultimate goal of Visual Planning is to make the work to be done in projects more efficient by facilitating communication between team members and decentralizing the control and planning of activities in the short term. To facilitate this, the main components of Visual Planning are stand-up meetings and project boards (see Mascitelli, 2011; Lindlöf and Söderberg. 2011; Bertilsson and Wentzel, 2015; Tanaka, 2005). The former are short meetings between the team members during which information about the activities carried out and problems encountered is exchanged. Stand-up meetings allow a quick and continuous exchange of information and facilitate the resolution of problems and conflicts that arise during the progress of a project. The project boards, i.e. the boards in which the various activities to be done are planned and scheduled, present an overview of the entire project and thus allow to capture in a simple and immediate way the progress of the project.

The management of the project is the result of collaboration between the various team members, who participate actively and personally in the planning and progress of the project, taking responsibility for the activities to be carried out and agreeing with each other independently. Decisions are taken together, by all the individuals involved in the project, who know better than others how certain choices can affect the development of activities and the progress of the project. The temporal relationships between activities are the result of "bargaining" between those responsible for the activities themselves, and not an intrinsic property of interdependence between abstract activities as in classical CPM or PERT techniques.

Planning, therefore, that evolves and goes hand in hand with action and becomes a collaboration, a dialogue between team members who assign tasks to each other and negotiate deadlines and end dates. The tools to support project planning and control are extremely simple and are based on the use of posters and "activity cards" typically made with post-it. Visual Planning, in fact, is based on the principle of "making visible" the fundamental contents of the project execution work, allowing team members to have a clear understanding of the status of the project, thus saving time that can be dedicated to the execution of the work, thus improving the efficiency of the team.

Two basic orientations can be identified when setting up a planning board, in relation to the choice of the primary visualization variable: a time-based approach - focused on time as the primary variable - and a workflow-based approach, focused instead on workflow. In the time-based approach the planning board shows in the horizontal axis the passage of time (typically in months or weeks). In the workflow-based approach the horizontal dimension is instead dedicated to the workflow; for example, the change of status of the activities as in a Scrum Board (see Wysocki, 2014; Schwaber and Beedle, 2002).

During the progress meetings, all team members, coming from the different company functions, actively participate in the planning and management of the project, facilitating communication and making it possible to better identify problems and possible project risks, with the possibility of analyzing them and perhaps solving them in advance. Posters and boards prepared and organised in such a way as to facilitate the conduct of meetings and make it as easy as possible to share information in order to ensure the clearest possible understanding (see Mascitelli, 2011).

It is therefore possible to identify 5 fundamental principles on which Visual Planning is based:

1. *Work visualization*: project planning and problem identification and resolution are made available in a "visible" form, allowing team members to have a clear understanding of the status of the project.
2. *Decentralized planning*: team members actively participate in project planning and management from the very beginning of the project, with an increase of the sense of responsibility towards the project and the team.
3. *Continuous collaboration*: There is an intense and frequent collaboration between the various team members, decisions are taken together, and everyone takes responsibility for the activities to be carried out.
4. *Transparency of information*: Participation, collaboration, communication and the use of posters and post-it cards promote the dissemination of knowledge and information allowing team members to have a clear understanding of the status of the project.
5. *Simplicity*: traditional, sophisticated techniques are replaced by simple posters and post-its which allow a clear, immediate and straightforward understanding of the progress of the project.

3. Visual Planning with digital technologies: towards Virtual Visual Planning

The advantages of visual planning, where the project objectives, activity planning and problem analysis and solutions are visible, are manifold: it increases sharing and participation in the progress of the project, it increases the sense of responsibility towards the project and it increases the sense of belonging to the team.

At the same time, however, Visual Planning also has some critical issues. First of all, it needs a lot of post-its to stick on the various billboards, or project boards, with the risk that they fall from the billboards, are placed incorrectly or even lost. Moreover, in such post-its, it is possible to write only a note or a small title of the activity to be carried out, without a precise and more detailed description. They are in fact small in size, and the space available to report the work to be completed is minimal.

Finally, Visual Planning is based on paper project boards, physical, which are present in one place and therefore accessible only if you are in the same company headquarters. However, in a globalized market, where trips to the various company plants are almost the order of the day, it is complicated and difficult to access and view the various billboards freely and when you need them.

The virtual evolution of relational project management consists in the use of software tools to replace or support normal physical systems in project management (see Romano et al., 2002; Chen et al., 2006; Schöpf, 2010; Martinic et al., 2012; McMahon, 2016; Ollus et al. 2011, Ferreira and Tereso, 2014).

These tools generally offer the possibility to create a list of tasks using virtual tags and to plan the various deadlines, defining the project milestones related to them. In these virtual tags it is also possible to attach documents and descriptions that can be viewed and edited directly on the platform or downloaded to your PC. This promotes clarity and reduces the risk of losing the various files between the various emails exchanged between team members.

Once the various activities have been planned, they can be viewed through time-based or workflow-based project boards, depending on the software used and the preferences and needs of the individual user. The history of each change and modification is recorded, allowing better control and easier future analysis.

This software also allows you to assign the various tasks to one or more people. As a result, it is possible to monitor the workload for each user and, if necessary, reassign tasks or re-plan them according to project needs.

To help you monitor ongoing activities, there are customizable dashboards that allow you to keep track of the status of the project and which can contain, for example: visual representations that show the planned activities and at the same time the completed activities of the entire project to compare what you have planned with what you have actually achieved; the list of activities to be carried out shortly and in the following days; notifications about activity updates, etc.

The main objective of the virtual approach to the management of new product development projects is to speed up the decision-making process thanks to a faster information sharing, in real time, without giving up a precise scheduling of activities and a rational allocation of resources according to the real time available. These software applications help companies to break down distances and barriers, increase the efficiency and productivity of project managers and their teams, resulting in new competitive advantages, a reduction in time to market and a faster return on investment (see Chen et al., 2006; Ferreira and Tereso, 2014).

It was stressed that Virtual Visual Planning allows to solve some problems of the physical approach to project management, such as the need to be in the same plant where the project board is present, a problem overcome through the use of the web that allows you to access posters and post-it anywhere in the world through the Internet and your account.

At the same time, however, Virtual Visual Planning has other critical issues. The main one is the decrease in face-to-face conversations between team members. The web and social tools can never replace the richness of face-to-face discussions and direct exchanges of opinions.

It is essential to understand how much the usage of Virtual Visual Planning software adheres to the principles of physical Visual Planning set out in section 2. To this end, 31 key features of project management software applications have been identified and a matrix of correlation of the key features of the software with the principles of Visual Planning has been developed (see Table 1).

This correlation matrix can be used to evaluate the adherence of a specific software to the principles of Visual Planning; by experimenting the use of the software with a test project, it is possible to evaluate the 31 features by assigning three levels of implementation: 1 (poor), 3 (sufficient), 5 (good); the value 0 indicates that this feature is not present in the software under examination. Then the scores along the columns are added up, thus obtaining a total score for each principle, which will then be normalized as a percentage of the maximum score obtainable.

In Table 2, we reported the analysis of Wrike and in table 3 the comparison of a sample of 5 leading project management software applications. The authors have elaborated the evaluations with the contribution of a panel of six senior Project Managers belonging to the Lean Group of University of Padova which is made up of companies that have participated in executive post-graduate courses on Lean Management over the last five years and have started Lean transformation projects.

Table 1: Software features and Visual Planning principles: the correlation matrix

Software features	**Virtual Visual Planning Principles**				
	Work Visualization	Decentralized Planning	Continuous collaboration	Transparency	Simplicity
Arrange and group tasks flexibly	X			X	X
Insert Milestone	X	X		X	
Customize the status of a task	X			X	
Connect tasks to people		X	X		
Attach files and documents to a task				X	
Make the duration of the activity not visible		X			
Insert dependencies between tasks	X				
Create subtask		X			
Synthesize personal work in an ad hoc section	X	X			X
Receive notifications of updates			X	X	
Insert comments			X	X	
Mention colleagues in comments			X		
See the Activity Stream	X			X	
Being User Friendly					X
Consult the guide and receive assistance					X
Export and share tasks and projects				X	
Manage user access and permissions				X	
Receive alarm messages (delays)		X			
Customize the board	X				X
Schedule tasks quickly and easily					X
Assign tasks quickly and easily					X
Visual differentiation between tasks (e.g. colors)					X
View old notifications and changes	X			X	
Display tasks in a time-based board	X				
View tasks in a workflow-based board	X				X
Create analysis report		X		X	
Create progress charts	X	X			
Enter the work in progress limit		X			
View user workload		X			
Create Custom Dashboards	X			X	X
Stand-up meeting support					X

Table 2: Adherence to Visual Planning principles: the detailed analysis of Wrike

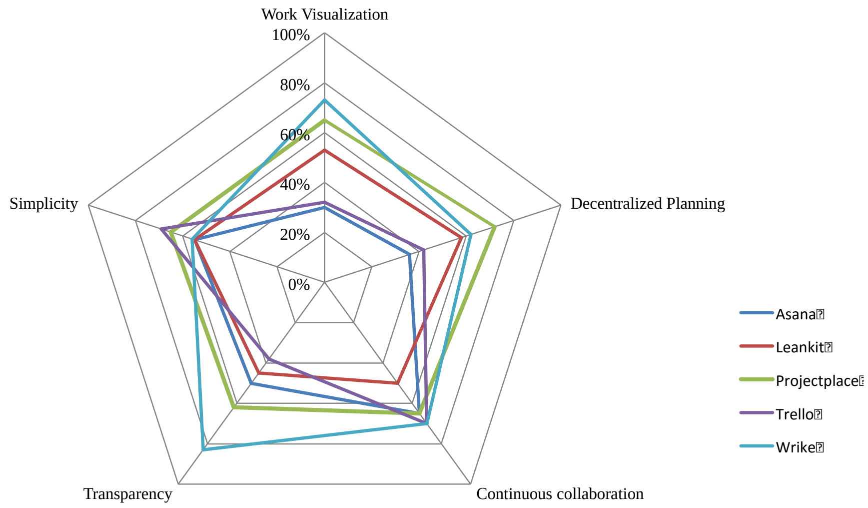
Software features	**Virtual Visual Planning Principles**				
	Work Visualization	*Decentralized Planning*	*Continuous collaboration*	*Transparency*	*Simplicity*
Arrange and group tasks flexibly	5			5	5
Insert Milestone	3	3		3	
Customize the status of a task	5			5	
Connect tasks to people		3	3		
Attach files and documents to a task				5	
Make the duration of the activity not visible		1			
Insert dependencies between tasks	5				
Create subtask		5			
Synthesize personal work in an ad hoc section	5	5			5
Receive notifications of updates			3	3	
Insert comments			3	3	
Mention colleagues in comments			5		
See the Activity Stream	5			5	
Being User Friendly					3
Consult the guide and receive assistance					5
Export and share tasks and projects				3	
Manage user access and permissions				5	
Receive alarm messages (delays)		1			
Customize the board	0				0
Schedule tasks quickly and easily					1
Assign tasks quickly and easily					1
Visual differentiation between tasks (e.g. colors)					1
View old notifications and changes	3			3	
Display tasks in a time-based board	5				
View tasks in a workflow-based board	0				0
Create analysis report		5		5	
Create progress charts	3	3			
Enter the work in progress limit		0			
View user workload		5			
Create Custom Dashboards	5			5	5
Support Stand-up meeting					5
SCORE	**44**	**31**	**14**	**50**	**31**
NORMALIZED SCORE (%)	**73,3%**	**62,0%**	**70,0%**	**83,3%**	**56,4%**

Table 3: Adherence to Visual Planning principles: an assessment of five leading software

Project Management Software	***Work Visualization***	***Decentralized Planning***	***Continuous collaboration***	***Transparency***	***Simplicity***
Asana	30%	36%	65%	50%	55%
Leankit	53%	58%	50%	45%	55%
Projectplace	65%	72%	65%	62%	65%
Trello	32%	42%	70%	38%	69%
Wrike	73%	62%	70%	83%	56%

The data in Table 3 are represented in Figure 1, which highlights the profiles of the five software examined in terms of adherence to the principles of Visual Planning. It is interesting to note that Wrike is positioned better than the other software on three of the five principles.

Figure 1: Comparative profile of software examined.



4. Conclusion

In recent years several new project management software tools have emerged that capture the spirit of the relational perspective, focusing on collaboration and sharing of information and knowledge, rather than activity scheduling algorithms (the heart of the rational project management paradigm).

To structure and guide the choice of a software application to support Visual Planning, we have identified several features which allow distinguishing one software from another; moreover, we have correlated each of these features to one or more of the five principles of Visual Planning. It is crucial to refer to these principles and compare the different software according to them because Virtual Visual Planning should transfer on the web the physical tools of Visual Planning. Therefore, a correlation matrix has been created between the core principles of Visual Planning and the identified features of the software. In this way it is possible to evaluate in a structured way the advantages and criticality of Project management software in simulating the logic of physical Visual Planning. The digitization of Visual Planning offers a number of advantages:

- Transformation of post-its into dynamic cards within which the following can be stored: changes in the status of the activity; "conversations" that have taken place regarding activity execution; relevant documents; the effort required to manage the workload; etc.;
- an opportunity to have, at the same time, multiple ways of viewing the project (time-based; workflow-based; time profile of workloads; personal calendars with deadlines; etc.);
- customized and dynamic dashboards can be created on the status of the project (e.g. the number of "post-its" delayed concerning the planned end date).

At the same time, however, the adoption of IT tools must be carried out with great care: with digitization, the characteristics of physicality, simplicity, interactivity and clarity of physical Visual Planning must be maintained. The proposed assessment methodology is a tool designed to support companies in the process of digitization of Visual Planning that does not deviate from the principles that characterize relational project management.

References

Bertilsson, J., & Wentzel, G. (2015). *Visual Planning: Coordination and Collaboration of Multi-site Teams in Product Development Organisations*. Department of Product and Production Development, Chalmers University of Technology.

Chen, F., Romano, N. C., & Nunamaker, J. F. (2006). A collaborative project management approach and a framework for its supporting systems. *Journal of International Technology and Information Management (JIITM)*, *15*(2), 1-16.

Cobb, C. G. (2011). *Making sense of agile project management: balancing control and agility*. John Wiley & Sons.

De Meyer, A., Loch, C., & Pich, M. T. (2001). *Uncertainty and project management: Beyond the critical path mentality* (pp. 1-23). INSEAD.

Ferreira, M. E., & Tereso, A. P. (2014). Software Tools for Project Management–Focus on Collaborative Management. In *New Perspectives in Information Systems and Technologies, Volume 2* (pp. 73-84). Springer, Cham.

Gingnell, L., Ericsson, E., & Sörqvist, L. (2012). Swedish lean product development implementation. In *ASQ World Conference on Quality and Improvement, Anaheim, CA*.

Highsmith, J. (2009). *Agile project management: creating innovative products*. Pearson education.

Hines, P., Francis, M., & Found, P. (2006). Towards lean product lifecycle management: A framework for new product development. *Journal of Manufacturing Technology Management*, *17*(7), 866-887.

Hoppmann, J., Rebentisch, E., Dombrowski, U., & Zahn, T. (2011). A framework for organizing lean product development. *Engineering Management Journal*, *23*(1), 3-15.

Lenfle, S., & Loch, C. (2010). Lost roots: How project management came to emphasize control over flexibility and novelty. *California Management Review*, *53*(1), 32-55.

Liberatore, M. J., Pollack-Johnson, B., & Smith, C. A. (2001). Project management in construction: Software use and research directions. *Journal of construction engineering and management*, *127*(2), 101-107.

Lindlöf, L. & Söderberg, B. (2011). Pros and cons of lean visual planning: experiences from four product development organisations. *International Journal of Technology Intelligence and Planning*, 7(3), pp.269-279.

Lindlöf, L. & Trygg, L. (2012), Task visualization in product development - improved communication for development teams. *The R&D Management Conference 2012*, May 23-25, Grenoble.

Lindlöf, L., Söderberg, B. and Persson, M. (2013), *"Practices supporting knowledge transfer– an analysis of lean product development"*, International Journal of Computer Integrated Manufacturing, Vol. 26, No. 12, pp. 1128-1135.

Loch, C. H., DeMeyer, A., & Pich, M. (2011). *Managing the unknown: A new approach to managing high uncertainty and risk in projects*. John Wiley & Sons.

Marle, F., & Vidal, L. A. (2016). Limits of Traditional Project Management Approaches When Facing Complexity. In *Managing Complex, High Risk Projects* (pp. 53-74). Springer, London.

Martinic, A., Fertalj, K., & Kalpic, D. (2012). Methodological framework for virtual team project management. *International Journal of Innovation, Management and Technology*, *3*(6), 702-707.

Mascitelli, R. (2011), *Mastering LPD: A practical, event-driven process for maximizing speed, profits and quality*, Technology Perspectives, Northrich.

McMahon, P. E. (2016). *Virtual project management: software solutions for today and the future*. CRC Press.

Ollus, M., Jansson, K., Karvonen, I., Uoti, M., & Riikonen, H. (2011). Supporting collaborative project management. *Production Planning & Control*, *22*(5-6), 538-553.

Radeka, K. (2012). *The mastery of innovation: a field guide to lean product development*. CRC Press, Boca Raton.

Romano, N. C., Chen, F., & Nunamaker, J. F. (2002). Collaborative project management software. In *Proceedings of the 35th Annual Hawaii International Conference on System Sciences* (pp. 233-242). IEEE.

Salameh, H. (2014). What, when, why, and how? A comparison between agile project management and traditional project management methods. *International Journal of Business and Management Review*, *2*(5), 52-74.

Saynisch, M. (2010). Beyond frontiers of traditional project management: An approach to evolutionary, self-organizational principles and the complexity theory—results of the research program. *Project Management Journal*, *41*(2), 21-37.

Schöpf, S. T. (2010). *Trends in Virtual Project Management: Using Web-based Collaboration Tools to Create Additional Value* (Doctoral dissertation, University of Nebraska at Omaha, USA).

Schwaber, K., & Beedle, M. (2002). *Agile software development with Scrum* (Vol. 1). Upper Saddle River: Prentice Hall.

Stenholm, D., Bergsjö, D., & Catic, A. (2016). Digitalization challenges for lean visual planning in distributed product development teams. In *DS 84: Proceedings of the DESIGN 2016 14th International Design Conference* (pp. 1595-1604).

Tanaka, T. (2005). Quickening the pace of new product development. *QV System*, New York.

Ward, A. C., & Sobek II, D. K. (2014). *Lean product and process development*. Lean Enterprise Institute, Boston.

Wysocki, R. K. (2014). *Effective project management: traditional, agile, extreme*. John Wiley & Sons, Hoboken, New Jersey.