ESTIMATION OF SPEED IN DESIGN TEAMS:

Implementation of Agile Tools for Retail & Construction Management

AUTHORS:
HUGO SÁNCHEZ VICENTE
MANUEL SOLER SEVERINO
ALFONSO GARCÍA SANTOS
Universidad Politécnica de Madrid - Spain

Abstract: Duplication of design teams in construction projects in the retail sector generates constant feedback between the client's team and the local engineering team, appearing downtimes associated with the validation of the deliverables by both teams. Any delay in delivery conditions the planned pace of work of production-validation-production. In order not to jeopardize the opening date, production times are adjusted on the fly, which motivates the search of planning tools less rigid than the traditional ones. Adjustment of deadlines involves reducing the quality of the deliverables, given the need to produce with the same resources in less time. As a result, the design deficiencies cause an increase of change orders in later phases. In this article, we propose the implementation of agile metrics to measure the speed of production of the design team and solve the identified deficiencies.

Keywords: Agile; Retail; Project Management; Construction Management; Architecture Teams

1. Executive summary

In construction projects of the retail sector, the brand team usually has its own management team and its own design team, receiving feedback from local engineering teams to adapt the design to the state and sectorial regulations. This constant exchange of information generates interruptions in the workflow of a team, with the appearance of time downs in those intervals in which the project is being reviewed by the other team. The duplication of teams determines the production of the deliverables or increases in sequence following the rate of production-validation-production. Usually, it's the brand team who determines the delivery of these increases.

The problem arises when one of the two teams does not deliver on time and compromises the planned production rate of the following increases. In order not to jeopardize the opening date, production times are adjusted on the fly, which motivates the search for more dynamic and flexible tools due to the impossibility to follow a rigid project planning of the project. Time adjustments involve reducing the quality of the deliverables, given the need to produce with the same resources in less time. This situation causes the appearance of design deficiencies which cause an increase of change orders in later phases and of requirements by sectoral institutions that grant permissions.

We propose as a solution to this problem, the implementation of agile tools to visualize the production speed of the design team IDPT (*Integrated Design Project Team*). The proper use of these tools by the management team PMT (*Project Management Team*) implies the implementation of preventive measures in the planning stage and corrective measures in the phases of design and construction.

First, estimating the speed in the planning phase depending on the required work and the defined deadlines identifies where will take place downtimes associated with the validation of the deliverables by the opposing team. These interruptions of workflow might determine the availability of resources, in order to assign activities to other projects.

Second, measuring the actual speed at later stages allows the comparison with the expected speed and to apply corrective measures to meet deadlines. If the need to reduce production time arises, maintain the planned speed in less time means to adjust the quality of the deliverables to the available resources; it is preferable to increase the speed by including resources from other projects.

DOI NUMBER: 10.19255/JMPM01809

"*Measuring cannot be an end itself*" (Scrum Manager, 2017). Once we have determined the need to measure the speed to reduce change orders and other requirements associated with the lack of definition in the design, we raised the possibility of applying agile tools that measure the speed, since the traditional tools do not allow it. Agile tools are applied as "*metrics for Software Engineering efficiency*" (Nonaka & Takeuchi, 2004) to plan and visualize the work progress. However, they are not applicable to the design teams in the construction sector. Considering this gap, in this paper, we carry out a study to answer the following question:

"Is it possible to apply agile metrics to plan and visualize the work progress on construction projects in the retail sector?"

This study was carried out in four steps. First, we determined the analysis criteria from the literature review and of the identified gap. The second step has been to select case studies, identify variables and perform data collection for later analysis. We have determined the variables from the identified criteria in the state of the art, that is to say, in order to use these tools, three magnitudes that the agile management displays, need to be measured: speed, work and time. Then we obtained data thanks to the questionnaires completed by the project teams.

Third, with the evaluation of the results obtained, we have demonstrated that it is possible to apply agile metrics to plan and visualize the work progress on projects of the sample. Fourth, we have collected the conclusions of the previous study ending with a series of contributions that these metrics consider adapting to the construction sector.

2. Introduction

Construction projects in the retail sector have some peculiarities that differentiate them from other projects: the retro-planning of the schedule, from the opening date until the start of the project, and the duplication of the teams: two management teams and two design teams. Communication flows established between the brand team and the local engineering team are constant. The team of the promoter or owner establishes the design criteria globally, giving details in each location; the local engineering team adapts the design to the local codes. The brand team performs management activities from the outside: supplier selection, air and sea shipments, schedule control and the budget. The management team of the local engineering coordinates the projects to a local level, carrying out more centralized management activities: obtaining permissions and legalization (G.Ruiz-Espiga, Soler S., & Humero M., 2018), design control, coordination of the work and commissioning.

Usually, the brand team establishes the deadlines. In practice, retail projects are planned by expanding the structure from the end to the beginning. That is to say, the project is planned for successor activities and not by predecessor activities. The teams' duplication and the feedback that is established between both teams results in the production of deliverables or increases sequentially (Schwaber, 1997), and interruptions of workflow on each team, with the appearance of down times in the phases in which the project is being validated by the brand team or the local engineering team.

Duplication of teams hinders the compliance with the initial schedule. Any delay in the delivery of an increase by one of the teams involved means to change the successive production schedules. With the aim not to change the delivery dates, design teams produce in less time with the same resources. The deliverables do not meet the required quality and the number of orders changes in subsequent stages increases, because of design deficiencies.

On the one hand, the traditional tools display the status of activities on a time scale; on the other hand, the agile tools measure the speed of execution of activities. In order to reduce change orders and rectifications to the requirements due to design deficiencies, we raised the possibility of using agile tools that measure speed from the estimate of the necessary work and the required production time (Kniberg & Skarin, 2009).

Measure the speed is a preventive measure in the planning phase. Considering the speed as the amount of work that is done per time unit, we can identify those stages where the working increase is zero, and this way to determine the duration of the down times. It also allows seeing the production of those increases that require more effort, and therefore, a greater number of resources.

Measuring the speed is a corrective measure in the design and construction phases. When viewing the actual speed of the team we can identify possible deviations and act accordingly to avoid compromising deadlines. Measure the speed from the start helps to produce on schedule within the available resources and avoids having to reduce the effort required in the production and compromise the quality of the deliverables.

We aim to complement the limited existing literature on the implementation of agile metrics in the construction sector. We seek to contribute to the literature of project management by providing a study that determines the possibility of adaptation of agile metrics to be implemented by the PMT, Project Management Team, at work planning of the IDPT, Integrated Design Project Team. For this purpose, we propose the following question as a starting point:

"Is it possible to apply agile metrics to plan and visualize the work progress on construction projects in the retail sector?"

The article continues with the most relevant literature review (3) and introducing the analysis criteria from the identified gap. This section is followed by the methodology (4), where we expose how we have selected the study sample and which variables we have taken into account for the data collection. Next, we present the results of the analysis (5), and we evaluate (6) them in the corresponding section to the discussion of the results obtained. The article ends with the research contributions (7) and conclusions, and we answer the starting question.

3. Literature review

This section introduces the most important contributions to this research, found in the literature of the tools used in the work display. Then we discuss the traditional visualization tools and the deficiencies that they present, as well as the most used agile metrics to measure the speed in software projects and the IT sector, which will help us to identify the study gap and determine the analysis criteria.

Henry L. Gantt (1861-1919) continues the research begun by Frederic Taylor (1856-1915) about how to improve the productivity following the premise that a project is not a monolithic task but a set of interrelated activities. For this, he developed the Gantt chart (Gantt, 1974) in the company Frankford Arsenal for the building of warships for World War I, dividing projects into smaller units ("tasks") and estimating their duration. The Gantt chart "*represents the activities of a project on a horizontal bar arranged on a calendar or timeline*" (McDaniel, 2001).

Based on the Graph Theory (Dressler, 1980), network diagrams are developed in the 50s, after World War II, as a tool for analysis, planning, and representation of a project; it defines the critical path as "*the path through the network of activities that has a longer duration than any other path*" (Thayer, 1997). In 1956, the president of IEE (Institute of Electrical Engineers), ES Slagle, published an editorial that addresses the need for planning to use probability distributions (Slagle, 1956). Two years later the US Navy published the PERT (Program Evaluation and Review Technique) in order to develop the Polaris weapons program (Mc Daniel, 2001). PERT is an analysis tool to optimize the schedule from estimates of time per task, based on the Graph Theory, when the time is the main objective of the project. At the same time J.E. Kelly and M.R. Walter develop the CPM model (Critical Path Method) in order to display the time and the costs, continuing the research line of graphs to get the critical path.

In 1962, Carl Adam Petri presents a model of systems information flow, Petri nets (Petri, 1962) (Greene, 1965), used in non-complex or lengthy modeling processes. The IDEFØ model (Integration DEFinition for Function Modelling) combines the graphical representation of functions and explanatory text for the modeling of decisions, actions, and activities of an organization or system (KBSI, 1994). It is part of a system of methods for the designing and modeling of software and models the analysis functions and the communications of a system using SADT, Structured Analysis and Design Technique (Marca & C.L., 2005). This method allows structuring the information in an orderly manner (Hanrahan, 1995). Functions (activities, processes, actions or operations) of the system are graphically represented so that the inputs give place to the outputs using the corresponding tools and the control mechanisms.

The literature review has identified traditional tools used in the visualization of the structure and determines the incompatibility of traditional tools and techniques that shape the information to fit the visualization (Ruiz Bertol, 2011). After reviewing the existing literature on traditional tools, we complete this section with the review of agile metrics used to plan and visualize the progress of the projects.
The Product Backlog of Scrum "*is never completed; it is in continuous growth and evolution*". As opposed to project plans, the agile development "*prefers verbal or direct way to writing communication*" (Scrum Manager, 2017). It visualizes owner requirements or "*user stories*", estimated effort, and the responsible person of the story.
The product chart or "*burn-up*" is a planning tool "*that visually displays the foreseeable evolution of the product. Project in time the construction, based on the speed of the work team*" (Scrum Manager, 2017). The estimated effort is represented on the vertical axis "Y", and the time (sprints) on the horizontal axis "X". The progress chart or "*burn-down*" is used to visualize the pace of progress of work, to determine whether the expected date of delivery is compromised. As for the measurement criterion, "*it does not determine the degree of progress of the project for the work done, but for the pending*" (Scrum Manager, 2017).
The contributions identified in the literature have found that traditional tools do not meet the visualization needs of the projects that are developed in unstable environments (Serrador & Pinto, 2015). Many studies show the success of the implementation of agile methods in projects regarding software development and the IT sector (Ohno, 1988); however, it has not been possible to find references that determine which tools that measure the speed are applied to construction projects that are developed in unstable environments, circumstance that has allowed to identify the gap that has led to this research.

4. Methodology

In this section, we explain the methodology used to show that agile metrics can be applied to plan and visualize the work progress on construction projects in the retail sector. First, we present the criteria used in the ***sample selection*** of the study and ***we determine the variables*** we have used to analyse the structure of the projects.

4.1. *Sample selection.*

To select the sample of the projects we have considered the following criteria: the projects have to be developed by a company that implements project management tools and techniques; the considered sample must be rigorous and representative of the retail sector. We contacted AEDIP, Spanish association of project management, to find the most representative segment and obtain a sample that belongs to the professional sector of projects of "*Retail & Construction Management*". We chose a certified organization in the ISO 21500 Standard regarding project management, whose invoice is included in the provision of services as local engineering in the retail sector. 105 projects were selected, and questionnaires were conducted by asking a series of questions to the teams that developed the projects that make up this sample.

4.2. *Determination of the variables to analyse the structure visualization: Planning and work progress.*

To analyse the visualization of the structure of the projects, and to evaluate if agile metrics can be applied or not, of the reviewing of the existing literature, we have obtained the following criteria to determine the analysis variables:

- User stories are broken down into tasks.
- The expected speed can be visualized in the production of the increases, depending on the effort and time for both work planning (burn-up chart) and the progress of work (burn-down chart).
- The criterion measure of the work is different from the traditional one: the agile metrics measure the outstanding effort, not the effort made.

The variables have enabled us to know what activities make up the processes, how much work has been required for its execution, and which has been the measurement criteria used.
To employ agile metrics, it is necessary to measure the speed; and to measure the speed, work in a time interval must be quantified. Previously, it has been necessary to identify the activities that make up the processes. Finally, it has been necessary to determine whether the measurement criterion used by the teams is the same as that used by the agile models, that is, "*pending work*" instead of "*done work*."

We have determined the three variables that have allowed us to know if it is possible to use these tools: the variable "*activities*" which contains the values for the activities that have been implemented in each process; the variable "*work*" which contains the quantitative values corresponding to the effort (hours of work), which involves implementing each activity obtained with the previous variable; and the variable "*measurement criteria*" which has allowed us to determine whether teams measure the work done or the pending work, as well as the tools that the teams have used to plan and monitor the projects.
Given these variables, to split work up, define the complexity in the implementation of tasks and determine the measurement criteria, we have asked a number of questions to the team members of the organization: PMT, Project Management Team, and IDPT, Integrated Design Project Team. Next, we explain how we have carried out the data gathering, and we show the analysis of the obtained data.

5. Data analysis and results

For the data collection, we have developed a series of questionnaires considering the variables identified in the previous section. The answers to these questionnaires by the organization are the data for this study. The analysis of the structure has allowed evaluating "*if it is possible to plan and visualize the progress of work using agile metrics*".
Agile tools split user stories up into tasks and measure the team speed regarding the production of the increases with the measurement criterion of pending work. First, we have split processes up into tasks to identify activities. Then we obtained the data to determine whether it is possible to quantify the work and to visualize the planned speed in the production of the increases. Finally, we have obtained the necessary data to determine whether the measurement criterion has been the pending work, not the work done.

5.1. *Analysis to determine the activities.*

We have identified the deliverables that have been requested in the 105 projects that make up the study sample, and we have selected those that are common to all projects. As a result, we have obtained a pattern of 89 deliverables, internal and external to the organization. These deliverables are equivalent to the "user stories" in the software development, and each deliverable represents a progress in the project. External deliverables are those that are delivered to external teams, such as the brand team. Internal deliverables are produced by and for the internal teams of the organization and constitute 37% of the total.
From this list of deliverables, local engineering resources have identified the activities to produce the requested deliverables. Thus, the Project Management Team (PMT) and the Integrated Design Project Team (IDPT) have split the deliverables or user stories into activities.
From the total number of deliverables, 4 have meant a closure phase. These deliverables are the increases produced in the 4 iterations of the construction project in the retail sector. In the production of these increases, other internal and external deliverables are associated, which are inputs or outputs in the production flow. **Figure 1** represents the production of the increases and the feedback generated due to the duplication of the teams: the owner project team and the local engineering team. Below, we discuss the processes associated with the production of the 4 deliverables involving 4 iterative increments, with the data obtained from the analysis of the 105 local engineering projects.

- Survey. It is the increase that determines the viability of the project. It is an external deliverable, requested by the sponsor team. The input is the implementation itself, formalized through a custom form or request for service delivery. The PMT assigns activities to the IDPT responsible for producing the required deliverable. The output is the survey increased. It contains all the information necessary so that the sponsor team conducts the layout.
- Layout reviewed. It is the increase that validates the layout of the brand team and verifies that meets the standards of local regulations. The input is the deliverable layout for approval of the brand team. The output is the layout reviewed. It contains all the information needed so that the brand team designs the detail drawings.
- Construction set. It corresponds to the technical project and includes all the necessary information to get permissions of external agents (Owner, Landlord, City Hall... etc) to begin the work. The input is the detail drawings of the brand team. The output is the construction set. It also contains all the information necessary so that the brand team assigns the work to the construction company with the tender documentation.
- As-built and commissioning. It is the increase that ends the brand request and includes all the necessary documentation for the implementation of the asset. The input is the tender documentation for the construction company. The management team (PMT) assigns the activities to the design team (IDPT) responsible for producing the required deliverable. The output is the project as-built.

The data obtained have allowed, therefore, to identify process flows from the requested deliverables, and split processes into the activities carried out by the local engineering team.

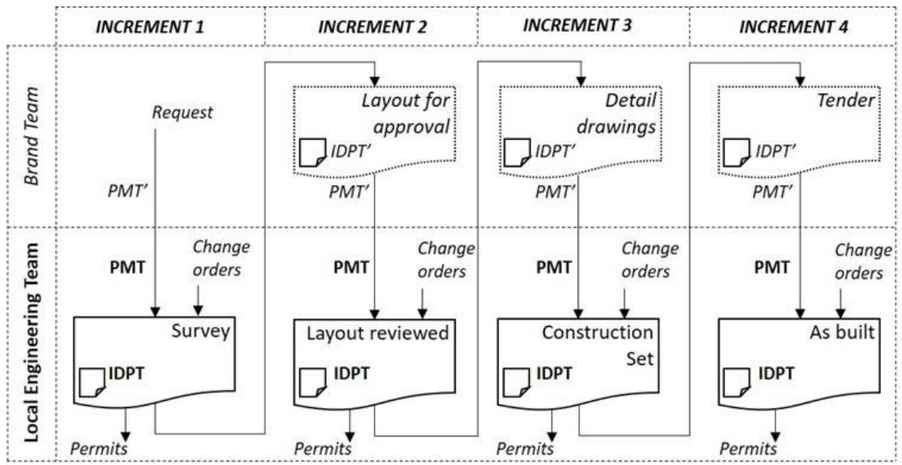


FIGURE 1. Duplication of Project Management Teams (PMT) and Integrated Design Project Teams (IDPT), in projects of the Retail & Construction Management sector.

5.2. *Analysis to determine the work.*

Having identified the activities that make up the processes associated with the production of the 89 deliverables, we have determined the necessary work that the implementation of each activity entails. The data obtained have allowed knowing in which activities work can be measured and which activities it is not possible.
The obtained data show that it has been possible to measure the work done by the design team (IDPT). Instead, it has not been possible to measure the work done by the management team (PMT). Next, we analyse the work associated with the activities that make up the inputs and outputs of the production flow of the design team (IDPT) of the local engineering, represented by arrows in **Figure 1**. As it can be seen, the inputs and outputs are concurrent, that is to say, repeated in the 4 iterations of the project.

First, we analyse the inputs of the production flow of the design team (IDPT) of the local engineering:

- Assignment of activities. It is an input of the workflow of the design team (IDPT), where the necessary activities are assigned to produce the 4 increases. The work done by the management team (PMT) to award the activities to the design team is not quantifiable. They are management activities related to the preparation of the list of tasks that make up the work breakdown structure (Department of Defense, 2005), and the allocation of unplanned activities that require immediate implementation.
- Change orders. It is an input of the workflow of the design team (IDPT) representing changes in the BIM model or prototype. Activities associated with the change orders are not quantifiable and are related to the acceptance, control and registration of change orders by the management team (PMT).

Secondly, we analyse the outputs of the flow production of the design team (IDPT) of the local engineering:

- Request for information or permits. They are outputs of the design production flow. The work done by the design team (IDPT) to produce the subprojects is quantifiable. They are those activities necessary to prepare the deliverables presented in the institutions to obtain permits or documents necessary to request information.
- Deliverables production. They constitute outputs of the workflow of the design team. They correspond with the production of the 4 increases requested by the brand team. The activities carried out by the design team (IDPT) are quantifiable. Each increase represents a closure phase in the project and corresponds to the different versions of the BIM model or prototype. In the construction phase, besides finishing the version of the as-built prototype, the design team (IDPT) carries out activities related to the monitoring of the work, generating the corresponding deliverables of the construction process, such as the document verifying readiness for construction, work reports or certifications.

5.3. *Analysis to determine the tools used by the teams and the measurement criterion:*

Data collection has allowed knowing whether tools for planning and monitoring the project have been used; and, if so, whether these tools consider the needed work to implement the activities and the planned speed. With the data obtained, we have determined whether the measurement criterion is the "*work done*" or the "*pending work*". As set forth below, the data vary according to the project team.

- The resources that make up the organization of the projects have not used tools for planning and monitoring that visualize the work or the speed in the production of deliverables.
- Although the speed is not visualized, the resources playing a role within the management team (PMT) have used the Gantt chart as a tool for planning and monitoring of the projects.
- The resources that have played a role within the design team (IDPT) have measured the work done, in order to compute hours of work to each project, without adding value to the result.
- The resources that have performed functions within the management team (PMT) have measured the pending work and they have planned projects according to successor activities rather than predecessors, i.e., from the opening date until the start of the project.

Therefore, the measurement criterion used by the management team (PMT) is the same as the measurement criterion of the agile metrics: the pending effort. However, the resources have not used tools to visualize work or speed and have used the Gantt chart to plan the duration of deadlines for successor activities rather than predecessors.

6. Discussion

The evaluation of the results has allowed determining that "it is possible to plan and visualize the work progress using agile metrics" for activities that are assigned to the design team (IDPT). However, it is not possible to apply these tools to measure the work done by the management team (PMT). Nevertheless, the evaluation of the results has determined that the management team (PMT) can make use of agile tools to plan and visualize the work progress of the design team (IDPT). Below, we discuss the results obtained.

-Duplication of teams in retail projects
We have identified the duplication of teams on construction projects in the retail sector: the brand team and the local engineering team, both with their management teams (PMT) and design teams (IDPT). This situation causes the appearance of down times in those time intervals in which one of the two teams is producing and validating the deliverables. We have determined, therefore, that the production increases, instead of being free, is sequential (Scrum Manager, 2017).

- Iterative incremental development and concurrency of processes: breakdown structure or product backlog.
We have transferred the data into a visual representation that facilitates the interpretation of the results. Figure 1 shows the processes in which the Integrated Design Project Team (IDPT) is involved in an input or an output of a process; they are the only processes that contain activities whose efforts can be measured, and they are the ones that interest us to define the project breakdown structure (traditional terminology) or product backlog (agile terminology).

-The inputs represent interruptions in the workflow of the design team: allocation of activities and change orders.
We have identified those activities in which it has not been possible to quantify the work. These activities are those performed by the management team (PMT). Some management process flows are inputs in the design production flow: the allocation processes of activities and change orders. The inputs are interruptions in the flow of design production. On the one

hand, we identified the allocation of "unexpected" activities whose implementation is a priority and the allocation of activities of other projects coming into the production flow to be planned. On the other hand, we identified change orders involving changes in the design.

-The outputs allow quantifying the work done by the design team: subprojects production and increases production. Process flows that are outputs of the design production flow are those associated with the collection of permits and the production of the deliverables that represent an increase in the project. The increases closing iterations are the survey, the layout, the construction set, as-built and commissioning. It is possible to quantify the needed work to produce the 4 increases.

-Retro-planning of successor activities and use of traditional management tools. The resources of the organization involved in the processes associated to the project management plan the production increases from the end to the beginning, according to the duration of successor activities rather than predecessors and depending on the opening date set by the brand team. They rely on the Gantt chart to plan the production of the increases and define the measurement criterion of the work as the pending effort. However, they do not use tools to visualize the work required or the estimated speed of the design team (IDPT), resulting in the overallocation of resources in the multi-project team, or no workload on other resources (Poppendieck & Poppendieck, 2003).
The answers of the teams have allowed determining that the organization has not used planning tools in which the expected speed is indicated, or the necessary work is estimated on effort points or hours. However, the resources that belong to the management team have used the Gantt chart in the planning phase of the project.

Second, the answers of the teams have allowed determining that the organization has neither used tools to visualize the actual speed in the implementation of tasks or the effort measured on points or working hours as a means to identify whether the scheduled dates to produce the increases are compromised. However, the resources of the management team have also used the Gantt chart as a reference or baseline as well as updates to show the actual status of the project and have defined the criterion for measuring work as "pending effort" planning the project as a sequence successor's phases, i.e., disaggregating the structure from the end to the beginning, according to the opening date set by the brand team, and determining whether the scheduled dates for the production of the deliverables have been compromised. Instead, the resources that have played a role within the design team (IDPT) have measured the work done, in order to compute hours of work to each project, without adding any value to the result.

- The possibility of using agile metrics.
The evaluation of the results has allowed knowing that the agile metrics can be applied to visualize the estimated speed and the actual speed from work and runtime of the activities of the Integrated Design Project Team (IDPT).
In the next section, we present the implementation of the product chart or "burn-up" and the "burn-down" chart by the Project Management Team (PMT), to estimate the speed and measure of the pending work by the design team. These tools allow displaying the availability of resources and the work required in the execution of each increase. They make possible to distribute work efficiently and produce within the timeline with the available resources without compromising the quality of the deliverables.

7. Contribution and conclusion

We have determined the structure of the projects with the processes involved in the production of the deliverables. These processes are split into activities associated with the production design or project management. The effort associated to the activities of design production can be quantified. However, it is not possible to estimate the work associated with the management activities.
Once work values are known, it is possible to estimate the speed necessary for the implementation and comply with the deadlines set by the brand team. We have identified two flows of management processes that imply interruptions in the design workflow: the assignation of tasks and the change orders. First, when developing several projects simultaneously, the assignation of tasks is constant, and it interrupts the production. Second, the acquisition of information is incremental (Notkin & Grisworld, 1988), due to the changing owner requirements and the deficiencies in the design, assuming interruptions in the workflow.

As mentioned, the concept of measurement is different from that used by traditional metrics: "*The agile management does not determine the degree of progress of the project by the work done, but by the pending work*". In addition to answering the initial question, in this section, we determine the contributions of the study, by applying agile graphs to estimate the speed and measure the work progress.
As mentioned, a feature of these projects is the duplication of the teams. To demonstrate that it is possible to implement the agile tools on both the brand team and the local engineering team, we have validated both proposals in the owner's design team.

7.1. Application of burn-up and burn-down charts to plan and visualize the progress of work of the design teams (IDPT)

The first contribution has been to apply the burn-up chart in order to estimate the speed of the design team and, depending on it, determine the date of delivery of successive increases. It also offers the possibility of determining deadlines and get the speed required based on the estimation of work. Table 1 shows the product backlog, commonly used in software development, adapted to a construction project in the retail sector. To avoid prejudicing the opening date, user stories appear in sequence from the end to the beginning, according to the successor stories. The project manager estimates the work hours or effort points for each increase produced by the design team. With the obtained values, it determines how many resources are needed to produce the deliverables. As shown in **Table 1**, the design team (IPDT) has to produce the layout in one week. 80 effort points of are estimated for its production, so two team resources are needed.

CH CAROLINA HERRERA - THE GARDENS - PALM BEACH - FLORIDA								
PRODUCT BACKLOG			**PLANNING**			**EFFORT**		
TEAMS	**USER STORY**	**W.**	**SCHEDULE**	**DELIVERY**	**W.**	**E.**	**C.E.**	**R.**
PMT/IDPT -CH	Construction + Inspections	11	Hand over (As built)	**19/04/2019**	33	16	248	**1**
PMT/IDPT -CH	Demolition	1	Asset after demolition	01/02/2019	22	32	232	**1**
Local ENG	Pre-start construction	1	Construction Start	25/01/2019	21	0	200	-
City Hall	Permits	6	Permits obtained	18/01/2019	20	0	200	-
Local ENG	Project - changes	1	Permits application	07/12/2018	14	0	200	-
Land Lord	Landlord review	1	LL comments	30/11/2018	13	0	200	-
IDPT - CH	Project - changes	1	LL project reception	23/11/2018	12	0	200	-
Owner	Owner review	1	Owner pr. reception	16/11/2018	11	0	200	-
Local ENG	Construction Set Production	3	Construction Set	09/11/2018	10	0	200	-
IDPT - CH	**Detail drawings Production**	**2**	**Detail drawings**	**19/10/2018**	**7**	**120**	**200**	**2**
Local ENG	Layout review Production	1	Layout reviewed	05/10/2018	5	0	80	-
IDPT - CH	**Layout Production**	**1**	**Layout for approval**	**28/09/2018**	**4**	**80**	**80**	**2**
Local ENG	Survey Production	1	Survey	21/09/2018	3	0	0	-
PMT - CH	PM Review and acceptance	2	Info and doc review	14/09/2018	2	0	0	-
EXP - CH	New project notification	0	Project Charter	31/08/2018	0	0	0	-
	Container CT.3	3	Reception CT.3	**05/04/2019**	**31**	-	-	-
	Shipping	5	Customs	08/02/2019	23	-	-	-
PMT - CH	Material production MAT.3	2	Request MAT.3	**25/01/2019**	**21**	-	-	-
	Container CT.2	1	Reception CT.2	**08/03/2019**	**27**	-	-	-
	Shipping	5	Customs	25/01/2019	21	-	-	-
PMT - CH	Material production MAT.2	4	Request MAT.2	**28/12/2018**	**17**	-	-	-
	Container CT.1	1	Reception CT.1	**22/02/2019**	**25**	-	-	-
	Shipping	5	Customs	11/01/2019	19	-	-	-
PMT - CH	Material production MAT.1	5	Request MAT.1	**07/12/2018**	**14**	-	-	-

W. = Weeks / **E.** = Effort / **C.E** = Cumulative Effort / **R.** = Resources needed (IDPT).

INTERNAL TEAMS. **PMT** / **IDPT** / **EXP** - CH = Project Management Team / Integrated Design Project Team / Expansion Department - Carolina Herrera Team.

EXTERNAL TEAM: **Local ENG** = Local Engineering Team.

Table 1. Implementation of the product backlog in projects of the Retail & Construction Management sector.

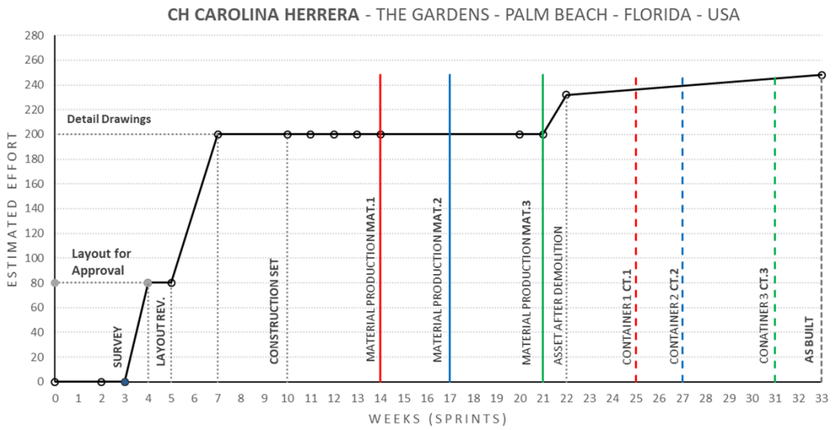


Chart 1. Application of the "burn-up" planning chart in projects of the Retail & Construction Management sector.

As shown in the burn-up chart, it is possible to avoid down times in the design production flow. In those time intervals in which the increase of the work is zero, the allocated resources have no workload, so they can perform activities of other projects that are being developed by the team.
Therefore, besides being a planning tool, the burn-up chart is an *availability indicator* in
construction projects in the retail sector, where there is the duplication of multi-project teams.
In **Chart 1** we determine the deliverables requested by the brand team within a timeline, defining an iterative incremental development: "*Using time-stamping techniques or timeboxing to maintain the production of product increments in a cyclic and continuous way*
" (Scrum Manager, 2017).
The duplication of the teams leads to the appearance of down times when no work is performed since the team is waiting to receive the feedback from the external teams.
The quality of the deliverables is usually a high-level requirement and determines the average speed of the team. When there are no support resources available, and we want to meet the scheduled speed without compromising the quality of the deliverables, there is no other alternative but to extend the production time. It is essential to be critical with each project, and with the level of detail (LOD) or the quality of the deliverables, because sometimes the quality excess does not bring value to the result and compromises the delivery date.
The second contribution is the adaptation of the burn-down chart, as a monitoring and control tool, which displays the pending work as the time scale moves forward, showing the remaining weeks until the opening date. In construction projects in the retail sector, usually located in urban centers and shopping centers in operation, collecting material is complicated. Shipments of containers require thorough planning. The construction process involves a restriction on air and sea shipments of material, so these must be performed once concretized the start and end dates of the construction phase. For this reason, the graph of the actual progress of the project or burn-down chart, is ideal for viewing, in addition to the actual speed of the design team, the dates of receipt of containers. And, based on these dates, the minimum deadlines for manufacturing and deadlines for shipping the goods. As shown in **Table 1** and **Chart 1**, the product backlog and the burn-up tool can also include in the project planning, the deadlines of the material manufacturing and the unloading of containers.
A peculiarity of agile metrics is the concept of measurement, "*how much effort is pending*
", rather than "*how much effort I've made.*
"
The main goal in the projects analysed is the deadline and the corresponding speed in the implementation of activities. In traditional project management, however, it is planned from the start to the end and the work done is measured.
Secondly, most of the effort required by the design team is related to the early stages. In such projects, less time is spent in the construction phase than in the planning phase as well as the detailed definition of the product. For the construction phase may be appropriate to employ traditional display systems, such as bar charts or the Gantt chart. For the early stages, it is necessary to visualize possible deviations from the planned effort for the activities using agile tools.

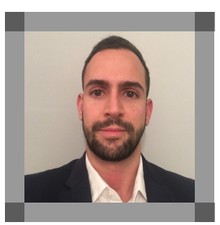
7.2. Future development

Due to the size of retail projects, with tighter deadlines than other projects in the construction sector, the teams develop several projects simultaneously (Petit, 2012), a fact which causes the overallocation of resources (Terlizzi, Albertin, & Cesar de Moraes, 2016.). The continued allocation of activities of several projects to different team members interrupts the production flow of a specific project. The simultaneity of projects may result in the accumulation of activities in the same resource, unable to perform the design properly.
The planning chart (burn-up) and the progress chart (burn-down) plan and visualize the progress of work for a single project. We propose as a future research, the possibility of applying agile tools to visualize simultaneously the status of various projects and the workload of resources, to assign activities depending on availability.

8. References

Department of Defense. (2005). Department of Defense Handbook. Work Breakdown Structures for Defense Material Items. United States of America.
Dressler, J. (1980). Construction Mangement in West Germany. Journal of Construction Division, , 106(4), 477-487.
G.Ruiz-Espiga, A., Soler S., M., & Humero M., A. (2018). Incidence in Licensing Management Activities in Building Project Life Cycle: a Strategic Matter of Knowledge. Journal of Modern Project Management, 6(1).
Gantt, H. (1974). Work, Wages and Profit. . Easton, Pennsylvania: Hive Publishing Company.
Greene, C. (1965). Communication with automata. Technical Report RADC-TR-65-377. Translation of thesis "Kommunikation mit automaten". Rome Air Development **Center, Griffiss Air Force Base, 1965. .**
Hanrahan, R. (1995). The idef process modelling methodology. Crosstalk: The Journal of Defense Software Engineering, 8(6), 19-23.
KBSI. (1994). Information integration for concurrent engineering(IICE): IDEF5 method report. Technical report, Knowledge Based Systems, Inc. Technical report, Knowledge Based Systems, Inc.
Kniberg, H., & Skarin, M. (2009). Kanban and Scrum, making the most of both. InfoQ books.
Marca, D., & C.L., M. (2005). IDEFO and SADT: A Modeller's Guide. . OpenProcess, Inc.
Mc Daniel, N. (2001). Scheduling Guide for Program Managers. Defense Systems Management College Press.
McDaniel, N. (2001). Scheduling Guide for Program Managers. Fort Belvoir: Defense Systems Management College Press.
Nonaka, I., & Takeuchi, I. (2004). Hitotsubashi on Knowledge Management. Singapore: John Wiley.
Notkin, D., & Grisworld, W. (1988). Extension and software development. En I. C. Press (Ed.), Proceedings of the 10th International Conference on Software Engineering., 2176, págs. 274-283. doi:10.1109/ICSE.1988.93708
Ohno, T. (1988). The Toyota Production System: Beyond Large-scale Production. London: Productivity Press.
Petit, Y. (2012). Project portfolios in dynamic environments: Organizing for uncertainty. Int. J. Proj. Manag., 30, 539–553. doi:10.1016/j.ijproman.2011.11.007
Petri, C. (1962). Kommunikation mit automaten. PhD thesis, Schriften des IIM, Heft 2, Institut für Instrumentelle Mathematik, an der Universität Bonn.
Poppendieck, M., & Poppendieck, T. (2003). Lean Software Development: An Agile Toolkit for Software Development Managers. Crawfordsville, Indiana: Addison Wesley.
Ruiz Bertol, F. (2011). Técnicas Conceptuales en la Gestión de Proyectos Software. Universidad del País Vasco.
Schwaber, K. (1997). Scrum Development Process. OOPSLA Business Object Design and Implementation Workshop. Springer London, 117-134. doi:10.1007/978-1-4471-0947-1_11
Scrum Manager. (2017). Scrum Manager Professional Community Core I: Scrum Master. Versión 2.6. Zaragoza: Lubaris Info 4 Media.
Serrador, P., & Pinto, J. (2015). Does Agile work? – A quantitative analysis of agile Project success. Int. J. Proj. Manag.(33), 1040–1051. doi:10.1016/j.ijproman.2015.01.006
Slagle, E. (1956). Prestige and progress report. The Journal of Industrial Engineering, 7(1).
Terlizzi, M., Albertin, A., & Cesar de Moraes, H. O. (2016.). Barriers to the use of an IT Project Management Methodology in a large financial institution. Int. J. Proj. Manag., 34, 467–479. doi:10.1016/j.ijproman.2015.12.005
Thayer, R. (1997). Software Engineering Project Management (2 ed.). IEEE Computer Society.

AUTHORS



HUGO SÁNCHEZ VICENTE

Received his Architect degree from Escuela Superior de Arquitectura de Madrid (ETSAM) Spain, where he is collaborate professor at Master in Project & Construction Management (MeDIP). He is PhD Candidate by the Universidad Politécnica de Madrid (UPM), Spain. His professional career has been focused on construction projects in the retail sector.

MANUEL SOLER SEVERINO

Received his Architect degree from Escuela Superior de Arquitectura de Madrid (ETSAM) SPAIN, and his PhD degree from the Universidad Politecnica de Madrid (UPM), Spain, where he is currently the Director of Master in Project & Construction Management (MeDIP). He is a senior lecturer (associate professor) in Architectural Management.

ALFONSO GARCÍA SANTOS

Received his Architect degree from Escuela Superior de Arquitectura de Madrid (ETSAM), and his PhD degree from the Universidad Politécnica de Madrid (UPM), Spain, where he is Full Professor in Construction and Architectural Technologies. He is author of a multitude of books, publications and research works related to Construction materials.

"The first contribution has been to apply the burn-up chart in order to estimate the speed of the design team and, depending on it, determine the date of delivery of successive increases."

"The second contribution is the adaptation of the burn-down chart, as a monitoring and control tool, which displays the pending work as the time scale moves forward, showing the remaining weeks until the opening date."