International Association for Management of Technology
IAMOT 2014 Proceedings

GLOBAL PROJECT MANAGEMENT USING DIGITAL PULSE METHODOLOGY

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Globalization is constantly increasing; companies are opening offices in different countries and having international partners. The ability of managing global projects is becoming an indispensable part of the companies' competency portfolio in order to survive in the fierce competition. This research aims to provide an efficient and lean methodology for companies that want to be efficient at managing global projects. This paper contributes to the project management literature by expanding the knowledge on pulse methodology with a new methodology called digital pulse methodology, which helps companies to manage their global projects. Pulse methodology is a well-known and widely used methodology in Sweden for managing deviations in product development. Companies appreciate its simplicity and its lean tools. However, previous studies show that it is not efficient in global projects and there are a number of requirements it must fulfill in order to do so. We developed digital pulse methodology as an expansion on baseline pulse methodology aiming to improve the appreciated methodology towards making it fulfill the given requirements, thus help companies to manage deviations in global projects. We tested the new methodology by making the case company use it over a three months period. We gathered the results of the requirement tests along with the other benefits of the methodology using observations and interviews.

Keywords: Lean; Deviation management; Visual management; Digitalization.

1. Introduction

Pulse is a lean deviation management methodology introduced by Scania in 2003. It is widely used in product development in Sweden. It is based on two main concepts:

(i) Identifying deviations with traffic-coded magnets on whiteboards as boundary objects
(ii) Synchronizing organizations and managing deviations with short frequent meetings as integrative events

Boundary objects are artifacts that enable knowledge sharing between knowledge boundaries in companies (Bechky, 2003). Integrative events are defined as "meetings where all current deviations are openly discussed, mitigated, and the work comprehensively coordinated, verified for consistency with value proposition" (Oppenheim, 2004). The methodology names these whiteboards as pulse boards (Figure 1), and names these meetings as pulse meetings. In pulse methodology, pulse boards can be considered as brief status reports of projects of different divisions (e.g., groups, departments, lines etc.). Using this artifact, knowledge boundaries (divisions) can get information about the other knowledge boundaries. Pulse meetings are short (10-30 minutes) and frequent (e.g., daily, weekly, biweekly) meetings where attendees briefly share their current deviations. The goal of pulse meetings is not to solve these deviations, but if it is possible the attendees can do so. If they cannot, which is the case for most of the deviations, they arrange a separate meeting at the pulse meeting with the stakeholders of the deviation to further discuss and solve it.

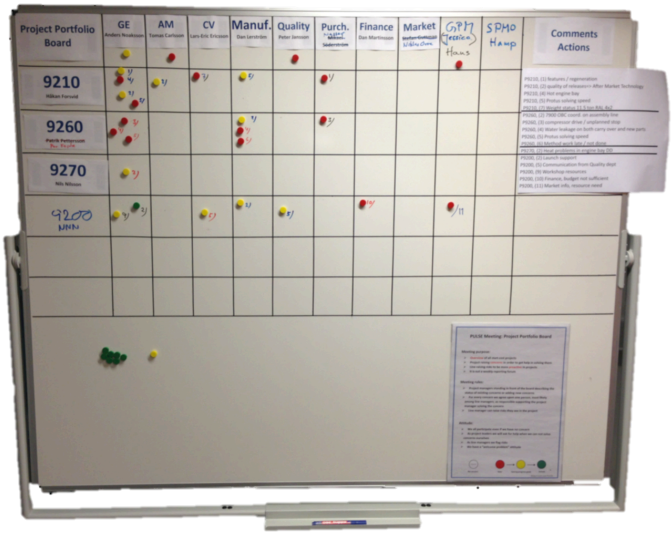

Figure 1. Pulse board

The case company is a Swedish product development company having 8000 employees worldwide. They started using Pulse methodology at their headquarters for their local projects in the second half of 2012. Since then, they have been convinced that the methodology brings value to them. Some of the benefits that the methodology brought to the company are as follows: better synchronization, decreasing the number of meetings, reducing time spent for meetings, increasing transparency, increasing visualization, and providing optimum workload distribution (Kaya *et al.*, 2014b). Being satisfied by pulse methodology at the local projects, the company wants to start using it for their global projects as well.

This research aims at helping the case company towards making them start using pulse methodology for managing their global projects. Previous research shows that a company, which uses pulse methodology with physical pulse boards, needs to do the following improvements on the pulse methodology tools in order to use the methodology for global projects: provide remote access, solve the space limitation problem, and automate the routines (Kaya *et al.*, 2014b). Accordingly, in this paper we introduce digital pulse methodology (DPM) together with its tools and processes. We hypothesize that DPM, unlike baseline pulse methodology (BPM), facilitates management of global projects. We tested our hypothesis at the company premises for three months by testing DPM against the improvement points given by Kaya et al.

The structure of the paper is as follows. The introduction chapter continues with giving information about the methodologies similar to DPM. The following chapter describes how the research was carried out. The third chapter is the results chapter, where we present the case company, how they work, DPM, and test the results of DPM against the given requirements. This chapter is followed by the discussion chapter. The discussion chapter discusses the technology acceptance, DPM's affect on sustainability, a possible sub-optimization that DPM processes can lead to, and validity of the results. The paper finishes with the conclusion chapter.

1.1 Similar methodologies

Kaya et al. (2014a) introduces the hybrid pulse methodology as an expansion of BPM. This methodology makes use of both physical and digital pulse boards by combining their strengths. As Kaya et al. states, "it combines the simplicity of physical pulse boards with the communication and data storage capabilities of digital pulse boards". In this methodology, the main office hosts the pulse meetings and the distant offices join in. Main office has the main pulse board of the company. During pulse meetings, all updates are done on this main pulse board. The distant offices use the digital pulse boards, which are the exact copies of the main board, to follow the changes made on the main board during meetings, and to check the status of the company outside the pulse meetings. These digital boards are kept in synch with the main board so that the distant attendees can follow the meetings smoothly. The synchronization is done as follows. A webcam takes pictures of the main board. The image recognition software analyzes these pictures and transfers the information to the digital boards. The downside of this methodology is that it only provides one-way information flow, from physical to digital. Any change on the physical board updates the digital boards, however changes on the digital board do

not update the physical board. Therefore, for instance, during pulse meetings, when the distant attendees have a deviation and they need to update the pulse board accordingly, they explain this update and someone in the main office do this change for them on the main pulse board. This creates redundancy, tires out the person who does the updates, and also causes irritation in the attendees at occasions where misunderstandings happen. Likewise, employees that are on business trip cannot change the board themselves outside the pulse meetings. They need the help of someone in the main office. In conclusion, this methodology pays great attention to usability, has low barriers-to-entry, and increases accessibility using synchronously updated digital pulse boards. On the other hand, the lack of two-way information transformation lowers the accessibility. It can help the companies to manage global projects but also causes redundancy in the work.

Along with the hybrid pulse methodology, BPM and DPM constitute the total span of pulse methodology, from fully physical to fully digital version. Here, the term "pulse methodology" is used as an umbrella term for all the three methodology. Figure 2 shows different versions of pulse methodology over the physical-digital span.

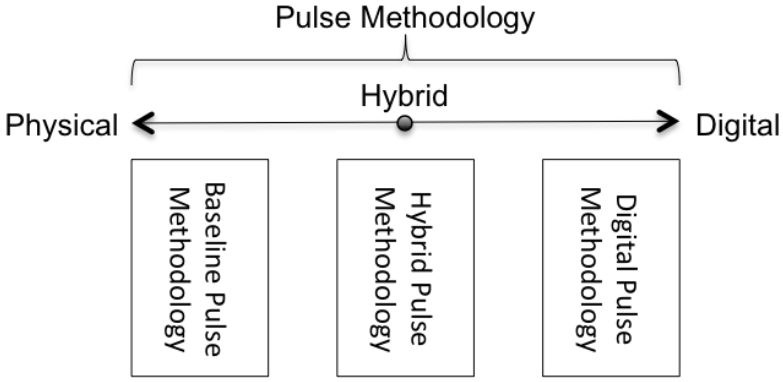

Figure 2. Versions of pulse methodology on physical-digital span

2. Methodology

The research was carried out in three steps: 1) understanding the need, 2) prescribing for the need, and 3) testing the prescription. The first step includes understanding how the company works, how they work with pulse methodology, and how they do the project management in the company. In order to have a knowledge basis with high validity, we used triangulation in the first step as the data collection method (Maxwell, 2012). As the triangulation suggests, we collected data via different ways (interviews and observations) from different sources (e.g., project managers, line managers etc.) (Fielding & Fielding, 1986). We continued the first step until we have the knowledge to develop the first prototype. The aim of the first prototype was to show the company in the early stages that how a digital version of the physical pulse boards would look like, and get feedbacks to be used while developing the real software. We used Microsoft Publisher, which is page layout design software, to make the prototypes and used it to do usability tests. After the first prototype passed the usability tests, we proceeded to the second step.

The second step includes developing the software, the digital pulse board, to be used as the digital boundary object of the methodology. We used the results of the previous step for developing the actual software and making decisions during the software development. These decisions include deciding to implement or discard new feature requests, and deciding to keep or eliminate existing features and procedures. These decisions helped the delivered software to be lean, i.e. it ensured that no unnecessary features were implemented. For the second step, we used extreme programming, from the agile software development methodologies, to deliver software with a low defect rate (Lindstrom & Jeffries, 2004). We divided the whole development process into small iterations. Each iteration includes the following cycle: describing a development task, prescribing the development task, testing the task in the company premises. Each time after getting the approval of the company during the test sessions, we proceeded to the next iteration cycle. After implementing the most basic functions of the software, we started the third step.

The third step includes setting up the software in the company premises, and testing it by observing how the employees use it. While the third step continues, we revisited the second step in the following two cases: when we observed a lacking part in the software during the company's pulse meetings, and when we received a new feature request for the software.

3. Results

We carried out the research in three steps: 1) understanding the need, 2) prescribing for the need, and 3) testing the prescription. The results of the first step are: the structure of the case company, their pulse methodology culture and project management methodology. The result of the second step of the research is the methodology we developed; namely, digital pulse methodology. Finally, the results of the third step include the test results of the methodology against the given requirements.

3.1 The case company

The case company is a global product development company. It has around 850 employees at the headquarters and in total 8000 employees worldwide. As seen in Figure 3, the company is vertically divided into three levels: lines, departments, and groups. Each level report to one level above; groups report to the department they belong to, departments report to the line they belong to, and lines report to the steering group. The following two headings give further information about the company: the pulse methodology culture in the company, and the project management methodology in the company, respectively.

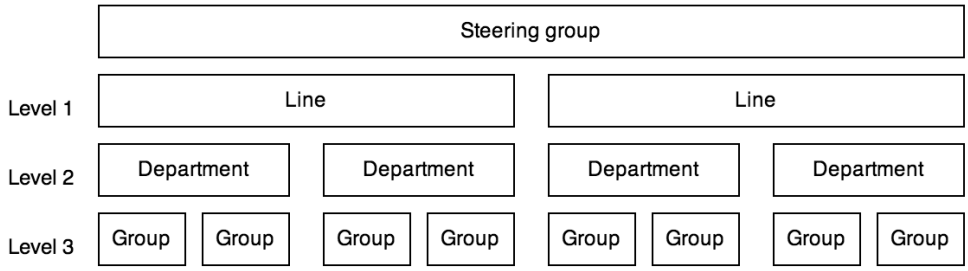

Figure 3. The structure of the case company

3.1.1 Pulse methodology culture in the case company

The company uses pulse methodology to keep track of the projects, synchronize the company about the changes and updates in the projects, and manage the deviations in the projects. Deviations include problems and risks in the projects. They began using pulse methodology in November 2012. Since then they adjusted BPM according to their needs. BPM was shaped to work with the company's three-level vertical structure. Each level has its own pulse meetings and pulse board.

The company gives high importance to the pulse methodology culture in the company. They have a paper attached to their pulse boards that writes the meeting purposes, the rules and the necessary attitude to be followed during the pulse meetings. They especially emphasized the importance of these two attitudes:

(i) We all ask for help where we cannot solve concerns ourselves
(ii) We have a "welcome problem" attitude

The first point aims to create a supportive environment in the pulse meetings, thus in the company. If a division (a line, department or a group) needs support (e.g., extra resources), they should not feel bad about it, e.g. they should not feel that their managers would think they are incompetent. Asking for help is not considered as a give-take relation. Instead, the pulse methodology culture in the company promotes this idea: "we all are on the same boat, therefore whatever we do, we do it for ourselves". Similar to the first point, the second point also aims to create a supportive environment. Attendees should not feel bad about sharing the deviations they are having in their projects, e.g., they should not feel that their managers would think they are causing problems.

3.1.2 Project management in the case company

In the case company, the projects run across the lines, where the projects are managed at the highest level of abstraction. The other two vertical levels (departments and groups) manage the projects with a detail level according to their place in the company's 3-level structure: departments being middle and groups being lowest level of abstraction.

Pulse methodology and time planning together forms the total project management structure in the company. Time planning provides a rough route map to the projects, whereas pulse methodology helps to handle the arising problems on the way and also helps updating the route map accordingly.
The first thing before starting a project is to do the time planning. In this phase, senior engineers and project managers try to come up with a rough route map for the project using their experience in the previous projects. The experiences are comprised of partly personal (non-logged) experience and partly the documents that include estimated time spans for each activity. An example sentence in this document looks like as follows: "having winter tires test for this truck takes three months". The project starts after its route map is finished. Project members meet every week at the pulse meetings and discuss about the deviations in the project. If a deviation requires updating the time plan, then they update the time plan accordingly. An example scenario can be as follows. A project member brings up the problem they are having to the pulse meeting that some tests will take longer time than expected. Then this is reflected in the pulse board as a deviation. Project managers then update the route map accordingly. Figure 4 depicts this project management workflow.

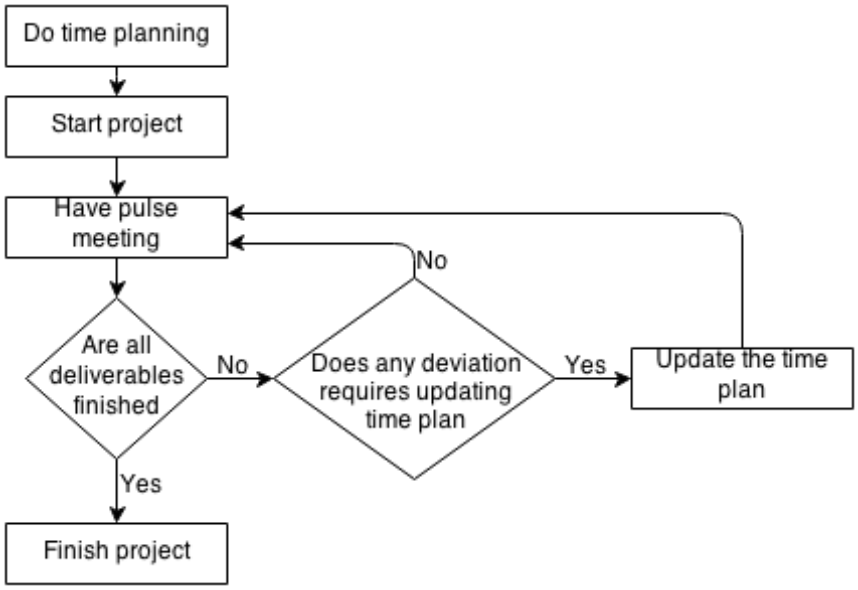

Figure 4. Project management flow chart in the company

3.2 Digital pulse methodology

DPM is a methodology made as an expansion on BPM to fill the gaps on it to make the case company be able to use pulse methodology for managing their global projects. BPM uses physical boards as pulse boards, which limits the methodology (e.g., lack of providing efficient telecommunication). Whereas DPM makes use of web technologies and makes it available to use the methodology for managing global projects.
There are many similarities between BPM and DPM. DPM also makes use of pulse meetings as integrative events and pulse boards as boundary objects. The number of deviation statuses also kept the same as in BPM in order to keep the methodology lean. Deviations are represented as circles on the digital pulse boards. Color of the circles represents the status of the deviation:

(i) **Red:** New critical deviation
(ii) **Yellow:** Deviation with an ongoing resolution or a risk that must be focused
(iii) **Green:** Resolved deviation

The differences between BPM and DPM come from the IT backbone of the latter one and the processes regarding using them. The escalation process is one of these differences. Escalation can be considered as lower divisions asking for help from the higher divisions (e.g., asking for extra budget). This process takes place as follows. Divisions share the deviations they are having in the pulse meetings where all divisions in that level join. If they cannot solve a deviation in that level, they ask for help from one level up by using the escalate function of the digital pulse boards. That creates the same deviation on the digital pulse board that is used at the pulse meeting one level up. This deviation forms a vertical interconnectivity between these two boards. When the escalated deviation is updated on one of the vertically interconnected boards, the others get informed about

this update immediately. After the higher-level divisions receive the escalated deviation, they first accept or reject the deviation. If they reject, the deviation is sent back to the lower level to make them try to solve it themselves again. If they accept, then they try to solve it themselves. If they cannot solve it, they escalate the deviation to the next level. This continues until the deviation reaches the level that it can be solved. After the deviation reaches the appropriate level and gets solved, that level updates the deviation's status as solved and writes necessary details about the solving process to the digital pulse board. All the lower levels that the deviation has passed see this update instantaneously. This ensures the vertical synchronization of the company.
The process of updating the pulse board forms another difference between BPM and DPM. In BPM, pulse meeting attendees update the board about their deviation during the pulse meeting. Only exception is the attendees that work very close to the board, who can update the board at will. However, other attendees do not have this option due to lack of accessibility. In contrast, in DPM, pulse meeting attendees update the board about the deviations that they will share in the meeting before the meetings. Throughout the week, whenever they detect a deviation, they connect to the board and put that deviation to the board. This brings the following two benefits:

(i) Shortens the pulse meetings by saving the time spent for updating the board
(ii) Helps to provide fully structured meetings, which then create a more lean company by eliminating waste caused by chaotic work environment (Womack & Jones, 2003)

BPM has semi-structured meetings: the date and place of all the meetings throughout the year is fully known but the length and the agenda of each meeting is not known. Whereas, DPM provides fully structured meetings. Here, a fully structured meeting means that even before the meeting one can know who will discuss which topic at exactly what time during the meeting. DPM assures fully structured meetings by knowing the order of the speakers and how long each individual speaker would speak. DPM gathers these two key data as follows. Physical pulse boards provide a structured pulse meeting where the order of the speakers is known (Kaya et al., 2014b). This benefit comes from the layout of the physical pulse boards. Since the digital pulse boards also use the same layout with physical pulse boards, they also inherit this benefit of providing the order of the speakers. This forms the first key data towards providing fully structured meetings. Regarding the second key data, DPM gathers the information about how long each individual speaker will speak using one of the formulas given below. In the formula number 1, the meeting length is accepted as constant. Whereas, in the formula 2, the time to be spend for each deviation is kept constant. In the formulas, the total number of deviations to be discussed can be found by checking the pulse board for which deviations have been updated since the last time. The maximum time for a pulse meeting can be defined by the company. However, companies should keep in mind that pulse meetings should be short (15-30 minutes) while deciding the maximum time.

$n: integer;\ n \leq number\ of\ meeting\ attendees$
$x = maximum\ time\ for\ a\ pulse\ meeting\ (normally\ 30\ minutes)$
$L = Total\ meeting\ length$
$T = Time\ to\ be\ shared\ for\ each\ deviation$
$t_{(n)} = Time\ to\ be\ shared\ for\ the\ n^{th}\ speaker$
$D = Total\ number\ of\ deviations\ to\ be\ discussed$
$d_{(n)} = Number\ of\ deviations\ that\ the\ n^{th}\ speaker\ will\ discuss$

(1) $$T = \frac{L}{D} \quad \rightarrow \quad t_{(n)} = T \times d_{(n)}$$

(2) $$L = T \times D \quad \rightarrow \quad if\ L > x;\ then\ L = x \quad \rightarrow \quad t_{(n)} = L \times \frac{d_{(n)}}{D}$$

3.2.1 Pulse meetings in DPM

Pulse meetings provide horizontal synchronization in the company structure. Every level in the company structure has their pulse meetings. All the divisions in the same level (e.g., all the departments) join and share their statuses in these common meetings. The frequency of the meetings depends on the vertical level, lowest level being most frequent (e.g., daily), highest level being least frequent (e.g., biweekly). The reason behind is that more deviations arise for lower level pulse meetings where divisions deal with projects in the highest level of detail, whereas less deviation arise in the higher level pulse meetings where divisions manage projects in the

lowest level of detail. For the cases where different levels in the company structure have pulse meetings with the same frequency, it is necessary to have the lower level divisions' pulse meetings before the higher level one's. The reason for this is that the lower levels provide input to the higher level pulse meetings. The escalation function as explained above is an example for this.

3.2.2 Digital pulse board

The digital pulse board is the demonstrator we developed to test and prove that DPM fulfills the requirements given in Kaya et al. (2014b) to make the company use pulse methodology for managing their global projects. Figure 5 shows the digital pulse board on a smart board. In this example, rows represent projects and columns represent the divisions in the company. It is a single page web application. During its development, the aim was to have a lean application that is easy to use with only the necessary feature. Consequently, it has all the necessary basic functions (e.g., add, edit, remove deviation) of a physical pulse board along with the minimum add-on functions that makes it fulfill the requirements. These add-on functions will be shortly explained in the next chapter, under the related requirement test headings where each add-on function is specifically used.

Figure 5. Digital pulse board on a smart board

3.3 Test results

Under this heading we will present the results from the tests on the DPM, particularly on the demonstrator developed for the methodology, against the requirements given in Kaya et al. (2014b). These requirements are: providing remote access to the pulse board for distant attendees, solving the space limitation problem that the physical pulse boards have, and automating the routines.

3.3.1 Providing remote access

Kaya et al. (2014b) defines the requirement of providing remote access as follows: "Employees sitting in the remote offices (e.g., another country) should be able to read and write to the board themselves, without asking for help from the people sitting in the office where the board resides". Since the company uses pulse methodology only at their headquarters for now, this requirement was tested at the local settings. The test was done as a user acceptance test. In a simulated pulse meeting settings, local employees asked to control the digital pulse board from different rooms. The employees that joined this test agreed on that the digital pulse board passes this acceptance test.

Kaya et al. also discusses that the remote access function may cause rebound effect and damage the methodology. He explains this rebound effect as follows. This improvement point aims to increase the accessibility to the pulse meetings by providing simultaneous remote access to the pulse boards. However, even the local attendees may begin to use this function instead of joining the pulse meetings in person. Face to face interaction enriches the communication (Holmdahl 2010, Mascitelli 2011). Therefore it constitutes a very important part of the pulse methodology. If even the local attendees begin to use the remote access feature instead of joining the meetings in person, the lack of face to face interaction will damage the methodology by lowering the quality of the information conveyed. In order to avoid this rebound effect, he suggests regulating the use of this feature of the digital pulse board. He suggests that if only the distant attendees use this feature, then such rebound effect would be avoided. This means that every attendee should join to the pulse meeting in their offices in person, and then connect to the hub of remote offices using the digital pulse boards in the

meeting rooms. Only the employees that aren't in any distant office due to business trip may connect to the meeting via the digital pulse board on their computer.
We did further investigations on the possible rebound effect that can arise from fulfilling this requirement. We observed the pulse meetings while the attendees using the digital pulse board. The results showed that such a rule is not necessary. The annual meetings memo that the company holds assures that the local attendees join the meetings in person. This document holds the yearly record of who did not attend to which pulse meetings throughout the year. The employees that did not attend a number of meetings may get negative reaction from their managers. As a result, this document assures the physical attendance to the pulse meetings, thus avoids the described rebound effect.

3.3.2 Solving the space limitation problem

One of the top benefits pulse methodology brings to the company is that they can see the current status of all the projects in the company in one picture (Kaya *et al.*, 2014b). Using this information, Kaya et al. points out the space limitation problem on physical pulse boards. Physical pulse boards have limited space therefore the number of projects that can be displayed on them is limited. For the case company, beginning to use pulse methodology also for their global projects means increasing the number of projects represented on the pulse boards. Therefore it is necessary to improve the pulse boards so that they have the ability to store and show higher number of projects on them.
DPM was tested against the space limitation requirement as follows. The company used the demonstrator (digital pulse board) developed for DPM for their global project management meetings for over three months to test it against this requirement. They added all the global projects to the digital pulse board. The results showed that the digital pulse boards provide unlimited space to enter projects. However, the visible area to display the current status of all the projects in one picture was still limited. In order to solve this problem we added two view modes to the boards: edit mode and view mode. Edit mode is the default mode for using the boards. It can be considered as the zoom-in view, whereas view mode provides the zoom-out view. The view mode makes the size of the board small enough to fit it to the display so that all deviations can be seen in one picture. We tested the view mode of the digital pulse boards using the real company data and the results showed that this zoom-out view provides enough space and still provides enough resolution to see each individual deviation on the board.

3.3.3 Automating the routines

As the third requirement, Kaya et al. mentions the need for automating the routines to start using pulse methodology for global projects. He refers to updating the interconnected boards as the routines. When the case company begins using DPM for their global projects, they will need to update the interconnected boards in two cases. First case happens during the deviation escalation process. When a division in the lower levels of the company structure has a deviation that they cannot solve themselves, they escalate it to the higher levels of the company structure in order to ask for their help. The escalated deviation creates a link between the escalating and receiving levels: they both own the same deviation. Therefore any update of that deviation made on one of the boards should update the other board automatically. This case is even applicable now: using pulse methodology only for local projects. The second case will be applicable after the company begins using pulse methodology for their global projects, while having global pulse meetings. In these meetings, all the attending distant offices have their own copy of the global pulse board. These boards are fully interconnected; they are exact replicas. This means that any change on one, should instantaneously and automatically update the rest.
This requirement was tested for both of the cases given above, as follows. The requirement was tested for the first case in two phases: first in a simulated pulse meeting settings, and second in the real settings with the real data, while the company was using the digital pulse board at their pulse meetings. The first test we did was to verify that digital pulse boards successfully escalate deviations from lower to higher level boards and creates a link between them through that deviation. After getting acceptance from the users regarding this function, the second test phase started. The boards were implemented in the pulse meeting rooms and began to be used at the real pulse meetings. For three months, the users used the boards in real pulse meeting setting with real data. The results of the second phase of the first case showed that the boards fully fulfill the automating the routines requirement for the first case. To test the requirement for the second case, we used the same method that we used to test the first phase of the first case. We created simulated global pulse meeting settings. We asked users to update the board in turn to test that if the boards fulfill the requirement by providing synchronous update between fully interconnected boards. The result of this test showed that the boards fulfill this requirement also for the second case.

4. Discussion

Under this heading four topics will be discussed: technology acceptance of the DPM from the case company, DPM's effect on sustainability, a possible sub-optimization that DPM processes can lead to, and validity of the results.

4.1 Technology acceptance

The company have already been using modified version of BPM for two years. Therefore the employees have been familiar with the methodology. The requirement tests that took place before starting to use DPM took six months. Within this period, the employees have always been kept in the loop. Meaning that, they have been involved, if not, informed about each development iteration. This way the users have already been familiar with the methodology and its tools upon its completion. Therefore the transition from their old methodology to DPM was smooth. After the tests finished, they used it for three months without any problems. Thereby it can be concluded that the methodology got high acceptance from the company.

4.2 DPM and sustainability

Environmental (aka. ecological) sustainability is the maintenance of natural capital (Goodland, 1995). DPM helps companies to increase their positive effect on environmental sustainability with the following points:

(i) It facilitates distant meetings with high interaction quality, which then lowers the travelling needs, and consequently lowers the carbon footprint of the company.
(ii) Starting to use DPM is an immaterialization process (e.g., using digital boards instead of physical boards). If the electricity is provided from sustainable resources (e.g., wind power comparing to oil), then this immaterialization would increase the company's environmental sustainability.

4.3 Is it a sub-optimization?

Eliminating waste caused by chaotic environment makes the companies more lean (Womack & Jones, 2003). Therefore DPM have processes that would assure having fully structured meetings. This is assured with the process of updating the board about the deviations before the meeting and then calculating who will speak how long. Trying to calculate how much each individual speaker should speak during pulse meetings may seem like a sub-optimization. One can claim that in order to get full structured meetings, for each pulse meeting trying to calculate how long each speaker would speak can create more waste comparing having less structure in the meetings. This dilemma-like debate can be avoided by letting the digital pulse board handle these calculations. It can automatically get the information about which deviations would be discussed at the next pulse meeting by finding which deviations have been updated since the last pulse meeting. The constant values like meeting length and deviation discussion length can be entered just once manually. After that, each week before the pulse meeting, the digital pulse board can do these calculations automatically. Furthermore, it can also keep the time for each speaker during the pulse meetings and warn them if they are exceeding the time shared for their speech.

4.4 Validity

Providing remote access requirement and the second case of the automating routines requirements could not be tested at the real global pulse meetings because currently only the Swedish office of the company uses pulse methodology. Therefore these two requirements were tested in simulated global pulse meeting settings. This gives validity to the results at the requirement acceptance level from the users.
DPM solves the space limitation problem for the case company. It is not possible to generalize this result as the methodology can solve this requirement for all the companies. However, assuming the size of the company and

the number of running projects in the company are linearly correlated, the results regarding this requirement can be concluded as valid for the equal or smaller size companies than the case company. The case company is one of the top companies in car manufacturing and has around 8000 employees worldwide. The size and the prestige of the company in the global car manufacturing arena is a proof of high applicability, consequently high validity of the results regarding this requirement. However, even for the same company, the tests may give different results depending on the time when the tests are done. If the tests took place in a time while the company does not have many projects going on, then the results may not be valid for a time where they have a high workload. In order to increase the validity regarding this pitfall, we tried to make company use DPM as long as possible to test the methodology during high and low workload times. The company used the methodology for three months. Thereby further validation comes from the timeframe the company used the methodology.

It is also possible to solve the space limitation problem with a different way than we provided here. Companies' can arrange specially made pulse boards for them with very big sizes. An example of it can bee seen in Figure 6, Scania's pulse board (Johansson, 2010). These specially made big boards can solve fulfill this requirement. However the other two requirements (remote access, automating the routines) requires a digital system. Big physical pulse boards cannot fulfill these two requirements. This validates the conformity of the solution we provided in this research paper for the requirements provided in Kaya et al. (2014b).

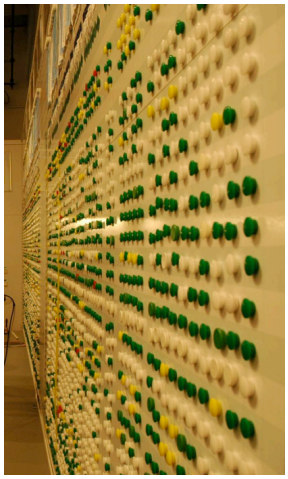

Figure 6. A wall-size pulse board (Johansson, 2010)

5. Conclusion

In this paper we presented a new methodology called digital pulse methodology, which is an expansion of baseline pulse methodology. We tested it against the given requirements in order to prove that it helps companies to use pulse methodology to manage their global projects. The requirements were: providing remote access, solving space limitation problem, and automating routines. We did the tests in the company premises at real pulse meetings for the applicable cases. For the other cases, we did the tests in simulated pulse meeting settings using real company data. The results of the tests showed that the new methodology is ready to be used as the main way of managing local and global projects. However, one major drawback of pulse methodology is that it does not have time planning in it. Considering the results of the study, we conclude that in order to use pulse methodology for project management, companies need to employ an additional time planning methodology.

Regarding the benefits of DPM, it increases accessibility comparing BPM by providing access to the pulse boards during and outside the pulse meetings. In pulse methodology, it is important that the meetings should be brief, fast paced and short. DPM shortens the classical pulse meetings without lowering the added value, i.e. the quality of the information conveyed. It makes the company more lean even than BPM does by providing fully structured meetings. Last but not least, DPM provides full synchronization in the company. BPM provides only horizontal synchronization. It provides intra-level synchronization. It only synchronizes the company by synchronizing the divisions that are in the same level, whereas DPM provides inter-level synchronization (vertical) as well. It ensures horizontal synchronization with pulse meetings and vertical synchronization by the use of escalation function.

The future work for this research is as follows. Currently only the Swedish part of the company is using pulse methodology. Therefore, in order to do the tests in real global settings, the other offices should be introduced with the methodology. Introducing the methodology and doing tests on the interaction between the distant offices forms the future work of this study.

Acknowledgements

This study was carried out at the Wingquist Laboratory VINN Excellence Centre within the Area of Advance Production at Chalmers, and supported by the Swedish Governmental Agency for Innovation Systems (VINNOVA).

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