

Identifying Improvement Areas in Production Planning Meetings by Assessing Organisation and Information Systems at a Small Production Company

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Abstract

The increased mass-customisation of production requires operators to manage an increasing number of complex work tasks. From a social sustainability perspective, better sharing and dissemination of production information supports operators cognitively to manage and understand their work tasks, which in turn improves quality of work. So, the focus of this paper is to study how production planning meetings can be improved. Previous research suggests that the MEET model can be used as a framework for improving meetings and information sharing by studying 10 different areas within a company's Organisation System (OS) and Information System (IS) whilst considering the time and place prerequisites and aims for these meetings. In this paper, the applicability of the MEET model and its 10 areas are tested at a small production company by applying two different approaches. First, a questionnaire was presented to and filled out by a manager, the results of the questionnaire identifies the improvement potential of each of the 10 areas. Second, a comprehensive current-state analysis based on observations on the shop-floor and interviews with operators were carried out with regards to the 10 areas. The results from these two approaches were compared and the comparison showed that both approaches point towards similar areas for potential improvements. This paper concludes that the MEET model can be used as a general framework to inspire change by suggesting areas with potential improvement in information sharing. While the self-assessment questionnaire can identify a direction, additional information and involvement of other stakeholders are recommended for actual implementations of change. For future research, the methods based on the MEET model will be further developed to improve accuracy and the suggestions provided to the case company in this paper will be tested as a validation of the model.

Keywords: MEET, Organisation System, Information System, time-place flexibility, information sharing, improvement potential, production planning.

1. Introduction

Ever since the paradigm shift in modern production towards mass-customisation, an increasing number of product variants has brought higher demands on production flexibility [1] [2]. Hence, operators are required to manage more and more complex work tasks [3].

Digitalisation in general, and Industrial Internet of Things in particular, have enabled connectivity and promise easier transfer of production data and information in the manufacturing industry.

From a sustainable development perspective, human's role in future production systems need to be considered because job satisfaction is positively correlating to performance [4]. Concerning social sustainability in production, it is important to consider cognitive automation besides physical automation [5]. To support operators' cognition, some factors that need attention include proper organisation, information and communication, among others [6]. Also, effective processing of information can create a competitive advantage for organisations [7].

Meetings are an integral part of communication and dissemination of information and much research has been done on how to improve such information sharing, decision making and problem solving, but often in a physical face-to-face meeting context [8] [9].

Previous research suggests that *Organisation System* (OS) and *Information System* (IS) overlap in important *Meetings* (M), described in the MEET model [10]. The MEET model considers flexibility of time and place, where people may not always have the opportunity to meet face-to-face every time for information sharing, which is often the case in industry [11]. In a continuous improvement context, it is possible to use the MEET model in Plan-Do-Study-Act cycle as an assessment tool [12].

This paper examines if a small production company's information dissemination and shop-floor communication on daily production planning can be improved with regards to the operators' cognition, by applying the MEET model.

1.1 The Case Company

The case company, LaRay AB, is a small Swedish production company with around 20 employees. The case company provide surface finishing for their customers with different types of coating methods (wet painting and powder coating), mainly for customers in automotive, domestic appliance, defence, offshore, telecommunications and electronics industries.

There are three daily face-to-face meetings today that concern daily production planning; two production management meetings at 08:00 (8 a.m.) and 13:00 (1 p.m.), and an information meeting at 14:00 (2 p.m.) for all employees.

2. Frame of Reference

The frame of reference introduces the MEET model, on which this study is based. Other presented concepts serve as a contextual background for the results and discussion.

2.1 The MEET Model

It is a major challenge for businesses to accomplish and maintain meetings in the daily operation that are efficient, innovative, and support work activities and organisational learning. The MEET model was developed with the purpose of providing a complete picture of the aspects that are important to consider when developing organisation, meeting structure, or information systems [10] [11]. The structure of the model can support analysis of current situation, provide inspiration, and guide improvement processes investments, and implementation work. The model can be applied on both a small scale for individual meetings, and large scale when planning a whole company's meeting structure, locally, between departments as well as between plants.

The MEET model, as represented in *Fig. 1*, consists of the *Organisation System* (OS) with its five areas to the left, the *Information System* (IS) with its five areas to the right, and the *Meetings* (M) with its four time-place flexibility categories that connects the two systems in between.

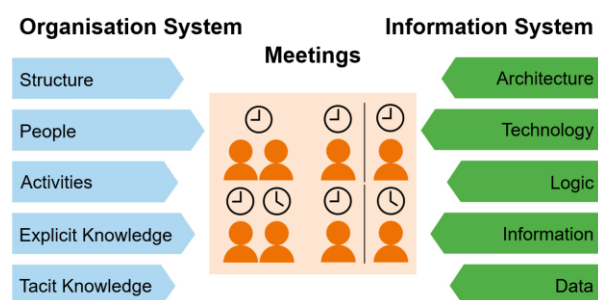


Fig. 1: Graphical representation of the MEET model.

The OS consists of five important inter-related areas: the *structure* that concerns the organisation of people, the *people* involved in the meetings in focus, the *activities* carried out, and the knowledge of the people. This knowledge can be *explicit knowledge* that is visible, easily shared, documented and easy to explain, and experience-based *tacit knowledge* that is difficult to document and share.

The IS also consists of five areas: the *architecture*, the *technology* that concerns the physical resources (digital as well as analogue), the *logic* that refers to the functions performed by resources on the information, the *information*, and the *data*. Generally, large amount of *data* in organisations are hidden, unavailable and thus unused. When data is made available and provided a meaning by the context, it is seen as information.

The *Meetings* structure is the central part of the model where the areas of the OS and IS are integrated. This structure identifies different types of communication used at meetings, depicted in the middle of *Fig. 1*. First, the information exchange in meetings can be carried out either locally at one place or between places. Secondly, it can take place in real time, or occur over time. Thus, a flexibility in place and time. Each of these four contexts of communication has its own specific conditions, requirements, and opportunities. Most

often a combination of several of these time-space contexts should be used to support effective meetings.

2.2 Information Sharing and Visualisation

Proper sharing and dissemination of information are important for organisations to communicate internally. Two popular strategies for managing knowledge within organisations are the *personalisation* approach, which strongly emphasises face-to-face interactions, and the *codification* approach, which heavily relies on documentation [13].

Both strategic approaches have their merits and should be applied in tandem [14]. Meetings can be supported by proper documentation and visualisations can be supported by a narrative. Proper visualisation of information supports communication and helps coordinating work tasks efficiently [15].

2.3 Computer Systems and Platforms

The case company uses digital systems and platforms to support their operations.

Enterprise Resource Planning (ERP) systems are business management software that can support companies with decision making and visualisation of data and information from a variety of sources and categories.

Content Management System (CMS) platforms are software for managing digital information that integrates a variety of different applications.

3. Methods

Based on the MEET model, two approaches, a faster *questionnaire approach* and a more thorough *observations and interviews approach* were applied.

The *questionnaire approach* uses a web-based self-assessment questionnaire and results in a simplified overview of possible areas with improvement potential, corresponding to the 10 areas of the OS and IS from the MEET model.

The *observations and interviews approach* with a current state analysis based on the same 10 areas from MEET model result in more comprehensive suggestions on possible improvement activities.

The results from the two approaches are compared and analysed in the discussion. This methodological approach is visualised in *Fig. 2*.

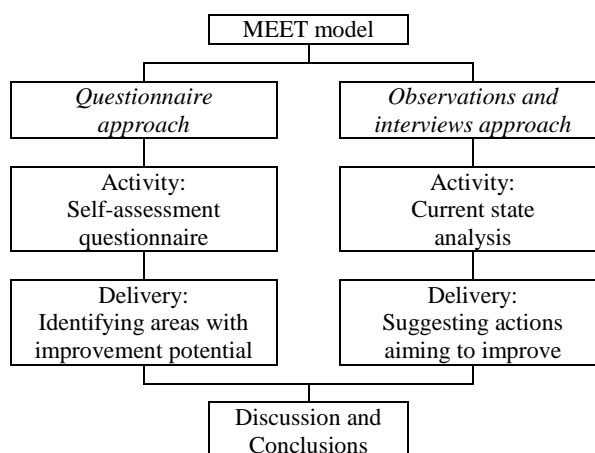


Fig. 2: The methodological approach.

3.1 Self-Assessment Questionnaire

The self-assessment questionnaire is a web-based questionnaire that consists of 10 questions. All questions are answered by selecting one of the possible choices. The results are an aggregate of the questionnaire answers, presented as improvement potential, on three levels, for each of the 10 OS and IS areas.

The questionnaire questions, with subsequent selectable answers are:

- Q1. Is there an expressed standard for *the meeting*?
- Yes, clearly expressed
 - Yes, in development
 - Yes, but no one knows about it
 - No
- Q2. Are appropriate competencies attending *the meeting*?
- Yes, always
 - Yes, mostly
 - To a certain extent
 - Rarely
- Q3. How often do the participants use their opportunity to speak during *the meeting*?
- Almost always
 - Often
 - It could be more often
 - Rarely
- Q4. Is it only the experts that are speaking during *the meeting*?
- Yes, and no one is questioning
 - Yes, to a certain extent
 - Yes, but everyone is an expert
 - No, we have a good dialogue
- Q5. Are there good technological support tools for presenting previous decision, processes and/or events during *the meeting*?
- Yes, and they are working properly
 - Yes, but we are rarely using them
 - We can do more
 - Technological what now?
- Q6. Are there good technological support tools for documenting information about previous decision, processes and/or events during *the meeting*?
- Yes, and they are working properly
 - Yes, but we are rarely using them
 - We can do more
 - Technological what now?
- Q7. Is it clear how information from *the meeting* should be saved?
- Yes
 - No
- Q8. Is it easy to find information relating to *the meeting* from other activities?
- Yes, never any problems
 - Yes, I often ask an expert
 - So-so, our information system is complicated
 - No
- Q9. Is it clear how information from *the meeting* is relevant for the daily work?
- Yes, it is clear
 - Yes, but sometimes repetition is necessary
 - No, it has to be repeated frequently
 - No, the information seems to not be reaching

Q10. Are the used technological support tools at *the meeting* compatible toward the organisation's overall information system?

- Yes, everything is integrated
- Yes, but further integration is possible
- To a certain extent
- No, nothing is integrated

The questions-to-results relationships are clarified in **Table 1**. Each question affects two or three OS or IS areas, and vice versa.

To provide further structure, three levels of improvement potential are defined in order to simplify an understanding for where focus may be directed from a meetings and communication perspective. Depending on how the self-assessment questionnaire was filled out, the different OS and IS areas will be associated with one of the three levels of improvement potential:

- *High level:* These areas have the highest level of improvement potential, and the short-term focus for development of meetings and communication should be prioritised to these areas.
- *Intermediate level:* These areas also have improvement potential, but when prioritising focus these areas are not as urgent as the higher level.
- *Low level:* These areas under control in a larger extent than the areas associated with the other levels.

Table 1: The questions-to-results relationship, indicated by x.

	Questions									
Organisation System	1	2	3	4	5	6	7	8	9	10
Structure	x									x
People		x		x						
Activities	x									x
Explicit Knowledge		x	x							
Tacit Knowledge				x				x		
Information System	1	2	3	4	5	6	7	8	9	10
Architecture							x	x		x
Technology					x	x				x
Logic					x				x	
Information			x			x				
Data						x	x			

This self-assessment questionnaire was filled out by the CEO of the case company with regards to the 14:00 information meeting with all employees.

3.2 Current State Analysis

The current state analysis is based on both several on-site observations and individual interviews with both shop-floor operators, management and CEO.

The observations included both attendance of the three different meetings related to daily production planning and presence during work, especially activities related to information sharing of production planning.

Based on the observation and the OS and IS areas, three sets of interview questions were formulated purposefully to match operators, management and CEO. The interviews were semi-structured and allowed for personal opinions of the meeting and information sharing situation concerning production planning.

Based on the observations and interviews, a current state analysis is formulated with regards to the MEET model.

The current state analysis resulted in suggestions for improvement in tandem with a workshop with operators and management at the case company.

3.3 Comparison of Results from the Two Approaches

While the *questionnaire approach* identifies which of the OS and IS areas have most potential for possible improvement, the *observations and interviews approach* suggest actions that reside within the OS and IS areas.

A comparison is made to entail in what extent the areas identified by the results of the self-assessment questionnaire match the areas from the results of the current state analysis.

4. Result from the Self-Assessment Questionnaire

The CEO at the case company filled in the self-assessment questionnaire with regards to the daily 14:00 information meeting for all employees. The 14:00 information meeting is a short meeting with a fixed agenda that discusses the production of the day before, the day itself and the next day.

The results from the self-assessment questionnaire, with levels of potential improvements, are listed in **Table 2**. Most improvement potential lies with the IS, while most OS areas are adequate.

Table 2: Results from the self-assessment questionnaire.

Organisation System (OS)	
Structure	Low
People	Low
Activities	Low
Explicit knowledge	Intermediate
Tacit knowledge	Intermediate
Information System (IS)	
Architecture	High
Technology	High
Logic	Intermediate
Information	High
Data	High

5. Result from the Current State Analysis

The current state analysis is based on observations and interviews from the case company.

5.1 Current State Analysis: Organisation System

Structure: The case company have a flat hierarchy. The CEO and the production management team works closely with shop floor operators.

People: During the production management meetings, all participants are actively involved. However, during the information meetings, where all employees participate, the relevancy of the meeting for all meeting participants is not as apparent.

Activities: The activities for the three meetings vary, however they have some topics in common. The agendas for the meetings are always the same, and are displayed in **Table 3**. While the 08:00 production management meetings discuss the plan for the day, the 13:00 meetings account for the different processes and outlines a plan for the next day. The 14:00 information meetings focus on informing the employees of the current status of the production.

Table 3: Agenda for each meeting with topics, marked with x.

Activity/Topic	08:00	13:00	14:00
Safety	x	x	x
Result	x		x
Daily brief	x		
Quick information	x	x	x
Process information: Coating			x
Process information: Precoating			x
Process information: Suspension			x
Process information: Logistics			x
Deviations	x		x
Goals/targets – today	x	x	x
Goals/targets – tomorrow		x	x
Resources	x	x	x
New products	x	x	x
Others	x	x	x
Positives/Negatives		x	x

Explicit Knowledge: On the three meetings, much of the disseminated information is explicit and based on concurrent events.

Tacit Knowledge: Despite that the meetings focus on transferring explicit knowledge, there exist a large amount of tacit knowledge, residing within the individuals of the production management team, which is apparent since many decisions are made based on past experiences.

5.2 Current State Analysis: Information System

Architecture: The case company uses an ERP system to manage information on products, work instructions, deviations, et cetera. The ERP system supports visualisation of production information and can output statistics for decision support. Also, a web-based CMS platform is used to simplify standardised documentation of deviations and coating reports by employees. Depending on severity of the employee reports, these items can either be quickly resolved or should be inputted to the ERP system for monitoring and future action.

Technology: Technological support tools used for the meetings are mixed analogue and digital. Some of the covered topics are based on information displayed on a digital screen, but large portion of the information are printed papers on a whiteboard. The digital screen and the whiteboard can be seen in **Fig. 3**.

Logic: Existing meetings follow a specific pre-defined logic with a static agenda, as shown in **Table 4**. However, operators frequently ask the management for clarifications of work tasks. This phenomenon is occurring mainly because allocation of work tasks to operators is not treated at any of the meetings. A whiteboard, seen in **Fig. 4**, for work task allocation exists but is rarely utilised.

Information: Information at the meetings support the topics and some are excerpted from the ERP system (e.g. production statistics, work instructions) or the CMS platform (e.g. deviations).

Data: For example, improvement and deviation data is usually gathered manually. However, some production data is gathered automatically, e.g. work in progress.



Fig. 3: Digital screen and whiteboard used for the meetings.

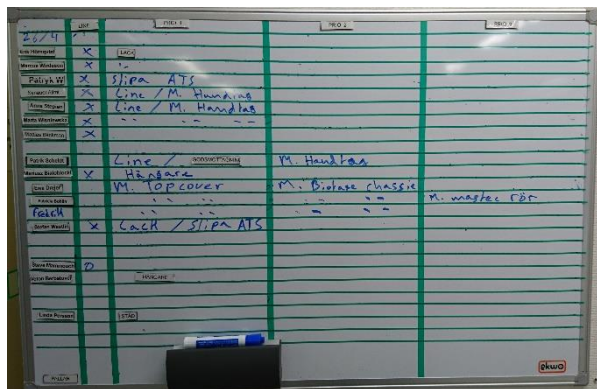


Fig. 4: Whiteboard for resource planning that is not utilised.

6. Discussion

The point of departure of the discussion is a comparison between the outcomes from the current state analysis and the self-assessment questionnaire, followed by a discussion on the selected methods. Implications for both the case company and future research are briefly explored.

6.1 Summary of the Current State Analysis and Comparison of the Results from the Self-Assessment Questionnaire

The current state analysis identifies that the OS areas are adequate, and higher improvement potential lies in the IS areas.

The structure at the case company seems to be fine today, and thus the improvement potential can be considered low. For the meetings, an improvement can be to consider the relevancy of the specific meetings for the participants, however it is a small improvement with regards to the current situation. The predetermined agenda makes it clear for the participants to have clear expectations of the meetings. Concerning explicit knowledge, the shared knowledge is mostly based on concurrent events, and the case company would benefit from considering how to use other knowledge for other context in production, hence there is an intermediate potential for improvement. The tacit knowledge based on previous experience often affect decisions, however it would be valuable for the case company if there exist encouragement for the sharing of tacit knowledge.

Architecture-wise, the ERP system and the CMS platform simplifies some aspects of the information availability for the meetings, however for the production itself, it would be more purposeful if more shop-floor operators could operate the software properly. As can be seen in Fig. 3, technological support tools are only used in a small extent, and an improvement in this area can help make relevant information more accessible. Even though that the existing three meetings related to production planning have good agenda-driven logics, these meetings fail to cover allocation of work tasks to operators, and a revision of meetings or agendas has a high level of potential improvement, which differs from the self-assessment questionnaire result. The information from the meetings could be documented in a way so that it becomes easy accessible and supportive of the operators' work, which would be a considerable improvement. Different data are gathered differently, the difficulty for the case company is to identify what data is relevant for the production and how to gather it properly.

The comparison between the outcomes of the current state analysis and the self-assessment questionnaire is summarised in Table 4. The level of improvement potential for the different OS and IS areas identified by the self-assessment questionnaire match the roughly the improvement potential considering the current state analysis based on observations and interviews. The main exception is concerning the allocation of work tasks to operators.

6.2 Discussion on Methods

This paper applied two approaches, and then compared the results.

The results from the self-assessment questionnaire were similar to the current state analysis. If the questionnaire were filled out by more stakeholders, the outcome would probably differ because of the varying perspectives and a compilation would give a more accurate picture of the situation. Since only one person filled out the questionnaire in this study, it is difficult to draw any generalizable conclusions about the quality of the questionnaire. However, its usefulness as an inspirational tool for assessing areas with improvement potential is demonstrated in this paper.

Interviews with operators were performed in production and not secluded. If interviews were secluded and the operators were less stressed, the answers may have been more comprehensive and elaborate. However, this approach provided shorter answers that were hopefully more spontaneous.

Table 4: Comparison between the improvement potential from the self-assessment questionnaire and the current state analysis.

Organisation System (OS)	Improvement Potential	Current State Analysis	Match?
Structure	Low	Flat hierarchy, management and operators work closely.	Yes
People	Low	All employees attend 14:00 meeting, relevancy unclear.	Yes
Activities	Low	Predetermined agenda on all the meetings.	Yes
Explicit Knowledge	Intermediate	Based on concurrent events.	Yes
Tacit Knowledge	Intermediate	Resides within individuals and affect decisions.	Yes
Information System (IS)	Improvement Potential	Current State Analysis	Match?
Architecture	High	Difficult for all employees to understand and use.	Yes
Technology	High	Unusual, most information is on paper.	Yes
Logic	Intermediate	The activities don't match all the needs at the case company.	No, should be high
Information	High	Information from meetings are rarely saved for later use.	Yes
Data	High	Most data are gathered manually, but some are automatically.	Yes

The comparison of the results was assessed with regards to if the improvement potential were matching between the two approaches. The comparison itself is subject to subjectivity. Arguably, one example is the *people* area that could be considered for higher level of improvement potential.

6.3 Potential Improvements for the Case Company

As demonstrated by **Table 4**, there are some potential for improvement at the case company, mainly towards the IS. As a continuation of this research, it would be interesting to study the effects of addressing the potential improvement areas. Apart from only identifying the areas for potential improvement, the observations and interviews provide a basis for actual change.

Based on the identified areas with high level of improvement potential, a *revision of meetings and agendas* and an implementation of *digital visualisation of information* are suggested. These suggestions are related to the OS and IS areas of *people, activities, technology, logic and information*:

- *Revision of Meetings and Agenda*: Introducing a morning planning meeting, where relevant information concerning allocation of work tasks are decided.
- *Digital Visualisation of Information*: Relevant information from the meetings need to be documented and be made easily accessible for affected operators.

These two proposed concepts aims to support the employees' self-perceived sense of cognitive ability to perform the intended work tasks. However, to implement the suggestions, a process involving relevant stakeholders is needed to support these changes. For example, if operators arrive to the factory and start their work at different times, the introduction of a new morning meeting need to consider being able to be carried out both in a same time-same place context and a different time-same place context.

6.4 Development of the MEET Model and the Self-Assessment Questionnaire

This case study uses the MEET model with two different approaches: a simple questionnaire method, and a more comprehensive current state analysis. The two approaches can be seen as two examples of how the MEET model can be applied. Despite the differences, both approaches signify the importance of studying the 10 OS and IS areas.

The MEET model itself, with the 10 OS and IS areas accompanied with the meeting context, can be used through

other procedures as well and it would be interesting to discover the flexibility of the model.

The self-assessment questionnaire gives an indication on which areas to focus potential improvement attempts. However, the questionnaire could be developed for better accuracy to give better support for its users.

7. Conclusions

Based on both a self-assessment questionnaire and a current state analysis, this paper shows that the MEET model's 10 areas in the OS and the IS can help identifying areas related to meetings and communication with improvement potential.

The results from the self-assessment questionnaire shows that a person with good knowledge about the activities of a specific company can easily use the self-assessment questionnaire, even though more answers are desirable. Hence, the self-assessment questionnaire can be used as a quick guide for managers, however it is encouraged to involve all stakeholders in change processes.

Concerning the comparison of the results from the two approaches, there is small discrepancy. Hence, additional information is needed if actual changes will be performed. However, the self-assessment questionnaire can help giving a direction.

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